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Laura Seppä

E-HEALTH SERVICES SUPPORTING ADOLESCENT LIFESTYLE

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Laura Seppä

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The aim of this literature review is to find out what kind of risk factors related to health and lifestyle adolescents have and how e-health services could offer solutions. The themes in this work are related to youths' wellbeing and its problem areas. The purpose is to seek e-health services directed for adolescents and examine how they could improve adolescent health. Adolescents' needs for e-health services are defined through specific lifestyle-related factors. Based on these needs, the usefulness of possible future e-health services is evaluated. In addition, this work seeks to find and report currently existing e-health services. This study aims to assess the feasibility and suitability of adolescent e-health services from the perspective of health promotion. Promotion of the population's health is important in order to prevent health-related problems and positively affect people's health in the long run. The research problems are 1. What kind of lifestyle related e-health services are available for adolescents 2. What kind of services are needed. This thesis is a descriptive literature review. Literature discussing the subject is sought and essential findings are collected. Material is gathered from databases, literature and websites. Some of the most utilized databases are PMC, PubMed, Cinahl and Google Scholar. The target group of this thesis is 13-29-year olds. Literature search was limited to results less than ten years old, which are in Finnish or English and available in full text. Peer reviewed articles were favored.

As information technology becomes more advanced and common, new e-health solutions are developed. Many e-health services are suitable for adolescents or targeted specifically for them. The results indicated that e-health services are available for adolescents for various kinds of health problems. There are many means for influencing lifestyle habits, including health related websites, smartphone applications, chats and conversational platforms, self-help programmes, game-like techniques, wearables and remote appointments. The findings indicated that especially e-services for mental health are common and easily accessible. In comparison, e-health services related to oral health are quite scarce, which is why they could be developed in the future as oral health can have a major impact on prevention of illnesses. Adolescents should be involved in the development process of new e-health services to create these services according to their wishes and opinions. This literature review examines e-health services available for adolescents and potential development needs.

KEYWORDS:

Lifestyle, E-health services, Adolescent, Health promotion

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ELINTAPOIHIN LIITTYVÄT ETÄPALVELUT NUORILLE

Opinnäytetyön tarkoituksena on selvittää, millaisia terveyteen ja elintapoihin liittyviä riskitekijöitä nuorilla on ja kuinka e-terveyspalvelut voisivat tarjota ratkaisuja niihin. Työn aihealueet liittyvät nuorten hyvinvointiin ja sen ongelmakohtiin sekä nuorille suunnattuihin etäpalveluihin, joiden avulla voitaisiin edistää nuorten terveyttä. Terveyden osa-alueiden kautta määritellään, mitkä ovat nuorten mahdolliset tarpeet terveyspalveluille. Näiden tarpeiden perusteella selvitetään, millaiset etäpalvelut voisivat olla hyödyllisiä nuorille. Työ pyrkii myös kartoittamaan tarjolla olevia etäpalveluita. Tutkimuksessa arvioidaan terveyden edistämisen näkökulmasta etäpalveluiden soveltuvuutta ja käytettävyyttä, kun kohteena ovat nuoret. Terveyden edistäminen väestötasolla on tärkeää, jotta voitaisiin ehkäistä terveysongelmia ja vaikuttaa ihmisten terveyteen positiivisesti pitkällä aikavälillä. Tutkimuskysymykset ovat: 1. Millaisia elintapoihin liittyviä etäpalveluja nuorille on tällä hetkellä tarjolla 2. Millaisia tarvitaan. Opinnäytetyön metodi on kuvaileva kirjallisuuskatsaus. Tarkoituksena on tarkastella kirjallisuutta liittyen kuvattuun aihealueeseen ja kerätä olennaiset löydökset. Lähdemateriaali on hankittu tietokannoista, kirjallisuudesta sekä internet-sivustoilta. Käytetyimmät tietokannat ovat PMC, PubMed, Cinahl ja Google Scholar. Artikkelihaun kohteena olivat 13-29-vuotiaat. Haku rajattiin alle kymmenen vuotta vanhoihin tutkimustuloksiin, jotka ovat saatavilla kokonaisuudessaan ja joiden kielenä on englanti tai suomi. Vertaisarvioituja artikkeleita suosittiin.

Informaatioteknologian kehittyessä ja digitaalisten laitteiden käytön yleistyessä myös e-terveyspalvelut lisääntyvät. Monet e-terveyspalvelut ovat nuorille sopivia tai suunnattu erityisesti nuorille. Ilmeni, että e-terveyspalveluita on tarjolla nuorille mitä erilaisimpiin terveysongelmiin. Kanavia elintapoihin vaikuttamiseen on useita, mukaan lukien terveyteen liittyvät internet-sivut, älypuhelinsovellukset, keskustelupalstat ja chatit, omahoito-ohjelmat, pelimäiset menetelmät, aktiivisuutta seuraavat laitteet ja etävastaanotot. Tutkimus osoitti, että erityisesti mielenterveyteen liittyvät e-terveyspalvelut ovat yleisiä ja helposti saatavilla. Suun terveyteen liittyvät etäpalvelut ovat puolestaan vähäisiä, minkä vuoksi niitä voisi tulevaisuudessa kehittää, sillä suun terveydellä voi myös olla merkittävä rooli sairauksien ennaltaehkäisyssä. Elintapoihin liittyvien etäpalveluiden kehittämiseksi olisi hyödyllistä ottaa nuoret mukaan kehittämisprosessiin, jotta e-terveyspalvelut olisivat heidän toiveidensa mukaisia. Tämä opinnäytetyö selvittää nuorille saatavilla olevia e-terveyspalveluita ja mahdollisia kehittämistarpeita.

ASIASANAT:

Elämäntapa, E-terveyspalvelut, Nuori, Terveyden edistäminen

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1 INTRODUCTION

In the future more productive, efficient and faster processes and services are needed in healthcare and this can be partially enabled by digital systems and devices. Digital methods can be used for preventive measures but also for the treatment of diseases. Through digital solutions information, advice and other services are easily accessible. Digital technology is rapidly changing and we don't yet know about all of the possibilities the future holds. At least digital healthcare offers a more diverse selection of services with lots of different options.

In 2017 two thirds of Finnish citizens had used some kind of e-health service and the most common uses were electronic appointment booking, information searching and viewing of patient's own documents. (Hyppönen & Ilmarinen 2018). Most young people are skilled in using information technology. Teenagers and young adults could be a good target group for new digital solutions. Lifestyle habits are formed in youth and they can remain unchanged throughout the whole life. At a young age the individual chooses those nutritional, activity, and leisure time habits and those psychological and social ways of operating that affect on health and wellbeing and become a permanent habit. (Terho, 2003). Wrong type of lifestyle habits can lead to ill health and chronic illnesses for instance type two diabetes and cardiovascular diseases, which is why early intervention is crucial. It can be achieved partly with digital methods. Lifestyle guidance is an essential part of good healthcare. Getting the patient motivated to make a change in his or her habits is important in lifestyle change (Buratta et al., 2016) and without a doubt leads to more sustainable results.

Finterveys 2017 study (Jääskeläinen, T et al., 2019) provided information about the situation of teenagers and young adults lifestyles in 2017 and showed what is going well in adolescents' lifestyle habits and what should be improved. Adolescents when compared to adults have less weight problems and other risks leading to diseases, such as hypertension, but many have such lifestyle habits that create a risk factor. For example more attention should be given to eating healthy food including vegetables and decreasing use of tobacco products. The research concluded that the state of lifestyle habits were good in only half or nearly half of the young adults. (Jääskeläinen, T et al., 2019.)

In January 2020 Turku University of Applied Sciences carried out a project, ANKKURI-hanke, which was funded by Terveyden ja Hyvinvoinnin laitos THL. This literature review is made as part of the project. The project seeks to develop new operating models such as e-health services to promote healthy lifestyle habits of adolescents in vocational institutions. The focus of the project is to make the services easily accessible. The aim is also to interfere with substance use, which is still a problem among adolescents and young adults. (Ankkuri-hanke, 2020.)

This study begins with introducing the topic and defining concepts essential to the subject of the research. This is continued with presenting the purpose and aim of the research and research questions. After this the topic is explored as research findings are collected and analyzed in order to find answers to the research questions. The chapters are divided into headings by different lifestyle related factors related to healthy eating, physical activity, substance use, sexual health, oral health, mental health and chronic diseases. The content of these chapters explain the meaning of these lifestyle related factors in relation to adolescents and introduce research findings regarding them and e-health services. Finally, the conclusion brings together the findings of this study according to research questions and discusses development needs.

2 CENTRAL CONCEPTS

2.1 Lifestyle, lifestyle habits and health promotion

The definition of lifestyle is that it is a structure of behavioral patterns that is based on the possibilities that an individual has at a certain point of life. (Cockerham et al., 1997). Those values and attitudes we have adopted in economical, social and cultural environments guide these possibilities of choices. (Abel, 1991). For example, these behavioral patterns can be associated with physical activity or leisure time.

From the perspective of lifestyle, we can observe health behavior such as nutrition, smoking or alcohol use. Lifestyle habits are those usual ways of operating that are related to health, such as alcohol use and physical activity. These habits determine health and they are automatically put into practice because they are internalized. In case if the objective is to improve health, lifestyle habits should be taken in consideration as they contribute to one's good or bad state of health. (Salvador-Carulla et al., 2013.) Through this it is easier to understand social and practical behavior patterns on a larger scale and see how they also reflect the socio economic status of a group or individual. (Cockerham et al.,1997; Giddens 1991; Abel 1991).

Health promotion can be defined as an approach that systematically seeks to improve lifestyle habits and living conditions. (Karvonen & Sihto, 2017). Health promotion is monitored and led by the Ministry of Social Affairs and Health. Certain laws regulate health promotion and some important ones are Terveydenhuoltolaki, Sosiaalihuoltolaki, Alkoholilaki and Tupakkalaki. (STM, 2019.)

Health promotion is defined as an activity with an objective to help people to take care and control their own health and also the health of the environment. Another perspective is to improve the prerequisites among individuals, communities and society. (Vertio, 2003.) Health promotion does not only denote the individual aspect but also health within a community, strong and sustainable health systems, healthy working conditions and public policies. (Kumar, S & Preetha, 2012). An example of health promotion is encouraging people to wash their hands to prevent the spread of infectious diseases.

In this thesis, health promotion is an essential concept as it can be achieved through behavior change. Education is a major channel for health promotion in adolescents. It is

important to note that health promotions' effect on lifestyle habits can be affected by certain limits which are environmental or social. (Evans et al., 2014).

This literature review involves all these three mentioned concepts. Lifestyle as a term includes lifestyle habits, which are the behaviors related to health that an individual puts into practice and they consist the themes in this thesis. Essential lifestyle habits related factors of adolescents are investigated and reported in this study, noting also the need for improvement in certain areas. Possibilities to carry out health promotion are surveyed through electronic and information technology based methods.

2.2 Prevention, health education and health interventions

Prevention in healthcare means those measures taken to avoid the manifestation of diseases by focusing on risk factors, lifestyle habits, immunization, social and economical factors of health and early detection. (WHO, 2021). Prevention of illnesses is divided into three groups: primary, secondary and tertiary prevention. Primary prevention is directed to those individuals who are healthy in order to maintain their health. Secondary prevention seeks to reduce the possibility for illness among risk groups for instance through regular screenings. The third stage, tertiary prevention, targets to improve people's self-management of diseases. (Evans et al., 2014.)

Health education is an important component of preventive healthcare. It's purpose is to increase the population's knowledge about health to maintain and improve the health of individuals and communities. Health education includes patient guidance, transmission of health information in lectures or media and work in health-related organizations. Psychosocial support and social skills are highlighted in health education. (Hiltunen et al., 2010.)

The purpose of a health intervention is to sustain, improve, promote or assess the health of people. Therefore, health interventions can be used for not only to sustain, but to attempt to change the health of the population. Health interventions can be established for example in the form of campaigns that are designed to promote health, improvements to the environment, programmes for care or education and changes to policy. (Clarke et al., 2019.)

Health interventions can be divided into preventive and therapeutic interventions. Preventive health interventions can be established for instance in the form of education,

vaccines, medications, injury prevention, modifying the environment, nutrition and maternal interventions. Therapeutic health interventions can include treatment and management of chronic and infectious diseases, diagnostic procedures, radiation treatment and surgical treatment. Health can also be affected from other kinds of interventions, for instance the law, policies and enhancement of leadership. This can be noticed for example when observing how the interventions targeted to increase the price of alcohol and cigarettes with the help of taxation have caused a reduction in the consumption of these substances. (Smith et al., 2015.)

In this literature review, e-health interventions are considered also as a means of prevention. Various e-health interventions related to lifestyle are examined. The concept of health education is essential, as it is a major way to make behavioral changes concerning the target group adolescents. Health education can address e-health services increasing the knowledge of adolescents about new and specific e-health solutions.

2.3 Socioeconomic differences

Socioeconomic differences are based on one's socioeconomic status which can be defined by education, profession, property, incomes and living conditions, for instance. These factors have been shown to affect health in a negative or a positive way, causing health differences between people. (Koskenvuo, 2003.)

Socioeconomic health differences manifest all over over the world, however the situation in Finland is not as bad as in many other countries. Socioeconomic health differences do not occur only between individuals belonging to the lowest and highest socioeconomic class, but the differences are gradual and subtle, existing also in the middle ground. (Lahelma et al., 2012.)

Socioeconomic status correlates with morbidity and mortality. Having a low socioeconomic status can expose the individual to health impairing factors. Use of the healthcare system can also create inequality as it possibly does not treat individuals in an equal manner every time. Social circles and certain attitudes, values, traditions and conventions have an impact on health and create differences between people. (THL, 2020.)

This indicates that socioeconomic differences still have an impact on peoples' wellbeing. Between adolescents there are also socioeconomic differences. Some adolescents who have a difficult economic situation can be socially excluded or at a risk for social exclusion. It is important to focus on prevention and interventions to avoid the accumulation of factors that have a negative effect on the individuals health.

2.4 E-health, mhealth, telehealth and telemedicine

When discussing healthcare and information technology concepts such as e-health, mhealth, telehealth and telemedicine are considered essential. In addition, there is also the term digital health which focuses on the use of computing platforms as health resources. It encompasses the use of computers and software, connections, applications and sensors in the healthcare field. (FDA, 2020.)

Mitchell (1999) defined e-health as the utilization of health related data in a digital form regarding transferring, storing and retrieval of data to use in clinical care practices, educational purposes and governance. This may be carried out when the part taking individuals are in the same area or in differing locations. E-health means that electronically implemented communication in the healthcare field is integrated with information technology. (Della Mea, 2001.) E-health requires continuous assessment and taking in account user needs and preferences. (Wernhart et al., 2019). E-health as a concept is involved significantly in the contents of this thesis.

As it may be interpreted, e-health is an hypernym for electronically transferred health information, communication and care services via different kinds of devices, for instance computers. From the perspective of the patient e-health can be seen as an important resource as it can increase the supply, variety and availability of healthcare services, providing potentially more effective care and answering to the healthcare systems needs for new resources.

Telehealth is a concept which consists of a vast scale of health activities, for example patient education and bedside care provided by systems that support healthcare. The aim is to make communication and information flow more efficiently via electronic systems. Remote health services and telecommunication in order to facilitate and optimize care play a major role. (Bashshur et al., 2000.) Telemedicine focuses on

producing clinical medical services, providing consultation and facilitating the flow of medical information with the help of computers and information technology, the patient and healthcare professional not being physically in the same place. Instead of meeting in real life information between the parties is transferred electronically. The secure transfer of data is highlighted. (Bashshur et al., 2000; Wernhart et al., 2019.)

As a comparison with other e-services, telehealth and telemedicine practices are usually medical remote services offered by healthcare professionals. For example they could be used as an aid in evaluating the need for care or diagnosing. It can be deduced that in telehealth and telemedicine interaction and clearness between the patient and healthcare provider are emphasized.

There is additionally a term called mhealth for healthcare services delivered by mobile phone. The World Health Organization WHO Global observatory for ehealth definition for mobile health is: *”Medical and public health practice supported by mobile devices.”* (Seewon, 2012). Mhealth is another important concept in this literature review. Mobile phones can be transported to almost everywhere, they are relatively simple to use and widely accepted, providing quick access to information. Health information can be transferred instantly, allowing direct interaction. These qualities of mobile phones can be utilized in the healthcare field for example through mobile phone applications and text messages. Mobile phones in healthcare can be beneficial for interaction with patients, education, monitoring and other purposes. (Marcolino et al., 2018.) Mobile phone applications are very common and several studies about mhealth applications have been implemented.

Mhealth promotes changes in health habits to a positive direction and increases access to healthcare services and information by sharing data in a timely and in an effective way, for instance through text messages, emails or video meetings. Rapid flow of communicated information in hospitals has been proven to reduce medical errors. (Ventola, 2014.) Mobile phones make it easy to collect and monitor health data. Mobile health offers healthcare professionals the possibility to make more finished patient records and increase the quality of documentation, reducing mistakes. New information can be accessed faster and work can flow more effectively and smoothly. (Mickan et al., 2013.)

Some examples of mhealth are wearable sensors that can connect to your smartphone or applications that allow you to monitor your health. Mhealth can facilitate behavior change that leads to prevention or treatment of disease by game-like techniques, individual reminders, or by engaging the user into setting their own health goals. These methods can increase commitment to taking care of one's own health. (Perski et al., 2016; Rowland et al., 2020.)

In this study the utilization of mhealth services on lifestyle habits is observed through health interventions based on literature findings. Due to mhealth, health information and services are available instantly in almost every location. Most people have a mobile phone, so it is a suitable platform for health services. Smartphones are in the reach of all age groups but less common among very small children and the elderly.

2.5 Child, adolescent and young adult

This study focuses on adolescents and young adults aged 13-29 years. There can be different kinds of opinions what is a young person or an adolescent. According to the Finnish law, a person under 18 years old is a child. Traditionally adolescence means the change from being a child into being an adult, from beginning of puberty to independence from parents. The period of adolescence has been considered to range from 12 to 18 years, but the definition has expanded to include young adults until 25 years. (Jaworska & MacQueen, 2015.) The law of Finland states that a person over 18 years old is legally an adult. In the Finnish law about youth, anyone under 29 years old is considered a young person. (Nuorisolaki, 2016.) In this study, the aim is to include both age groups, adolescents and young adults and discuss their lifestyle habits and the e-health interventions directed to these groups.

3 PURPOSE, AIMS AND RESEARCH PROBLEMS

This bachelor's thesis seeks to find out what is the state of lifestyle in the youth and what type of health concerns and risks in relation to lifestyle adolescents might have. In addition, this research focuses on how e-health services could improve the health and wellbeing of adolescents, what kind of services are currently available for them and what sort of needs this target group might have for e-health services.

In this research existing literature is collected to determine what kind of evidence already exists about lifestyle habits of adolescents and also about e-health services for adolescents and young adults. Adolescents experiences and opinions are reviewed to bring insight to their actual needs for health services. Furthermore, the findings of this study can be used to clarify the variety of e-health services available for the chosen age group at the moment and to navigate what kind of development needs there could be for e-health services, not forgetting the observation of how these services could promote and improve adolescents' health.

1. What kind of lifestyle related e-health services are available for adolescents?
2. What kind of services are needed?

4 RESEARCH METHODOLOGY

4.1 Literature review as a method

A research method explains how the research is implemented. A scientific research method allows the researcher to base his work on scientific principles and proceed in an arranged, rational and efficient way. Literature review is a research method which can be separated into descriptive and systematic review. Literature review aims to explore material on the chosen topic to produce a basis for new studies. (Salminen, 2011.) The purpose of a literature review can be seen to assess and build a wholesome picture of existing theory, observe the progress of certain theory within time, develop new ideas for research and to find questions and gaps in current theory. (Baumeister & Leary 1997). In a literature review it is essential to answer a clear and distinct research question and evaluate the quality of chosen research material. (Petticrew, 2001).

This study is a descriptive literature review, which is a type of review that describes previous findings on the chosen topic. The material used can be vast and the research subject is depicted widely and comprehensively. Descriptive literature review does not have as strict requisites for content and structure when compared with systematic literature review, which is used to test hypotheses and is sort of a synopsis of previous findings on a specific subject. (Salminen, 2011.)

4.2 Literature searches

This literature review is based on information collected from different databases, literature and websites. Examples of databases used are PMC, PubMed, Cinahl, Sciencedirect, Google Scholar, Medline and Sage Journals. Boolean operators were used to combine key terms in searches. Some keywords used include adolescent, health risk, e-health, website, mhealth, application, internet, virtual, lifestyle habits, intervention, vocational school and mental health. The terms were chosen according to the themes in this thesis (Table 1). Some material for the work was collected from websites, such as the website for Terveyden ja Hyvinvoinnin laitos THL, Tilastokeskus and various e-health service homepages. Mostly peer reviewed articles were selected for closer examination.

Table 1. Literature search

Database	Search terms	Limitations	Number of results/ utilized
Pubmed	Health risk AND Vocational education	2018-2021 Article type: review Full text	11/1
Google Scholar	E-health AND Weight loss program AND Adolescent	2015-2021 Sorted according to accuracy	6960/1
PMC	Disordered eating AND Adolescence	2012-2021 Medline journals	4092/1
Cinahl	Sexual health AND Young AND Website	2012-2021 English	65/1
Cinahl	Oral health AND Health promotion AND Adolescents	2018-2021 Full text	33/1
Pubmed	Smartphone AND Mental health AND Application	2015-2021 Free full text	341/1
Google Scholar	Mhealth AND Adolescent AND Diabetes	2012-2021 Sorted according to accuracy	15300/1
Cinahl	Physical activity AND Intervention AND Virtual AND Adolescent	2016-2021 English	10/1
Medline	Smoking AND Vocational schools	2017-2021 English Academic journals	55/1
Sciencedirect	Adolescence AND Healthy behavior	2012-2021 Research article Full text	821/1
PMC	Mobile phone AND Asthma AND Adolescents	2015-2021	2461/1
PMC	Mhealth AND Smoking cessation	2018-2021 Open access Medline journals	1029/1
Cinahl	Oral health AND Mobile application	2016-2021 Full text	9/1
PubMed	Telemedicine AND Health care OR E-health	2000-2021 Full text	34,355/1

4.3 Inclusion and exclusion criterias

The search was carried out by using inclusion and exclusion criteria, limited to results less than ten years old. Results available in full text in languages English and Finnish were accepted for closer examination. Those results were chosen which discussed adolescents, specifically 13-29 year olds. The search results were not limited to any specific country. Too outdated results were excluded and also those that were in some other language than Finnish or English or available only partially, not in full text. In

addition, literature search results needed to be applicable and relevant for the subject of this thesis.

4.4 Data analysis

Qualitative data analysis can be seen as a creative and dynamic way of action to facilitate thought and production of theory based on observations in scientific data. It differs from quantitative data analysis by not placing focus as much on statistics, measurements and technical attributes. (Basit, 2003.)

Data analysis means organizing and summarizing findings from research studies. Pinpointing of essential information of research literature for example in the form of a list or table is the first step of data analysis. (Arksey & O'Malley 2003, Aveyard 2007). Similarities and differences can be sought and the aim is to form a synthesis. This is defined as research findings interpreted and written down in a way which forms a wholesome entity that increases comprehension about the chosen research subject. (Whittemore 2005, Whittemore & Knafl 2005, Aveyard 2007.) It is important to note how applicable the findings of the research literature are from the perspective of the selected research questions. (Holopainen et al., 2008).

Research literature is read through and interpreted, notes are taken and possible themes or categories are selected for the research. (Evans & Pearson 2001, Whittemore & Knafl 2005, Aveyard 2007). The articles are critically examined and comparisons are formed by seeking similarities and differences. It is important to focus especially on the results of each research finding. (Whittemore 2005, Whittemore & Knafl 2005, Aveyard 2007.) Finally, a synthesis is formed based on literature assessment. (Whittemore & Knafl 2005, Aveyard 2007).

In this thesis, the search for scientific articles from databases was established through key terms. When an article was selected for closer observation it was first skimmed through, giving attention to the topic of the research article, the abstract section and results of the study. Interesting articles were read carefully through taking in account their content and material that was essential concerning the subject of this thesis was collected and included.

Categorizing was established through distinction and definition of essential themes and concepts. These divided the contents of this literature review into different headings and

subheadings. The relevancy of the articles found was evaluated by considering the themes of this work, such as adolescents, lifestyle habits and e-health services. Additionally, the convenience of the articles regarding this work was evaluated from the perspective of these main themes. Articles which formed a coherent entirety and were written in a clear and understandable manner were chosen for this thesis. Results of the data analysis process can be seen in the composed text and conclusion. At the end of this study a list about chosen articles and their main details can be located. (Appendix 1).

5 E-SERVICES IN HEALTHCARE

Digital solutions are a potential platform for health services for the youth, since most adolescents use technology effortlessly and the information technology use among adolescents is becoming increasingly prominent and popular. (Radovic, A et al., 2018). In 2018, 95% of teenagers report owning a smartphone or having the possibility to use one and many use online platforms of social media, such as Facebook, Instagram and Snapchat, with almost a half reporting that they are online nearly all the time. (Anderson & Jiang, 2018). In this chapter the theme is adolescents' use of information technology especially related to health. It is important to learn about adolescents' information technology use habits to find out, in what kind of platforms new e-health interventions could take place and what kind of qualities adolescents value.

In recent years the use of information technology among teens has increased when compared to a survey carried out in 2014-2015. (Anderson & Jiang, 2018.) Health services in a digital form would seem like a natural platform for the young. In a study from 2020 (Dienlin & Johannes), 31% of students in the United States had the opinion that digital technology has mostly a positive effect on wellbeing, with 24% seeing digital technology more as negative. Majority of 45% experienced the effect of digital technology on wellbeing neither being positive nor negative. (Dienlin & Johannes, 2020.) In 2018, an interview study (Radovic, A et al., 2018) with the participants average age of 15 years, indicated that the majority of adolescents participating in the study (84%) had searched information online related to health. Adolescents explained their main uses for information technology to educate themselves by collecting information, sharing experiences with other adolescents and hearing about others experiences, and to monitor their health habits and progress towards personal health-related goals for example with the help of fitness wristbands or watches. Adolescents collected health related information mostly around the topics of healthy eating and exercising.

Adolescents are fascinated with the internets' ease of access, feasibility, security and anonymity and the fact that the information is presented in a way that an ordinary person can understand it, with relatable, real-life individuals. They experience that the internet gives them motivation and ideas for health changes and offers many options of things to do. The internet is available around the clock, not dependent on any given

time. Adolescents like the fact that people can share opinions and stories on the internet effortlessly and privately. The youth use technology to monitor health habits such as using activity trackers that are worn on the go on your wrist, for instance Fitbit or Nike Plus to monitor steps taken and calories burned. Adolescents value digital technology that is entertaining, easy to use and has game-like techniques, for instance the ability to earn something such as points to gain motivation and a sense of accomplishment. (Radovic, A et al., 2018.)

The use range of digital solutions may grow even more wide in the future. The population's information technology skills are improving in every age group. In Finland (2020), 92% of people aged 16-89 years had sometimes used the internet and 82% used the internet multiple times a day. This amount was 3 percentage points more than in the year 2019. From 16-24 year olds, 98% report using the internet many times a day (Figure 1). Finnish people use the internet mostly for communication, social media and online shopping. (Tilastokeskus, 2020.) Technologys' constant development and population's familiarization with information technology enables new kinds of possibilities for e-health services.

Internetin käytön ja eräiden käyttötarkoitusten yleisyys 2020, %-osuus väestöstä

	Käyttänyt internetiä [1)]	Käyttää internetiä yleensä useita kertoja päivässä	Verkosta ostaminen [1)]	Internetpuhelujen soittaminen [1)]	Yhteisöpalvelujen seuraaminen [1)]
16-24	100	98	62	87	92
25-34	100	97	77	91	92
35-44	99	97	80	86	86
45-54	99	93	70	82	80
55-64	97	83	46	69	60
65-74	88	62	25	55	46
75-89	51	30	8	19	16
Miehet	93	83	56	69	66
Naiset	91	80	53	74	71
Kaikki	92	82	54	72	69

1) Viimeisten kolmen kuukauden aikana

Figure 1. Popularity of the internet and what it is mostly used for in Finland. Tilastokeskus, 2020.

There are some questions to address when developing e-health services. The safety concern when handling data that contains individual health information is an important issue. Cybercriminals can benefit from wireless networks which are unsecured because some people may use these public networks to handle personal health data, giving criminals an access to their sensitive information. In addition, unknown locations of information are a problem in cloud services, which should be taken in consideration when developing e-health services such as mhealth apps. (Gurupur & Wan, 2017.)

Adolescents themselves also see some downsides to technology including expensive devices, e-services not being specific enough, not remembering passwords and the sharing of behaviors that could be hazardous via the internet. Negative effects of comparing oneself socially to others are seen such as competition and discontentment to one's own body, leading to lower self-esteem and possibly provoking disordered eating behaviors. (Radovic et al., 2018.) Anxiety and depressive symptoms correlate with the amount of hours spent on social media. (Dienlin & Johannes, 2020). The internet or a smartphone can be a distraction for not completing actually important activities such as school assignments or sleeping enough. Additionally, bullying can occur on the internet. (Radovic et al., 2018.)

In addition to safety and other previously mentioned concerns, unreliability of web based information can be seen as a negative side of information technology (Gurupur & Wan., 2017). Adolescents would benefit from skills to evaluate the reliability of material on the internet. It depends a lot on the individual what kind of skills regarding this concern he or she has. This encompasses for example the ability to decide about the reliability between a conversational platform and an evidence based website as an information source.

6 ADOLESCENT HEALTH, LIFESTYLE HABITS AND INTERVENTIONS

Finterveys study (Jääskeläinen, T et al., 2019) discussed the state of adolescents and young adults health in 2017. Adolescents aged 18-29 years were compared with 30-39 and 40-49 year olds. It can be observed that adolescents when in comparison with adults have less weight problems and other factors leading to diseases such as hypertension, but many have such lifestyle habits that increase the risk for health problems.

The study shows that 18-29 year olds themselves experience mostly a good state of health (Figure 2). Those lifestyle habits which are formed in youth often continue unchanged to adulthood. Increasing independence and the challenges when growing into an adult can affect the health related behaviors of the adolescent in a negative way. These habits formed in adolescence can also lead to health differences in adulthood affecting socio-economic status. (Jääskeläinen, T et al., 2019.)

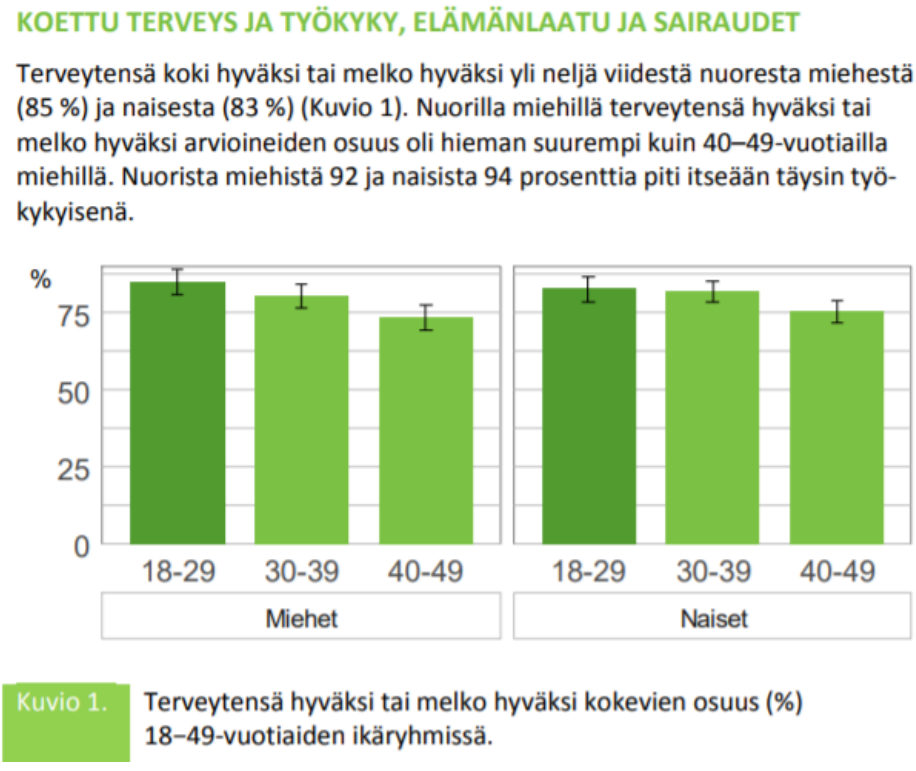

Figure 2. Adolescents' experience of own state of health. Jääskeläinen, T et al., 2017.

There are certain health-promoting behaviors that increase wellbeing during adolescence and are linked with better lifestyle habits during adult life. These include maintaining a healthy diet including a balanced breakfast and getting sufficient amounts of physical activity and rest. It is also essential to avoid substance use, smoking and excessive drinking to maintain a desirable health condition. Healthy lifestyle habits formed in youth can act as a preventive means in order to postpone or inhibit serious chronic diseases that would appear later in life such as type two diabetes and diseases of the heart and circulatory system. (Frech, 2012.)

Studies show that 18-25 years is a vulnerable age since adolescents at this age get more independence. During this age adolescents are less controlled by their parents and healthy behaviors decrease, increasing the risk for new unhealthy habits. This is not related to race nor gender so it can be seen as a part of the life stage. (Frech, 2012.) During adolescence certain health risk behaviors are more likely to be present including low consumption of fruits and vegetables and overall adverse eating habits, use of intoxicating substances and inadequate physical activity. Students in vocational schools are a major target for health interventions, as many of them belong into this age group. In addition, a notable amount of vocational institution students have more than one factor that is detrimental for health. (Atorkey et al., 2021.)

Before this developmental stage, adolescents are typically living with their parents and although the change in social environment is great even at the age of 13-17, however, the risk is smaller for an unhealthy lifestyle. For example, parents can keep an eye on the adolescent's eating and sleeping habits and what their child is doing in their free time. When smoking and drinking recklessly adolescents are exposed to punishments from school or home. (Frech, 2012.)

6.1 Alcohol and smoking

Adolescence is a crucial developmental stage where changes can be seen not only physically but also in emotional, social, cognitive and behavioral functioning. (Romer et al., 2017). The human brain is not fully mature before 25 years as the prefrontal cortex continues to develop until this age. It's function is to regulate thought processes and one's actions related to social life and help navigate complex life situations. (Arain et al., 2013). Adolescents experience decreased control of self combined with

impulsiveness, seeking of sensations and increased sensitivity for rewards. This is why some adolescents engage in harmful and risky behaviors such as excessive alcohol consumption. (Romer et al., 2017.) In a 10-year study (Hanson, 2012) it was found that binge drinking and use of other substances during adolescence and withdrawal symptoms cause a decline in learning ability, visuospatial function and verbal memory. In addition, maintaining attention during tasks becomes more difficult. The effect of alcohol on cognitive functioning depends on dose, the heavier the consumption, the greater effect and a more significant decline. (Hanson, 2012.)

Although the Finterveys study report from 2017 shows that abstinence has increased between 2011-2017 in all age groups (Koponen et al., 2018)., binge drinking is still a problem among young adults. When discussing the drinking habits of 18-29 year old men and women in Finland, 14% of men binge drink weekly repeatedly and 17% of young women binge drink monthly. (Jääskeläinen T et al., 2019.) The habit of excessive alcohol consumption adopted at an early age can remain as a permanent habit as the adolescent grows older. Besides this it can have harmful effects on physical and psychological health and social life. Due to these factors it is particularly important to intervene on problematic alcohol use in adolescence. Attention could be given to informing adolescents about available e-health solutions related to alcohol and substance use.

Nuortenlinkki is a website for adolescents brought by A-klinikka foundation. At the website young people are able to discuss substance use, internet use and gambling, bullying, depression and other topics. There are educational articles and animations about different kinds of themes. It is possible to self-evaluate current mood, substance use and internet use with tests the site offers. There is also a section for personal stories of adolescents, links to video blogs and tips on places where to seek more help. (A-klinikkasäätiö, Nuortenlinkki website.)

Sometimes the adolescent is not the one with the drinking problem. There is a Finnish website that is designed for adolescents struggling with parents who have drinking problems called Varjomaailma. In Varjomaailma website it is possible to get support from adults and peers with similar kind of issues. At the help desk and chat the adolesent can discuss their concerns confidentially with a psychiatric nurse. Varjomaailma has also a blog page which discusses alcohol and other themes that

might be affecting adolescents including eating disorders, self-esteem, bullying, worry about future plans and other topics. (A-klinikkasäätiö, Varjomaailma website.)

The Finterveys 2017 study (Jääskeläinen, T et al., 2019) on young people shows that every tenth of young women and men smoke daily cigarettes, cigars or pipe. Among women 14% use any of these or in addition snuff or electronic cigarettes and in men the percentage is even higher, 22%. It has been shown that almost every adult smoker has started smoking in their youth, latest as a young adult. Overall to this day smoking in young adults has decreased when compared with the beginning of the 2000s. (Jääskeläinen, T et al., 2019.) This is a positive and significant development.

Among 16 year olds in 2009, 22% of girls and 21% of boys were daily smokers. Statistics show that in 2019 the prevalence of smoking every day has decreased in this age group, as the numbers were 6% for boys and 7% for girls. However, there are differences between students in different educational institutions. The graphs (Figure 3 & 4) indicate that among 14-20 year olds, smoking is more common in vocational institutions with 17% of boys and 21% of girls being daily smokers in 2019 although the gradual decrease in smoking is apparent also in vocational institution students. (Jääskeläinen, M & Virtanen, 2019.)

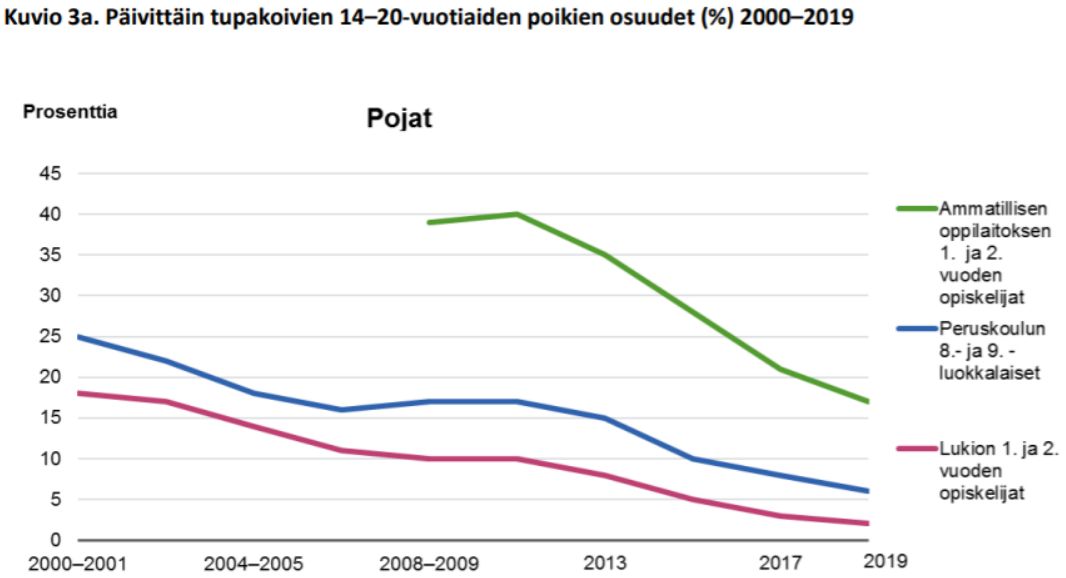

Figure 3. Daily smoking of 14-20 year old boys. Jääskeläinen & Virtanen., 2019.

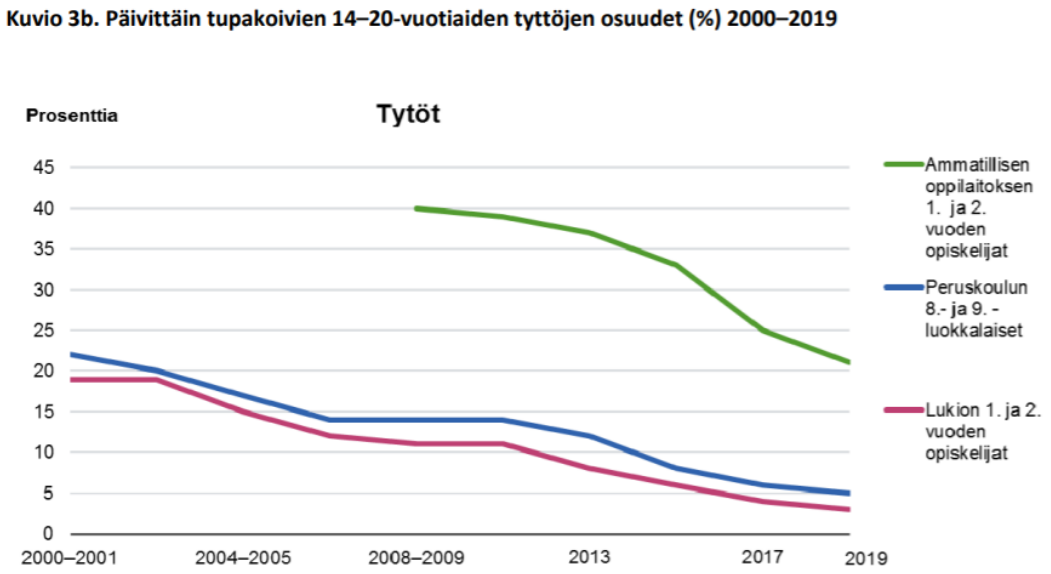

Figure 4. Daily smoking of 14-20 year old girls. Jääskeläinen & Virtanen., 2019.

A study in Finland (Aho et al., 2019) of 34,776 students investigated how smoking is associated with relationships with others in the same age group and reported experience of one's own health in vocational schools. The prevalence of smoking was studied and it showed that 37% of girls and 36% of boys in vocational schools smoke every day. For 15% of girls and 14% of boys, the smoking is not that regular but rather casual.

Smoking is a preventable health risk-habit that can lead to morbidity and socioeconomic inequality. Additionally, a worse quality of life with physical and psychological issues has been reported among daily and occasional smokers when compared with non-smokers. When smoking starts early it typically continues to adulthood. Smokers see their health as worse than non-smokers and exercise less. Smokers academic goals are usually lower when compared to their non-smoking peers and smoking is associated with certain behaviors including bullying and truancy. Smoking was more common in those students who are bullies themselves or have a history of being bullied and then had become bullies. Majority of smokers who are adults have started smoking in adolescence before turning 18 years. Socio-environmental factors affect the adolescents' smoking behavior, that is friends and family, peer relations, social bonding, belonging and beliefs. In schools adolescents meet classmates and can develop similar behaviors as them. Smoking can create a

sense of togetherness for the adolescent in a friend group making the health risks of smoking seem less important. When the adolescent has friends who smoke it is more likely to begin smoking yourself too. This may be based on social identification which means that the people in a group compare themselves socially to the members of the group, dividing people into different groups according to their smokers or nonsmokers status. Adolescent smokers are not able to put an end to smoking because they fear that they will lose their status or be left out from the social circles. (Aho et al., 2019.)

It has been noted that the most effective treatment for smoking cessation is medication together with therapeutic psychological and behavioral approaches. However, a significant number of smokers are not successful in quitting smoking and this can be related to their lack of motivation. The effect of mhealth interventions including text messages targeted for smokers who want to quit the use of tobacco products have been studied and proven useful in increasing motivation. Focus in one study (Carrasco-Hernandez et al., 2020) was on long term effects of text messages with personalized motivational content. The content of these messages can include motivation for lifestyle change in general, healthy eating and physical activity proposals, amplifying positive messages and the assets of quitting tobacco products. The application was designed so that the messages were brief and contained simple language. In addition, the messages aimed to utilize health promotion methods through health education and change of misinterpretations and establishment of empathy.

This mhealth approach was used besides psychopharmacology based therapies. A study conducted in Spain with 240 participants was established for a 12 month period. Half of them were assigned to a control group with psychopharmacological therapy treatment and half to a group with previously mentioned therapy but also motivational text messages for quitting smoking. The results of the study showed that with these two methods (mobile health and psychopharmacology) it is possible to get more efficient results than with psychopharmacological therapy alone when the objective is to quit smoking for one year. It has been also reported that during a half year period, mhealth SMS messages as a supporting treatment were almost 1.7 times more efficient than a traditional method approach alone. The greatest effect is achieved when mhealth users get various health related, tailored motivational recommendations. In this distinct study during the year’s time span in the intervention group quitting smoking was 2.75 times

(per-protocol analysis) and 2.15 times (intention-to-treat analysis) more common when compared with the control group. (Carrasco-Hernandez et al., 2020.)

There are also internet based interventions for smokers. A Finnish website Stumppi can help to increase motivation to give up smoking. It is a website provided by Hengitysliitto ry, which offers education for example about withdrawal symptoms, peer support and a telephone line to help quit smoking. There is also a possibility to contact a professional. Stumppi has a discussion forum where the adolescent can get support and feel like they are not alone with their goal to a smoking-free lifestyle. The website offers tests and counters such as an option to count how much money it is possible to save by quitting smoking. With registration the user gets more options, for instance a diary to keep track of their journey. (Stumppi website.)

E-health services and applications can enhance those frequently used interventions proven efficient and bring the objective to stop smoking more as a part of everyday life. When planning smoking interventions it is important to take in account different kinds of social and educational groups and the factors affecting smoking behavior within these groups. A website such as Stumppi is a potentially useful approach for smoking cessation as it enables peer support and people sharing the same health goal at the same moment of time.

6.2 Healthy nutrition and eating related problems

We should give attention to weight control issues among adolescents, since in Finland almost half of men aged 18-29 have a body mass index of 25 or more which is considered as overweight or obese. In women the number of overweight or obese young adults is one third. 17% of young men and 19% of young women are obese (BMI over 30) with one fifth of both groups having a waist circumference that is considered unhealthy. In Finland, within 30 years, the amount of overweight and obese children and adolescents have become three times as many than before, shows the Finterveys 2017 study. (Jääskeläinen, T et al., 2019.) From high school aged Finnish adolescents 29% of boys and 20% of girls are overweight or obese (Figure 5). (Jääskeläinen, S et al., 2020).

Overweight and obesity cause adverse health effects such as high blood pressure and blood glucose, cholesterol problems, cardiovascular diseases and premature mortality. Being obese in adolescence often leads to obesity in adulthood. Obesity is a risk for the cardiovascular system and among the cardiovascular risk factors it is the most alarming since it increases the risk for morbidity in adulthood more than other heart and circulatory disease risk factors. Elasticity of the arteries and proper function of the endothelium is decreased in obese children. (Ruiz et al., 2020.) Majority of obese adolescents (80-90%) will become obese adults and within overweight adolescents, this number is 70%. (Chen et al., 2017).

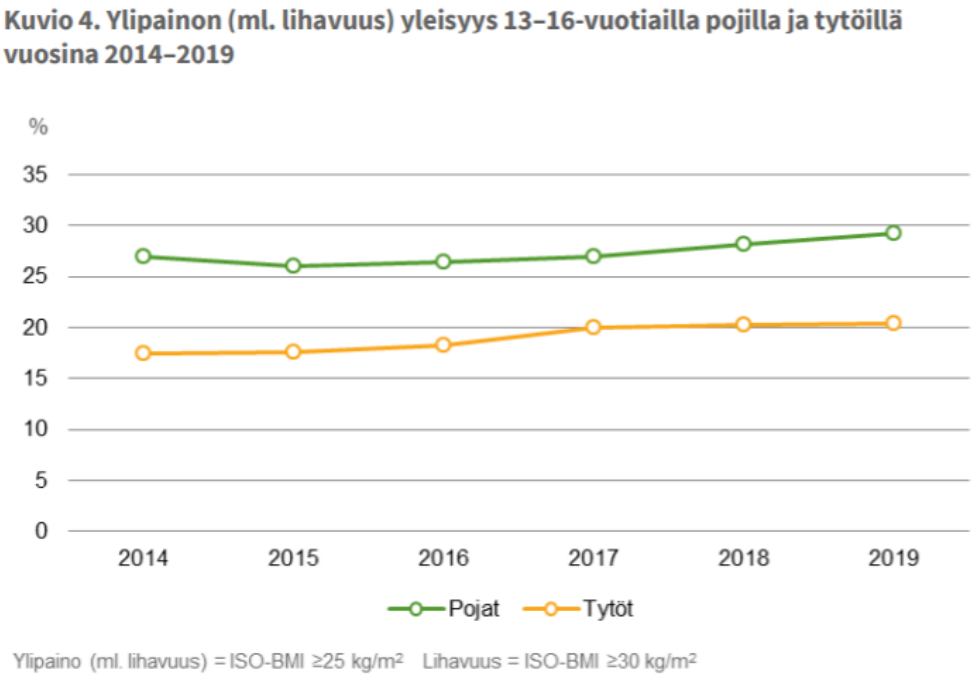

Figure 5. Increasing overweight among 13-16 year old boys and girls in 2014-2019. Jääskeläinen, S et al., 2020.

Obesity also affects mental health increasing for example anxiety symptoms and depression possibly caused by negative body image, embarrassment of being overweight or social exclusion which may be the result of the adolescent being bullied based on weight. These can lead to adverse and unhealthy coping mechanisms such as overeating. (Puhl et al., 2013.) Overeating is a behavior that activates the reward system and can lead to a temporarily elevated mood. (Tryon et al., 2013). This is a harmful behavior, however, because it results in more weight gain and the physical and psychological problems associated with weight gain and obesity. (Hruby & Hu, 2016).

It has been shown that young women use the internet to seek information about weight loss, healthy eating and exercise and the ways to maintain a certain weight.
In 2016 an e-health weight loss programme for young women who are overweight with a body mass index over 25 was developed and studied (Hutchesson et al., 2016). Be positive Be healthe aimed to accomplish a 5% weight loss in participants within a 3-month follow-up period. The participants set objectives for healthy eating and physical activity. The programme was based on cognitive behavioral therapy methods and it utilized various technology-based platforms: a smartphone app and text messages, forums for online discussions, an internet site, online tests with individual feedback, goal setting and newsletters via email.

Programme developers took in consideration young womens motivators for weight loss, including positive self confidence and health and feeling good about themselves. Aim of the website was to provide important information about weight management, healthy eating habits, physical activity and cognitive behavioral strategies. Online questionnaires were used to assess current situations in terms of measurements, behaviors and attitudes towards weight loss. In the beginning of the study period, based on the questionnaires, e-mail feedback was given to help set personal goals. Later surveys were used to track progress and give feedback in the form of a virtual prize. The smartphone application gave young women a possibility to monitor their weight and have a food and physical activity diary on their smartphone. Emails gave guidance on how to change health-adverse behaviors.

Young women actually have interest in these kinds of programmes, as much as 95 % of young women stating in an online survey that they have interest in an online weight loss programme that is specifically made for them. In the Be Positive Be Healthe programme participants experienced that text messages, emails and feedback including online quizzes gave beneficial nutritional and physical activity information, email interventions being the most useful in terms of achieving weight loss. Use of online tests and email letters was high at the start, but over time became less important for the users.

However, the programme managed to help the participants achieve a reduction in weight and BMI, waist circumference and amount of fat in the body. Young women stated that they had interest in monitoring weight, eating and exercising themselves

through a smartphone application and keeping a journal on individual goal achievement. (Hutchesson et al., 2016.) Attention should be given on how to maintain the participants interest and motivation as time goes by. The study shows that there is potential for an e-health weight loss solution for young women, noting also that the programme could use some further development.

In adolescence there are certain socio-environmental factors that affect the development of disordered eating. These include importance and concerns about body weight to the individual, body image and depressive symptoms. Disordered eating, such as using diet pills, purging, fasting and smoking to control weight is prevailing in adolescence. (Loth et al., 2015.) These disordered eating habits often continue into adulthood. Eating disorders usually start at age 15-19 years. (Micali et al., 2013).

A 10-year research study (Loth et al., 2015) about disordered eating called Project EAT-III was conducted for 21-28-year olds. Based on social cognitive therapy, the study followed the participants weight control behaviors such as skipping meals or fasting in the course of a year. The study assessed also how satisfied the participants are with their bodies, what is their level of self esteem, do they have any symptoms of depression or health or weight concerns and how much importance they placed on their weight. The research took into account also how parents and peers can affect adolescents' eating and weight controlling, or do they have any effect. Results of the study showed that women who placed a lot of importance on weight in adolescence were more likely to have tendencies for disordered eating and continued dieting. In men, disordered eating was linked with high weight concern. Continued dieting was more likely in men who had low body satisfaction, symptoms of depression and placed a lot of importance on their weight. Dieting of peers and parents were not found to be as significant in the development of disordered eating and weight control habits in adolescents.

The study result shows that these mentioned factors, especially increased weight importance and weight concern, have an impact on the development of youth eating disorders. To prevent disordered eating schools could have screenings for young men and women which map out the level of weight concern and weight importance the adolescent experiences. This could be done e.g. in the form of a website or email questionnaire. (Loth et al., 2015.) Based on this research article it appears that these

qualities such as thinking patterns and attitudes have the greatest effect on the risk for eating disorders.

Adolescents suffering from eating disorders can find help from e-health services. The Finnish Eating Disorder Foundation Syömishäiriöliitto SYLI ry has regional organizations including the southern Finland Etelän SYLI ry foundation. Etelän SYLI offers peer support groups, email support and anonymous group chat and a chat with guidance and counseling for people who are recovering from an eating disorder. There is a specific peer support group for those recovering from anorexia. The website also contains personal stories about recovery which can increase the adolescent's motivation and belief in their abilities to recover. (Etelän SYLI ry website.)

It has been shown that deciding about objectives, monitoring one's own eating and physical activity habits and getting feedback that is individualized will improve behaviors that are harmful for health. (Greaves et al., 2011). With mobile health it is possible to carefully track those habits and behaviors that are unhealthy and cause weight gain. Besides clinic visits mobile health offers additional help for lifestyle change and can increase motivation. Mhealth is easily less expensive and allows the adolescent to get their weight loss intervention from home, the environment they are most comfortable with. (Chen et al., 2017.)

There are already different kinds of mhealth applications in smartphone application stores for monitoring eating habits and exercises. These applications can help the adolescent with weight problems to develop a healthy lifestyle. Smartphone app stores contain many apps for monitoring eating and physical activity habits so the consumer has a variety of options to choose from.

Adolescents can also find various types of wellness programmes from the internet that are targeted specifically for those who want to change their eating habits. These programmes usually promise healthier eating habits and help in weight management. One example is Via Esca nutrition programme. Via Esca has a mobile application which offers daily plans for meals, recipes and grocery shopping lists. Through the application it is possible to get chat support and monitor calorie intake and energy expenditure. (Via Esca website) One has to pay for these kind of programmes and

follow the programme instructions carefully. However, adolescents might favor those solutions that are less expensive or less time consuming and possibly free of charge.

In a study from 2017 (Chen et al.), a mhealth application was tested among adolescents. The study involved 40 participants, the intervention group and the control group. The adolescents were provided a Fitbit Flex mobile phone app and a monitoring wristband. The wristband tracked exercising, eating and sleep cycles. The application allowed users to write down and follow their food intake and diet, showing also statistics about progress. In this way the application promoted observation of one's own habits and unhealthy behaviors. Individual positive feedback was supplied in the form of messages and also guidance on adopting healthy behaviors and weight. Along these the adolescents used the iStart Smart for Teens programme containing videos from different categories for orientation and education to acquire strategies for weight management.

This intervention group included 23 adolescents aged 13-18 who were overweight or obese. Effects of the mobile health applications were studied by comparing the weight related qualities of the control groups 17 participants with the intervention receiving participants. All of these mobile application using participants thought that the mhealth solution was good for following individual physical activity and they would recommend using the application. In addition, the application was considered useful also for monitoring and documenting consumption of calories. The main benefits among these adolescents were that they were eating more fruits and vegetables and exercising more, they consumed less sugary drinks and their body mass index and blood pressure decreased. In addition, their self-efficacy increased and they spent less time watching tv and on the computer. (Chen et al., 2017.) This study supports the use of mhealth technology and wearables as an assistance in handling youth weight problems.

However, when discussing the pros and cons of mobile health apps we should keep in mind that there are certain problems or issues of concern. Some smartphone apps contain false information that is not from a reliable source nor developed according to evidence from literature. Another point to consider is that the application evokes a feeling of sincerity and works when you need it to, including network connectivity in different areas. (Gurupur & Wan., 2017.)

Overweight is a relatively common problem also among adolescents and it can lead to detrimental physical and psychological consequences. In terms of e-health, web-based wellness and nutrition programmes and health applications such as diaries for eating or exercising are popular.

6.3 Physical activity

Almost 80% of young men and 74% of young women were physically active every week in Finland in year 2017. (Jääskeläinen, T et al., 2019). As a comparison, in 2004, 55,5% of 22-25 year old students in universities of applied sciences were physically active many times a week and 17,2% were physically active once a week. (Erola, 2004).

On a global scale adolescents do not meet the recommendations for physical activity. WHO launched a project More Active People for a Healthier World in 2010 aiming to increase physical activity over the world and reduce inactivity 15% by 2030. A study included 1,6 million students aged 11-17 from 146 countries. It showed that in 2016 four out of five students were deficiently physically active, with girls exercising less. (Figure 6) (Guthold et al., 2019; WHO, 2018)

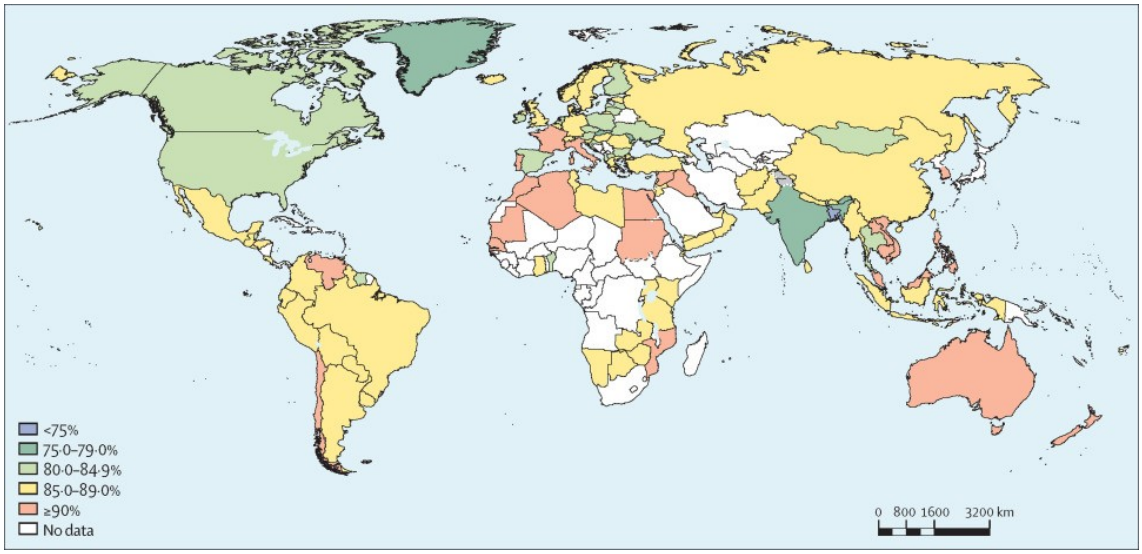

Figure 6. Prevalence of insufficient physical activity among 11-17 year old female students in 2016. Guthold et al., 2019.

Kumar, B (et al., 2015) reported that regular physical activity prevents weight problems and diseases related to the metabolic, musculoskeletal and cardiovascular system. Physical activity has an effect on cardiorespiratory fitness which affects the development of diseases and mortality. When observing the development of chronic diseases, an overweight adolescent who is physically active is more unlikely to acquire a long term disease than a normal weight, physically inactive peer.

It has been shown that a physically active lifestyle in adolescence offers many benefits for the individual including maintaining strength in muscles and flexibility, and promotion of good condition of the bones. The probability for cardiovascular risk factors for instance high blood pressure is lower. Physical activity facilitates the work of insulin and helps to maintain a healthy weight, preventing type two diabetes. Many sports require teamwork such as ball games. Team-based physical activity can help to develop social interaction skills and leadership abilities. Physical activity can help in cognitive skills and mental health. Affecting the brain's neurotransmitters, exercising can improve mood, focus, belief in oneself and the acquisition of new skills, decreasing the likelihood for stress and anxiety.

Today's inactive lifestyle, with developing information technology and increasing screen time emphasizes the need for health promotion of physical activity. These measures include traditional approaches such as walking to school or using a bicycle. (Kumar, B et al., 2015.) Although usually considered to make people more sedentary, technology can also be used to facilitate physical activity. Development of new types of solutions for inactive lifestyle could be considered, including smartphone applications, video games, activity trackers, step counters and virtual lessons for different kinds of sports. A positive influence from these is motivating the user to observe their health behaviors and change unhealthy habits. Multiple these kinds of services already exist available for consumers.

According to Moran & Coons (2015), as a response to the increase in adolescent's inactive lifestyles some game developers have become interested in developing games that are physically engaging. Gaming consoles such as Nintendo Wii or Xbox have a possibility for motion sensors which follow the users movements. Related to the increasing usage of smartphones, utilization of this feature is growing more popular also among smartphone app developers.

An example of this is the Zombies, Run! application released in 2012, which is an audio based survival application that tells a story involving the user being in an imaginative

reality with zombies. In order to survive missions need to be completed and items collected. Global positioning system tracks the user's running pace and the application gives a notification when the user needs to run faster in order to escape and progress in the game. If the running pace doesn't accelerate during these intervals the user loses progress and the items collected earlier. (Moran & Coons, 2015.)

A larger study (Farič, et al., 2021) concerning this application showed that among 5343 participants physical activity improved 84 minutes per week. Those qualities of the game which had most effect on physical activity levels were setting objectives, getting intrinsic achievements by enjoying the game and experiencing the favourable results of physical activity. 39,89% started to run more frequently. From 30 interviews, 70% (21/30) reported that the game had a favorable effect on mental health. Participants perceived that the story motivated them to continue being physically active and their attitude towards sports shifted to a more positive direction. (Farič, et al., 2021.)

An usual topic is that new developed technology devices such as smartphones and computers passivate people consuming the time that could be spent for instance outdoors. It is essential to bring e-health related to physical activity to the reach of adolescents to find new solutions to increase physically active lifestyles among this age group.

6.4 Sexual health

Sexual health is considered a sensitive theme. This is the reason why adolescents might prefer using web-based information as a source because of the security of personal details and ease of access it gives. The internet can offer adolescents important sex education because it gives attention not only for biological nature of sexual relationships, but also for communication with your partner about sensitive matters, sexually transmitted diseases, pregnancy, sexual pleasure and emotions in relationships and sex, taking in account peoples individual sexual experience. (McCarthy et al., 2012).

These topics were also what the participants of a study (McCarthy et al., 2012) in the United Kingdom were interested in. A qualitative research was conducted about adolescents' wishes for a sexual health website. The study focused on 67 adolescents aged 16-22 years old. Discussions with the group focused on what the young people

would consider important in sexual health, what they would want the website to be like visually and what kind functions and features the website should have in order to be interesting for youth.

The participants wanted information in the website to be presented in an uncomplicated and truthful way, containing easily understandable language with content that is valid. Relationships and communication about sexual health matters were seen as important and the adolescents wanted guidance on this. The youth wanted information about sexual pleasure in a way that is not accusatory, when considering e.g. having one-night stands. There was also a need for information for more serious topics such as risky sexual behavior. The participants wished for information about pregnancy and also a possibility to hear about others sexual experiences for example through videos with real life stories, and information that is suitable for adolescents with different kinds of sexual experiences.

The participants preferred a sexual health website that is engaging, with interactive features, encompassing regularly updated content. They wanted the website visuals to be realistic with representations of real people. Adolescents suggested a possibility for connecting with peers and sharing stories for instance through an anonymous conversational platform. (McCarthy et al., 2012.) These kinds of studies are important from the perspective of development, as they allow adolescents to voice their own opinions and wishes related to sexual health.

When having issues and questions related to sexuality, Väestöliitto website can offer advice as well as Seta website. Väestöliitto also has some telehealth services for adolescents. Poikien puhelin is a telephone line with a chat service for adolescent males under 20 years old. The adolescent can converse confidentially and anonymously with a professional who is well trained and familiar with the issues boys may have when growing up. (Väestöliitto, 2020.) Väestöliitto offers sexuality-related advice through a chat service on their website which is aimed for adolescents aged 13-19 years. The chat is anonymous, with a sexuality advisor from Väestöliitto answering when contacted to worries adolescents may have. Conversation topics revolve around for instance puberty, sexuality or romantic relationships. (Väestöliitto, 2020.)

These topics are important for the adolescent as they can remove worries, help in managing relationships and coming in term with sexuality related matters. Mentioned topics are discussed also on Nuortenexit website, which is for 13-29 year old adolescents offering information with videos and advice about relationships, sexuality and establishment of boundaries. The site contains also information and guidance on maintaining boundaries online in the internet. A chat service on the website is open for adolescents and there is an option to contact a support person for instance about distressing sexual experiences. (Nuortenexit website.)

In adolescence, additionally questions related to sexual identity, orientation and health may arise and internet based services can provide valuable help and advice. Seta website has an anonymous Sinuiksi-service which has a telephone line and a chat service for sexual minorities. These services offer peer support from volunteers who have experienced similar kinds of issues. (Seta website, Sinuiksi 2021.) Furthermore, Sexpo website has an internet forum where adolescents can ask sexual health related questions and get advice from the team of sexpo employees. (Sexpo website).

Mehiläinen healthcare centre has offered guidance and counseling about birth control and sexually transmitted diseases through social media since 2016 through the smartphone application Snapchat, which is popular especially among adolescents. The service is anonymous and free of charge. Adolescents ask questions especially related to birth control pills and other contraceptive methods. The young also express concern for possible symptoms of sexually transmitted diseases and pregnancy. Healthcare professionals give information and advice and guide the adolescent to the right type of care provider, if needed. (Mehiläinen website, 2018.)

6.5 Oral health

A study on THL website (Pohjola et al., 2021) discussed the importance of oral health associated with general wellbeing. Oral problems can lead to long term illnesses such as problems of the cardiovascular system and through this, increase mortality. (Pohjola et al., 2021). Adolescence is the time when behavioral habits are formed, for example eating and smoking habits. These habits can affect oral health and become habits that remain throughout the lifespan. (Frech, 2012.)

Decent oral health literacy means that the adolescent has studied about oral health and self care and understands the importance of prevention. Insufficient understanding of these matters increases the risk for dental problems. People with adequate understanding of oral health go to the dentist regularly and this helps to maintain desirable oral health. A study in Brazil for 15-19 year olds (Dutra et al., 2019) showed that those adolescents who had a lower socioeconomic status or insufficient understanding of oral care had notably more cavities in their teeth caused by tooth decaying. Adolescents from a lower socioeconomic class usually have less regular routines for toothbrushing and might have less knowledge about oral care and possibilities to use different oral health services. It can be more difficult to follow a healthy diet instead of using sugary foods and drinks and afford dental hygiene products. On the other hand, low understanding of oral health leads to neglecting treatment by not going to the dentist. (Dutra et al., 2019.) However, these differences between groups regarding understanding the importance of oral healthcare are probably not as significant in Finnish adolescents.

This research article indicates that we should focus on health promotion and prevention to increase the level of oral health understanding. Giving adolescents more education about oral healthcare and the importance of regular dental care habits could decrease the need for treatment and save on dentist visits. E-health services could address this issue with tools that help the adolescent to monitor their own health habits and make changes to them. Information about the prevention of oral health problems can be supplied online, for example on an educational website, with a self-evaluation possibility.

According to Heikkinen (2019), prevention of certain health conditions such as diabetes and eating disorders are a major factor in the promotion of adolescent oral health, as they cause dental problems including periodontal disease, gum problems, tooth erosion, dental caries and dry mouth. In addition, adequate oral care including tooth brushing, flossing, regular mealtimes, avoiding sugary drinks and smoking impact health positively and help to prevent illnesses by blocking bacteria from getting to the body. (Tilander, 2016).

Pohjola (et al, 2021) studied that in adolescence mental health problems and psychological distress, such as depression or social phobia, increase the risk for bad

oral health since people with mental health problems may give less attention to self-care. This indicates it is important to treat those mental health problems affecting physical health, quality of life and general wellbeing. This Finnish study from 2021 showed that compared with the general recommendation with brushing teeth two times a day, those adolescents who had anxiety disorders brushed their teeth twice less daily than adolescents without such issues. Mental health problems such as social phobia often start in adolescence, the age when social and physical changes occur and independence increases, which is why the interventions should start early. The family of the adolescent also has an effect on dental hygiene and health, as parents can help establish routines for toothbrushing and be a role model. The educational level of parents affect toothbrushing, and parental habits easily move over to the child. This is why those adolescents from families with malfunctioning relationships can be at an increased risk for dental hygiene deficits and oral health problems. (Pohjola et al., 2021.)

It seems that the development of e-health services has not extended that much into oral health, at least in Finland. On the other hand, telemedicine services do exist, offering an opportunity to contact a professional in case of acute oral health problems or conditions occurring after dental operations, for instance. It is possible also to get advice on oral self care, prescriptions and aesthetical procedures. These services can be utilized from a computer or through a smartphone application. (Mehiläinen, Digiklinikka.)

There was a noteworthy study (Scheerman et al., 2020) about one smartphone application called WhiteTeeth, which aimed to improve oral health in adolescents during a 12 week study period. A total of 132 adolescents from the Netherlands took part in a study which was conducted to evaluate the effectiveness of the application. The adolescents were divided into two groups, with one receiving conventional treatment methods supported by the mhealth application and the other getting only normal treatment.

The application utilized behavior change methods, positive messages, photos, reminders and personal feedback. The study was initiated with the adolescents taking a picture of their teeth to determine the amount of dental plaque in them which the application analyzed. The adolescents were encouraged for goal setting and self

assessing their daily dental health. Reminders kept track of the achievement of individual goals. The application offered a timer for toothbrushing and gave instructions on proper brushing techniques. After every week, the adolescents took a picture of their teeth again and the application evaluated if the previously set goals had been achieved or was there a need to modify goals. The participants transmitted their health information from the application every week to the system managers.

At the beginning, halfway and the end of the study, the participants were able to report their oral health habits through a questionnaire with the support of clinical examination. The questionnaire included inquiries about dental care such as brushing teeth, flossing, using mouthwash and other oral care methods. Regularity of care practices was assessed. The study indicated that this mhealth solution had an effect on oral care, since bleeding of the gums and teeth plaque appearance diminished in the group of adolescents using the smartphone application as support. This group had 11 percentage points less plaque in their teeth after the observation period. There were variations of the site of dental plaque formation in participants teeth. In addition, use of mouthwash increased in the intervention receiving group. When developing applications targeted for oral health, it is essential to give attention to usability, utilize techniques which promote behavior change and properly give the user a role in their care in order to motivate long term self care. (Scheerman et al., 2020.)

7 CHRONIC DISEASES, LIFESTYLE AND E-SERVICES

7.1 Diabetes as a challenge for adolescents

Type 1 diabetes is a chronic condition where self-management is crucial. This includes frequent monitoring of blood glucose and reacting to those values by adjusting insulin and meals. Regular measurements of blood glucose are essential to maintain an adequate balance of treatment, reducing potentially dangerous complications and mortality in type one diabetics. The life period of adolescence with its challenges combined with the strict management of type one diabetes can create difficulties in self-care. Adolescent's goals for diabetes care are insufficiently achieved, according to findings across countries. (Cafazzo et al., 2012.)

Some e-health services for conditions such as type 1 diabetes can be delivered for example in the form of mobile apps. A suitable example are those wearable sensors that are available for diabetics, for instance Freestyle Libre. The sensor is easy to use, accurate and comfortable for the user. These sensors can be connected to a mobile phone app. The sensor can be scanned with a mobile phone and diabetes care monitored through the app. With the FreeStyle LibreLink app it is possible to monitor blood glucose values and changes in them, see the history of previous blood glucose readings and get notifications about high and low values. (Freestyle website, 2021.)

Cafazzo et al., (2012) studied the benefit of mHealth apps in the self-management of type 1 diabetes through a pilot study. Twenty adolescents (mean age 14.9) were sampled within a 12-week evaluation period. These adolescents had glycated hemoglobin 8-10%. The participants were provided an iPhone app called Bant and they also used the Lifescan glucometer in order to transfer information to the application. Readings from the glucometer were transferred automatically to the app via bluetooth. The application sent reminders for the users. There was a possibility to socially interact with other adolescent users. Game-like techniques were utilized, for instance in the form of points for certain behaviors, that enabled gaining levels and getting rewards.

Frequent measurement of blood glucose leads to a better balance of treatment and prevention of complications. Results of the pilot study indicated that measurement of

blood glucose increased as much as 50%. The participants enjoyed using the application and 88% said that they will use it also in the future. However, there was no notable change on glycated hemoglobin. Researchers predict that those methods which caused an increase in blood glucose measurement were the game-like techniques integrated into self care and also the notifications which the application utilized. The study shows that there is evidence that behavioral change in type one diabetes can be facilitated through a mhealth solution. (Cafazzo et al., 2012.)

Young diabetics and those worried about their risk of getting diabetes can benefit from a chat service including counseling such as the one on Diabetesliitto website. The chat was established in 2020. In the chat, diabetics at different life stages can get peer support from each other and discuss what they have in mind related to diabetes. The chat includes changing themes, such as care adherence and coping with diabetes. Diabetesliitto has also a telephone line which is useful in case the adolescent wants a professional opinion and guidance. A nurse specialized in diabetes care answers calls to the Diabetesliitto telephone line. (Diabetesliitto, 2020.)

7.2 Management of asthma in adolescence and e-health

It has been studied (Bitsko et al., 2014) that adolescence is an important stage in terms of asthma management, because adolescents who have asthma are at a risk for asthma morbidity and mortality related to those psychosocial and physical changes that one experiences during adolescence. When we discuss management of asthma, focus should be given also to harming health habits, for instance smoking. Adolescence is the developmental stage where smoking usually begins. Smoking aggravates asthma symptoms, as adolescent smokers have more severe symptoms as a result of smoking such as wheezing. Prevention of obesity is also essential, as it correlates with asthma and may result in more strenuous asthma control.

The adolescents face psychosocial challenges and changes such as growing more independent and autonomous, communicating and relationships with peers and family, dealing with conflicts, and coping with the demands of school and work besides having chronic illness. Psychological fears related to asthma can be highlighted and the chronic illness can cause embarrassment for the adolescent, making them reluctant to take asthma medications in the sight of other young people.

As the probability for mental health symptoms and illnesses such as depression increase overall in adolescence, the risk for anxiety and depressive symptoms is even greater when the adolescent has asthma. 20-50% of adolescents having asthma have also co-occurring symptoms of depression and one third has anxiety. Adolescents with co-occurring psychiatric symptoms can be unwilling to follow their treatment regimens, leading to worsened control of the condition, lower quality of life and more negative outcomes of treatment. (Bitsko et al., 2014.)

Based on this, it can be noted that encouraging adolescents to self care of their asthma could have a positive effect on outcomes. Another mhealth application for chronic conditions among adolescents was studied in 2015 (Burbank et al.), when researchers evaluated the usefulness of an asthma action plan delivered via mobile phone for young people aged 12-17 years. Aim of the study was to determine the usefulness of an asthma mobile application, the participants satisfaction with the app, frequency of app utilization, and the effects of the app on asthma management and self-efficacy after the study period lasting for eight weeks with mean use of four days per week. The application required a smartphone. With the application participants were able to keep track of their asthma symptoms, medications and document their peak flow measurements, getting also individual feedback and notifications from their smartphone.

As a result, the participants experienced that they gained better control of their asthma management with the help of the application. As much as 93% were content with the application, stating that the mobile asthma action plan increased self-control of their asthma. Those participants who had uncontrolled asthma at baseline, got better scores from the asthma control test, going from 16 to 18 and the self-efficacy measurement points in relation to the prevention of asthma attacks improved from 34 to 36. This study shows that an individually managed mobile application such as an asthma action plan could support the health and lifestyle of adolescents.

Adolescents are the fastest growing group to embrace smartphone apps and technology to themselves. That is also why it could be beneficial to make the apps interactive and interesting, with virtual prizes and status updates, and designs and graphics that are appealing to adolescents. This could increase the usage of apps even

for a longer time and encourage the adolescents to self-manage their asthma or diabetes, for example. (Burbank et al., 2015.)

7.3 Epilepsy and e-health

Epilepsy is a neurological abnormality which causes seizures. It is a chronic illness that can begin in any life stage, including adolescence. Three adolescents in a thousand have epilepsy among Finnish adolescents aged 16 years old or younger. Aim of care is to reduce seizures mainly with medication. (Käypä hoito-suositus, 2020.)

The Finnish website of Epilepsialiitto offers a specific virtual place for young epileptics to gather together and share their thoughts, experiences and feelings. Especially new epileptics can feel that they can come in terms and cope more efficiently with the illness when they hear about others in the same situation. A youth community known as Finnish Epilepsy Warriors organizes free time activities together. Adolescents from Epilepsialiitto have also social media pages and a shared Whatsapp group. In a blog on the website adolescents can write from a personal perspective about their coping with epilepsy. (Epilepsialiitto website.)

Living with a chronic disease can sometimes feel challenging and have an effect on motivation for self management. These kinds of internet based youth groups and meetups mentioned can make life with a long term illness such as epilepsy feel easier because they create a sense of togetherness and the group of adolescents can support each other. Hearing about various opinions and experiences can widen the adolescents perspective about the illness and a virtual group can seem easy to approach.

8 MENTAL HEALTH AND E-SERVICES

8.1 Adolescent mental health and the need for interventions

Mental health disorders are common among young people. Most prevalent mental health disorders among adolescents in Finland are mood disorders, anxiety disorders, substance use and behavior disorders. Every fifth, approximately 20-25% of adolescents have a mental health disorder, and clustering of disorders is common. Three quarters of mental health disorders start before the age of 24, and about half of them start before the adolescent is 14 years old. When assessing the adolescents' mental health status, it is important to give attention to all-encompassing functioning and survival of every day activities. The adolescent can skip class or withdraw from social interaction and these kinds of events can help to pinpoint the occurrence of mental health problems. (Marttunen et al., 2013.)

Reported by Pretorius, Chambers & Coyle (2019), adolescents use the internet often as their main information source, and this extends to searching data about health related to physical and psychological matters. Mostly utilized services among adolescents for this purpose are web-based search engines, where search terms concerning the issue can be applied. The internet's informational websites have internet forums where the adolescent can anonymously discuss their mental health related matters. Adolescents value a place where they can share their feelings and thoughts without the possibility of stigma. Adolescents can favor online help seeking also because of the fast and easy access, some also don't want to rely on others for help with mental health problems. However, some adolescents like the idea of connecting with peers and use internet communities, chats and social media. Online help seeking can also have negative effects, as it can prolong seeking of professional help. Content on the internet can lead to thoughts or actions that are harmful and all adolescents are not aware where to seek quality information from the internet related to mental health, caused by lack of understanding of the topic. (Pretorius et al., 2019.)

Adolescents and grown-ups search for mental health related smartphone apps to help with symptoms or increase understanding of conditions. In a study from 2014 from the United States, smartphone apps related to mental health were mostly used for relieving

symptoms such as low mood or anxiety, with techniques involving relaxation methods, management of stress, sounds that are calming and tracking of symptoms, for instance keeping a diary about moods to help observe behaviors. People were attracted to those apps that were described as easy to use, educational and insight-increasing. (Radovic et al., 2016.)

According to Kenny, Dooley & Fitzgerald (2014), smartphone applications that emphasize self-monitoring can be beneficial in reducing symptoms of depression. It is predicted that in the future, the use of mental health related smartphone apps will increase remarkably. Factors that adolescents consider important in mental health related mobile phone apps are simplicity and clarity, security and confidentiality, the apps should also be realistic and inexpensive. Mobile health applications are available when needed with continuous usability and easily accessed from home.

A study (Kenny et al., 2014) conducted for 34 adolescents aged 15-16 years old found 8 core values the adolescents considered important in mental health related mobile apps. (Figure 7).

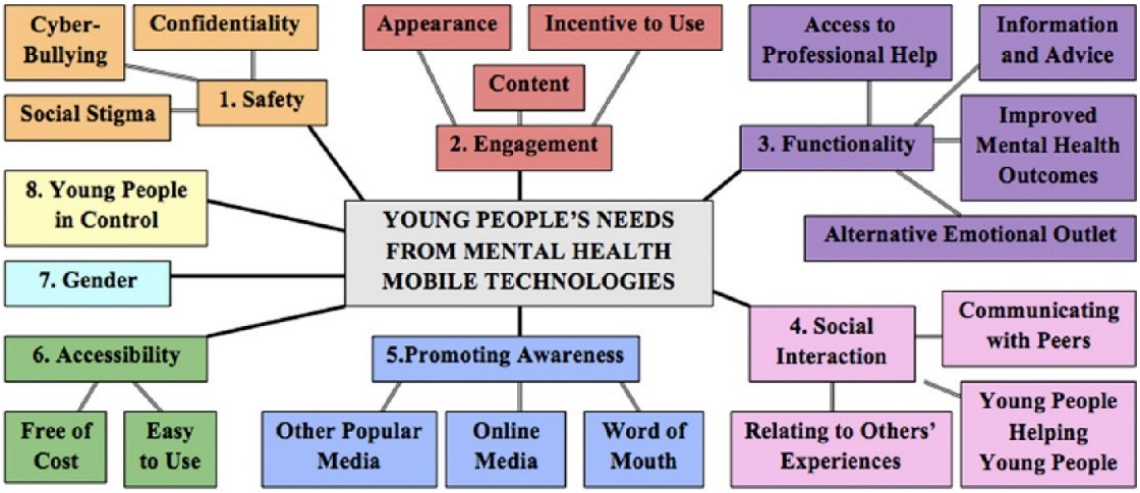

Figure 7. Themes adolescents consider important in mental health mhealth services. Kenny et al., 2014.

Safety and confidentiality were an essential issue. The adolescents wanted the applications to have password protection, be anonymous or have an option about choosing whether or not to share their identity, for example to prevent cyber bullying. Anonymity is also essential as not all adolescents want others to know that they use these kinds of applications. The adolescents wanted the apps to be engaging and

appealing, with nice content, colorful graphics, videos, audio and the ability to individually edit the app layout. Information should be exact and up to date and the application should have the ability to be individual and different from other applications.

Functionality meant that participants wanted the apps to contain relevant information and be useful with the possibility to contact healthcare professionals. A questions and answers feature was seen as beneficial. The adolescents wanted the apps to enable social interaction for instance through a chat feature with a chance to give and receive peer support and share their own experiences and issues. These first three themes were the ones adolescents in the study considered most important.

Promotion was seen as an important way to make these apps more common and increase mental health understanding among people. Social media and those kinds of websites and magazines adolescents use and read were seen as possible channels of promotion. Furthermore, the youth wanted applications that are easy to access, uncomplicated and inexpensive or free of charge, with adolescent-friendly language. The participants discussed gender differences and some boys' unwillingness to express emotion, and how this might affect app use. However, there were differing opinions with some stating that actually the application use is not dependent on gender but on personal factors.

Lastly, the adolescents also wanted a feeling of being in control, to choose themselves whether or not to use an mhealth app. Taking account the needs of users has been agreed to be a key factor when designing mobile applications related to mental health. To make these applications more adolescent-centered, the youth should be involved in the app development process right from the start. (Kenny et al., 2014.)

An Australian survey (Ellis et al., 2013) inspected young mens’ attitudes towards seeking help for mental health problems online. A total of 486 men aged 16-24 years completed the survey with different kinds of questions. The participants were asked what help sources would they recommend if a friend told them about a mental health problem. Most common answer was friends, with 86,6% of answers. Some answers were seeking the help of professionals such as a counsellor (70,1%) or a doctor (67,1%). Other help sources that came up were also relatives and members of the family (63,5%) and the internet (40,6%).

More than half of the participants had tried to find help for their problems on the internet. Majority of men, especially younger ones, had found online help seeking beneficial (81,3%). When the participants were asked about their preferred way to get mental health information with the help of information technology, the most popular answer was through an informative website, possibly containing fact sheets.

Some young men experience that because of their gender they should not seek help because it could be seen as a sign of weakness. Many participants had an opinion that they would not want to hear others discussing mental health issues or to confront their friend with mental health problems directly, but instead urge them to be more social or do sports. Young men were most welcoming for receiving help anonymously online. They wanted mental health related matters to be associated with their interests. This means mental health content being delivered for example in young mens' online communities or through a well designed search engine where it is possible to check symptoms and get guidance on them.

Young men were hesitant to seek professional help but rather relied on a friend to help with their problems. Seeking help from a professional was seen negatively. The study showed that Australian male adolescents in this study have insufficient knowledge about mental health and inadequate skills to seek information and support for mental health related matters. As young men use technology often, mental health interventions could be presented in an interesting and engaging way and integrated into the every day online habits of men and possibly talked about as improving strength and effectiveness rather than as help with mental health problems. (Ellis et al., 2013.)

Virtual clinics are a noteworthy, supplementary treatment option for adolescents. Through virtual therapy adolescents can take control of their care and develop skills in managing themselves and their condition. Virtual therapy can offer access to healthcare professionals and give symptom assessment and monitoring tools. When the undergraduate students (19-24 years olds) in a study (Farrer et al., 2015) were asked about what they would want from a virtual health clinic, there were suggestions that it would be important to focus on prevention and general wellbeing, instead of just treating existing conditions. In addition, living a balanced healthy lifestyle was noted as an important factor. Finding out about all the possible signs and symptoms of mental illness and information about each illness rose as a significant issue.

The participants also found it important that the content in a virtual health clinic is aimed specifically for university students and for issues they might have, such as stress about scheduling or schoolwork. The adolescents wanted the website to be tailored especially for their age group and take personal factors in consideration. Simplicity of website use and interactive features were favored, such as educational videos. Adolescents liked the idea of sharing their own experiences about recovery from mental health issues and also the idea of a possibility to contact a professional through the clinic and offer and receive peer support. Some found it important to get guidance on how to help family and friends with mental health related issues.

Some concerns were also raised about the virtual health clinic. These included the privacy of shared personal information and the fear of stigma for instance the mental health disorder affecting school grades. Students also wondered, would the quality of the virtual health clinic care be as good as the treatment that other services offer. The students acknowledged that diagnosing themselves could possibly be unreliable or even harmful. The services of the virtual health clinic should be evidence-based, with well-trained professionals, offering specialized care. (Farrer et al., 2015.)

8.2 E-services related to mental health

E-health services from Mielenterveystalo can offer valuable advice and help for adolescents. Mielenterveystalo is a website that offers education and online therapy for mental health problems. Online therapies are provided by HUS Helsinki University Hospital. Online therapy can be started by contacting the doctor and discussing the need for therapy. After the doctor's referral, it is possible to start an online therapy that is free of charge for everyone living in Finland. Online therapy is mainly directed for people over eighteen years old, but sometimes it can also be offered for sixteen and seventeen year olds, depending on the doctor’s opinion.

When the therapy begins, a therapist, such as a psychologist or a nurse specialized to the situation and the patient’s symptoms, will be the contact person, answer questions, support and give individual feedback. Online therapy is based on cognitive psychotherapy and it supports independence. Material for independent study is given and tasks increasing insight of self, such as writing a diary. Online therapy helps to increase self awareness and requires motivation in order to produce beneficial results.

There is online therapy for different kinds of problems including depression, bipolar disorder, generalized anxiety or social anxiety, obsessive-compulsive disorder, sleeping problems and alcohol abuse. (Mielenterveystalo, Nettiterapiat.) Mielenterveystalo also offers different kinds of self-help programmes and chat services. The self-help programmes deal with topics that can be important not only for an adult but also for the young person, such as relationships, mental health issues, binge eating and drinking, money problems, self harm and insomnia. The programmes can be completed at your own pace, directly from the home environment. (Mielenterveystalo, Omahoito.)

Furthermore, Headsted is a website that also offers self-help programmes for mental health around themes such as anxiety, stress management and sleeping problems. The programmes include for example mindfulness techniques and exercises related to the themes and aim to change the users reactions by approval of negative emotions, also known as cognitive-behavioral HOT-therapy. (Headsted website.)

Additionally, there is Toivo self-help programme helping with crises in life, such as loss of a loved one. Toivo offers information about crises and grief, helps to deal with grief, discusses thoughts and feelings, crises effect on identity, coping strategies and also the social aspect of crises. There are various exercises on the website, which include tasks that are thought-provoking, or help with relaxation or increasing self-awareness, for example. (Nuorten mielenterveystalo, Toivo oma-apuohjelma.)

A survey in 2018 (Anderson & Jiang, 2018) indicated that 90% of teenagers in the United States play video games on any platform such as a smartphone, console or the computer. In addition, 84% own a gaming console or have access to one. Video games can also be seen as a way to provide e-health services, such as games for treating mental health issues, for instance anxiety.

Palva (2021) from Aalto University is leading a research group that seeks to develop a computer game that could help with the treatment of depression used besides medication and therapy. The game is planned to be action-game like, taking place in a fantasy city. Those beneath the surface features the game offers produce a therapeutic effect. The game has been tested in an eight week clinical study that involved the University of Helsinki, Mielenterveystalo and the Helsinki University Hospital Psychiatry

Department. The participants played the computer game for the required trial period and it was shown that the game actually had a positive effect. Symptoms of depression alleviated and cognitive skills got better. However, conventional treatment methods offer still a better response, and this is why the researchers will continue to develop the game and study the game's effect on brain functioning to offer even better help for those who are depressed. (Palva, 2021.) In addition, there is already an existing video game which requires a doctor's prescription called EndeavorRX, targeted for 8-12 year olds for the treatment of attention-deficit hyperactive disorder. It affects the child's attention span with objectives which require handling many things simultaneously and maintaining focus. (EndeavorRX website.)

The supply of mental health related information technology solutions is already in a quite good situation as e-health, telehealth, telemedicine and mhealth services exist for adolescents. There are options to contact professionals or discuss issues with other adolescents. For some adolescents chat messages with peers may be the most comfortable way to get health-related tips and information. Chillaa-app is directed for high school aged adolescents and can help with social anxiety with different kinds of methods. These include tips for stress and social anxiety, peer support and relaxation techniques. By combating social anxiety at an early stage, later problems can be prevented such as substance abuse issues, depression and underachieving. Chillaa-app was developed with the help of high school students, together with Nuorten Mielenterveystalo, HUS Psychiatry Department, Duodecim and Adventure Club. It is available for Apple and Android smartphones. (Nuorten mielenterveystalo, Chillaa.) Nyyti ry chat service is directed at students. In the chat, adolescents and young adults can discuss different kinds of topics, such as loneliness in a school environment and self-criticism. (Nyyti ry website.)

Another mental-health related chat website is Sekasin 24/7, an anonymous conversational platform for adolescents aged 12-29 years. Sekasin is a project of MIELI Suomen mielenterveys ry and the Finnish Red Cross. It's aim is mental health promotion and early prevention. You can contact professionals of the organizations and in addition trained volunteers. The conversation stays secure, only between the participants. Sekasin is open every day until midnight, with a 45 minute time limit to have a conversation, in order to give an equal time for everyone. (Sekasin 24/7 website.)

There are also other chat based e-health services available. Finfami is a website that helps people with relatives struggling from mental health issues or substance abuse. Finfami has a chat service for 16-29 year olds whose relatives are having previously mentioned problems. Through this peer support based chat it is possible to discuss different kinds of issues including dealing with emotions such as shame or guilt with others who have a similar kind of situation. Every chat session has a theme chosen beforehand and there is a worker of the organization taking part in discussion. (Finfami website.) The Finnish Red Cross offers online services for adolescents through an anonymous chat service called Suhteellista-chat or alternatively a video chat with a worker of the organization. Adolescents can discuss for instance relationships or mental health. (The Finnish Red Cross website, 2021.)

9 VALIDITY AND ETHICAL ASPECTS OF THE STUDY

A valid study can be described as authentic or legitimate. Validity is the concept of an instrument measuring what it has asserted to measure. It means that the aim of the research must correspond to the content of the research. This includes choosing a research method and concepts which are suitable for the study in question. (Gerrish & Lathlean, 2015.)

The concept of validity can be divided into internal and external validity. According to internal validity the findings of the study should be accurate, legitimate and be coherent with the objective of the research. External validity or in other words reliability originates in quantitative research, and may be more difficult to achieve in qualitative studies. (Holloway & Galvin, 2017.) According to Lincoln & Guba (1985) it is defined as the ability of a measure to give the same kind of results as before when it is used in similar circumstances and populations, being generalisable and consistent. Concepts and research findings should be able to be applied to a similar study in some other context. (Sullivan, 2011; Holloway & Galvin, 2017.) The reader must be able to follow the researcher's decisions in order to gain insight into how the researcher has come up with the decisions and results in question (Lincoln & Guba, 1985). In addition, reliability helps other researchers who would like to produce research about the same subject, and allows the reader to assess the competency of the analysis process.

A valid research is objective and free of the writer's presumptions and prejudices. It is beneficial to open the background of the research for the readers by enabling utilized data to be followed to its original reference. This can be established by representing details of analysis, themes and interpretations. (Lincoln & Guba, 1985; Holloway & Galvin, 2017.) The process of data analysis in this research is explained in chapter four, where there is also a table about the details of literature searching.

References are a way to create validity for the research as well as methods including peer reviewing, multiple data sources (triangulation), decision trails and searching for other explanations for questions. (Holloway & Galvin, 2017). The researcher should be cautious not to distort or deform the contents of reference literature. (Gerrish & Lathlean, 2015). Validity is defined also by how well the content of the research answers the research question(s).

It is important to consider if it is possible to implement and transfer the results of the research and balance the pros and cons of the research. A work written according to the principle of validity is thoroughly planned and written in a honest and responsible manner. (Gerrish & Lathlean, 2015.) Validity requires data that is a desirable quality and up to date. Validity can be assessed with the aid of data quality measuring instruments such as control groups or randomization. (Swanson, 2014.)

One should not make up data themselves and change, misinterpret or neglect results or data. Chosen references or the research process should not be manipulated or falsified. Plagiarism in research is forbidden. It is the use of other person's ideas or findings as your own without giving acknowledgement to the original researcher. (Yip et al., 2016.) Finnish national board on research integrity (TENK) created guidelines for responsible conduct of research in 2012, which inform that in order for the results to be credible, the research has to be conducted with accuracy and honesty, following the mutually shared rules. Research conforms to ethically sustainable principles when collecting data. (TENK 2012.) Respect for other researchers means giving them the credit they deserve for their productions. (TENK, 2012). Researchers are responsible for their output which is why it is important to guarantee the certainty of work and assure the dissemination of results in an open manner. (Muukkonen, 2010).

In this literature review the guidelines of TENK were appreciated. Material was collected from many different sources, from several authors and writers to build validity for this study. Ethical aspects are taken in account in this thesis especially by choosing suitable references. Keywords and inclusion and exclusion criterias in selected databases were utilized in article collection phase to ensure acquiring of relevant and up-to-date information. Those articles were chosen which were important regarding the aim of this research, focusing on quality with adequate reasoning and information that is not too old, with a maximum of 10 years. Scientific and peer reviewed articles were favored. Primarily those articles were chosen which had the used references listed. All materials utilized were openly published or accessed through institutional name or email. Besides the content, attention was also given to the proper language of the articles.

All utilized references were written down to the reference list and the text in order to be respectful towards other researchers. This research was written truthfully and in a responsible way, without preconceptions. To ensure the exactness of this work, some notes were written down to help bring all important details about the subject of this thesis. The study aimed to process logically, according to the themes and research questions.

This literature review did not include personal information of individuals or meeting adolescents so matters considering ethical questions related to individuals and participant rights could be left out of consideration.

10 CONCLUSION AND DISCUSSION

10.1 Conclusion

In this literature review, certain lifestyle-related factors which affect adolescent health were identified and these are healthy eating, physical activity, alcohol and tobacco use, sexual health, oral health and mental health. E-health services were searched and found for every lifestyle related factor discussed in this work. E-health has been utilized quite diversely in healthcare as there are many types of options to choose from. Results of the study indicated that adolescents use technology often also in health related matters, which is why e-services are a suitable means of healthcare.

First of all, to consider the first research question in this thesis (what kind of lifestyle related e-health services are available for adolescents), existing data was found about different themes. Problems with weight management were reported as an area of concern. Considering problems with being overweight, adolescents' response to an idea of an online weight loss programme was mainly positive. An intervention based on a website emphasizing goal setting and a possibility to track eating and exercising habits was found beneficial. This intervention was supported by emails and text messages. Additionally a mhealth application combined with a wearable sensor helped to change adolescents eating habits to a healthier direction and adopt a more active lifestyle. A smartphone based method for self-monitoring was utilized also in an asthma action plan and proven useful.

There are various smartphone applications for monitoring exercises and distance or steps taken, for instance. Smartphone applications offer additional virtual training lessons. E-health interventions for physical activity are partly established through games, for example by some consoles motion sensor properties. Game-like approaches can increase participants' physical activity, changing their outlook on sports through goal setting and achievements. Gamification techniques have also been utilized in other health related e-solutions such as mobile applications including Bant, which increased adolescent type one diabetics measurement of blood glucose.

Among types of e-health services studied, there were not many e-health services about oral health and substance use. Concerning oral health, telemedicine services do exist, which means usually remote contact with a physician. Besides remote care services, in

a study a particular smartphone application was tested in adolescents and proven useful in reducing dental plaque. Regarding substance use, there are websites with support and information for the adolescent himself or alternatively help for those adolescents whose relatives have these kinds of issues. For smoking there is a website that can offer help with quitting tobacco products through a conversational platform, possibility to contact a professional and other kinds of support. In addition, a mobile application for smoking cessation was tested and gave promising results.

Mental health is not considered a lifestyle habit, however it can have a notable effect on lifestyle related factors, such as substance use. The majority of e-health services seemed to be developed for mental health. These e-services included online therapy, self care programmes, websites, smartphone applications, chats and conversational platforms focusing on mental health related questions. The results indicated that certain attitudes and mental health literacy affect help seeking.

Secondly, to answer the question of what kind of e-health services adolescents need, the findings indicated that adolescents are generally quite healthy but they have risk factors that could lead to later illnesses. Overweight however is common and increasing among adolescents. E-health services are a potential resource to combat this problem. The findings indicated that setting personal goals and monitoring one's own habits are beneficial in eating and physical activity management, which is why these factors should be noted in the development of e-health services.

Adolescents have an interest in self-monitoring of weight, eating and exercise habits. Wearables such as an activity wristband connected to a smartphone are useful for self-monitoring purposes. Motivational e-services that the adolescent does not quickly lose interest in are the most beneficial. Those adolescents who place a lot of importance on weight are at risk for eating disorders, making this an essential issue to note and a challenge for e-health.

Although e-health services exist, there could be even a greater variety of them targeted specifically for adolescents. Based on a sexual health website model, adolescents want internet based approaches to offer guidance not only about biological aspects of sexuality, but also for instance relationships and communication, presented realistically and in an understandable manner. Especially for oral health, e-health services seemed to be scarce. Understanding and knowledge about oral health have a major impact on dental self-care, which is why adolescents could benefit from informative and educational

e-health solutions. The supply of mental health e-services was the most comprehensive. Adolescents favor web based mental health services that are designed specifically for their age group, are confidential, relevant and have an ability to contact professionals. Those services for mental health which have involved adolescents in the development process taking their opinions into account, are secure, engaging and well functioning are needed.

10.2 Discussion

During the research process a better understanding of the state of youths' health and the variety of e-health services available for adolescents with different kinds of concerns was obtained. The significance of this study is that it investigates and clarifies current e-health services directed for adolescents and acts as an aid to navigate possible needs for development. Adolescents' lifestyle habits, e-services and their effect on health is a current and important subject. Nowadays information technology based solutions have grown to be even more specific and widely utilized. Currently with the global pandemic of covid-19 the relevancy and necessity for digital health services are highlighted and new e-services have been developed, for instance online symptom assessment.

Problem areas in adolescent lifestyle habits were found to be especially overweight and lack of physical activity. Creating and maintaining motivation for healthy eating and physical activity is essential for long term results. Adolescents should be encouraged to try different types of sports to assist them find out what they find most enjoyable. Various physical activity tracking smartphone applications already on the market are popular among adolescents and adults and likely have a role in building and maintaining motivation.

Perhaps more e-health services could be developed with the focus on adolescents' diet and healthy eating. Some adolescents might find already existing internet wellness programmes beneficial but they are not suitable for everyone. Presumably, a conventional diet or exercise plan is more effective at handling weight problems when compared with e-health methods, but electronic services could be used additionally to help adopt healthy behaviors. In addition, there appeared to be quite little e-health services related to oral health. However, a possibility to assess own oral health through a questionnaire or an educational website about oral health increasing oral health literacy could possibly be beneficial in prevention of dental problems and illnesses.

Fortunately there has been a reduction in prevalence of smoking in adolescence, possibly because adolescents are more conscious about the negative effects of smoking. Smoking is still more common among adolescents in vocational institutions, however. In adolescence, various factors affect this. The community, social atmosphere, and peer relations can have a remarkable effect on lifestyle habits. (Aho et al., 2019). In addition, these factors likely have an effect on youth alcohol use too. In terms of developing e-health services related to tobacco and substance use, anonymous peer support groups in the internet are most likely helpful for people tackling with these issues. Another potentially beneficial option is a virtual coach who offers guidance, motivation and support related to these matters.

As mentioned in the conclusion, especially mental health e-services are common and perhaps this is the field where the majority of e-health services can be found. Other lifestyle habits related factors could use more of these kinds of e-services that mental health already has. As mentioned, mental health is not an absolutely lifestyle related factor, but it has an effect on other factors. Mental health e-services could be a first route for contacting professional help because these services are usually secure, private and non-stigmatizing. On the other hand, e-services related to mental health can also have negative effects as they might delay or inhibit seeking help of professionals or result in misdiagnosing oneself. Not all sources on the internet are good quality which increases the risk of misconceptions and false information.

Gender and associated attitudes have an effect on help seeking for mental health problems. A study utilized in this thesis indicated that in order to lower the threshold for contacting professionals, mental health services could be integrated for instance into online communities and personal interests of adolescents. When developing chat services and discussion forums related for instance to mental health where adolescents can give peer support, we should give attention also to possible adverse effects of them including cyber bullying. Bringing safety into social platforms can be seen as a challenge for mobile health. (Kenny et al., 2014). Many chat rooms are lacking proper supervision or totally unmonitored (Norris, 2007). which exposes adolescents to bullying or other disadvantages. Cyber bullying leads to worsened mental health problems and can have a negative long term effect on the adolescent. Reporting mean or abusive behavior can be seen as one solution, but unfortunately there is sometimes no help from these kinds of measures. (Kenny et al., 2014.)

Information technology and digital services are rapidly developing and they are not used only for treatment, but also for health promotion and prevention of health problems. It became clear that the key in preventive lifestyle-related e-health services is to focus on behavioral change to facilitate the change of lifestyle habits into a positive direction. This study managed to pinpoint the shortages in adolescent's lifestyle habits and investigate what kind of e-health services are available for adolescents. In terms of validity, the search and use of reference material was quite versatile, providing different views to this thesis acquired from findings. In terms of doing something differently in this work, this literature review did not include material about the actual amount of adolescents using a specific e-health service. This study managed to review adolescents opinions and wishes for future e-health services but it could have involved more opinions of adolescents using a specific and current service. In addition, due to the extensive amount of e-health services, it turned out to be somewhat difficult to evaluate the quality of each existing service.

It can be seen that the supply of e-health services is already quite comprehensive. However, some of these e-health services could be developed further and targeted even more specifically to a group according to the chosen lifestyle factor in question, for instance, with more specific care and guidance. It appears that creating motivation (Buratta et al., 2016) and utilizing resources available lead to more consistent results. The results of the study indicated that information technology based solutions offer new kinds of opportunities to deliver healthcare, saving time and money. The ease of access is a major benefit of these kinds of services. When discussing adolescents' need for e-health services, this research indicated that it is important to focus on quality, security, patient-centered individualized approach and efficiency when developing new e-health services.

As the study showed, tailoring of e-health services and personalized information and contacting options such as text messages are necessary in order to increase commitment and efficiency of interventions. Adolescents appreciate the possibility of sharing personal experiences and information with others through applications and other conversational platforms. It was noted that adolescents give value also on the entertainment side of applications and websites, which is why it could be useful to design applications that are developed specifically for this age group, are appealing, interactive, interesting, contain videos and are possibly game-like. It is worthwhile to ask the opinion

of adolescents or involve them in the development of applications and other e-health services, since they are the group to which these services are targeted.

Adolescents are usually handy with information technology, but as e-services become even more common, some special groups need to be taken in consideration for instance people with poor eyesight and people with mental health issues. Mental health troubles can affect self care negatively which can be seen for instance in neglecting dental self care leading to caries. Furthermore, to narrow the gap between socioeconomic groups and promote health, living conditions and social factors in adolescents need to be taken in account. This includes also improving working conditions in some professions. E-health services seem to be a form of health education of one kind that is suitable for adolescents. Besides school education and e-health, healthcare providers could learn about safe internet use and be prepared to educate adolescents about e-health services and overall internet surfing.

Healthcare providers could ask during routine check ups or school nurse appointments for what purposes does the adolescent use the internet for and how often, and additionally questions related to the adolescents online health information seeking such as the use of health related websites and forums or other e-health sources. It could be beneficial for healthcare professionals to inquire whether if the adolescent has faced information he or she is unsure, disturbed or confused about (Norris, 2007.), and promote safety and wellbeing by giving guidance on suitable, evidence-based websites for health information related internet searches.

10.3 Further research and development

Regarding further studies associated with this subject, research could be conducted about the capability of e-health services to integrate with the reform of the social and healthcare system in Finland. Additionally, it could be considered how e-health services could be developed in association with the reform. E-health services can be seen as a solution for faster and easier access for care. One of the aims of the Finnish social and healthcare system reform is to make illness prevention more effective. (Valtioneuvosto website). Preventive care can be supplied through lifestyle related e-health services.

The actual functionality and effectiveness of the e-health services presented in this thesis could be studied more. This may be implemented through feedback based interviews

and inquiries for adolescents who use e-health services, suppliers of e-health services and also for healthcare professionals who regularly meet adolescents using these services. Besides ensuring technical functionality, information security and network connection, making e-health services easy to use and efficient is essential. Further development could be provided regarding the education and training of healthcare providers to e-health utilization. It is important to notice those patient groups and areas where e-health can be implemented and where it cannot. Education for adolescents about the variety of e-health services available helps to increase awareness of them.

Furthermore, as a development idea for e-health services, a Finnish database containing all available e-health services sorted according to different themes could be created. This would make it more convenient to find suitable platforms and services. Another option is an online questionnaire which based on the clients concerns offers a specific e-health service. These questionnaires could be offered also by the public health nurse or school nurse appointment, leading to the healthcare professionals recommendation for an individually suitable e-health service.

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Section Break (Next Page)

Appendix 1 Data selected from literature search

Title: Be Positive Be Healthe: Development and Implementation of a Targeted e-Health Weight Loss Program for Young Women.

Telemedicine journal and e-health : the official journal of the American Telemedicine Association, 22(6), 519–528.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4892194/

Author & publication year: Hutchesson, M. J., Morgan, P. J., Callister, R., Pranata, I., Skinner, G., & Collins, C. E. 2016, Australia.

Aim of study: : When compared with other life stages, weight gain is greatest in adolescence among women. Aim is to study the effect of an e-health weight loss intervention programme Be positive Be healthe to help overweight women take control of their weight and reduce risks related to being overweight. To achieve a 5% weight reduction among participants (18-30 year old women who are overweight) and find out do young women have interest in an e-health weight loss programme.

Sample: 274 overweight female participants aged 18-30 years. A single-arm pre-post study.

Results: Participants found beneficial information about nutrition and physical activity. Emails were most useful for weight loss goal achievement. The intervention managed to achieve reductions in weight, amount of fat in the body and waist circumference.

Title: The relationship between peer relations, self-rated health and smoking behaviour in secondary vocational schools

Nursing Open 6 (3) **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6650760/**

Author & publication year: Aho, H., Koivisto, A., Paavilainen, E., Joronen, K. 2018, Finland

Aim of study: To study how smoking behavior, self-rated health and peer relations are related among vocational school students

Sample: 34776 vocational education students took part in the school health promotion study in Finland. Descriptive quantitative study.

Results: The study reported the prevalence of smokers among vocational school students. Smoking was associated with self-rated moderate or poor health and having a close friend or friends. Bullying was also associated with smoking, in boys only.

Title: Adolescent Obesity: Diet Quality, Psychosocial Health, and Cardiometabolic Risk Factors

Nutrients Journal 12 (1) **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7020092/**

Author & publication year: Ruiz, L., Zuelch, M., Dimitratos, S., Scherr, R. 2020, US.

Aim of study: To define dietary habits and cardiometabolic and psychosocial risk factors such as stress among adolescents.

Results: Interventions are required in order to prevent and decrease adolescent obesity. Adolescents should be educated and taught skills so that it is easier to make healthy life choices. Stress management, a healthy diet and exercise are important and improve insulin sensitivity.

Title: Personal and socio-environmental predictors of dieting and disordered eating behaviors from adolescence to young adulthood: 10 year longitudinal findings

Journal of Adolescent Health Vol 55, No 5
https://www.jahonline.org/article/S1054-139X(14)00194-3/fulltext

Author & publication year: Loth, K., MacLehose, R., Bucchianeri M., Crow, S., Neumark-Stainer D. 2014, US.

Aim of study: To find out what kind of personal and socio-environmental factors affect dieting in adolescence and young adulthood.

Sample: 4746 adolescents completed surveys. After 10 years, 1902 of them completed surveys. 10 year longitudinal study.

Results: The personal factors were identified: depressive symptoms, weight concern, weight importance and body satisfaction. The study showed that these are predictive for dieting and disordered eating during adolescence and young adulthood. Especially increased weight importance and weight concern form a risk for youth eating disorders.

Title: Short-term efficacy of an innovative mobile phone technology-based intervention for weight management for overweight and obese adolescents: pilot study

JMIR Publications Vol 6, No 2
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5559653/

Author & publication year: Chen, J., Guedes, C., Cooper, B., Lung, A. 2017, US.

Aim of study: A study of 40 adolescents to find out, how effective a mobile phone intervention app is for overweight and obese adolescents and could the application be used in primary care clinics.

Sample: 40 adolescent participants. Randomized controlled trial.

Results: In comparison with the control group, the participants body mass index improved, physical activity increased, diastolic blood pressure improved. There was also an improvement in self-efficacy, eating habits and leisure time.

Title: Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants

The Lancet child and adolescent health Vol 5 No 1
https://www.thelancet.com/action/showPdf?pii=S2352-4642%2819%2930323-2

Author & publication year: Guthold, R., Stevens, G., Riley, L., Bull, F. 2019, Switzerland.

Aim of study: To describe the prevalence of insufficient physical activity among adolescents aged 11-17 globally and in different parts of the world.

Sample: Data from 1.6 million participants, from 298 school-based surveys from 146 countries, territories and areas. Pooled analysis of cross-sectional survey data.

Results: Insufficient physical activity is common. Globally, 81% of students from the chosen age group were insufficiently physically active in 2016. However insufficient physical activity among boys has decreased between 2001 and 2016, but there is no such change for girls. Most adolescents do not meet physical activity requirements. Adolescent physical activity should be increased.

Title: What young people want from a sexual health website: design and development of sexunzipped

JMIR Publications Vol 14, No 5
https://www.jmir.org/2012/5/e127/

Author & publication year: McCarthy, O., Carswell, K., Murray, E., Free, C., Stevenson, F., Bailey, J. 2012, UK.

Aim of study: To find out what elements and content adolescents consider important and engaging in a website about sexual health.

Sample: 67 adolescents aged 16-22 years.

Results: The adolescents wanted simplicity and truthfulness from the website and content about pregnancy, communication with partner, sexual pleasure and risky sexual behavior.

Title: Adolescents with worse levels of oral health literacy have more cavitated carious lesions

Plos One Vol 14, No 11
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0225176

Author & publication year: Dutra, L., Lima, L., Neves, Erick., Gomes, Monalisa., Araujo, L., Forte, F., Paiva, S., Ferreira, F., Granville-Garcia, A. 2019, Brazil.

Aim of study: To find out whether oral health literacy is associated with cavitated carious lesions among adolescents in Brazil.

Sample: 746 adolescents aged 15-19 years. A population-based, cross-sectional study.

Results: Those adolescents who had a lower socioeconomic status or insufficient oral health literacy, had more cavitated carious lesions in their teeth. Adolescents from a lower socioeconomic class have less information and possibilities for different oral health services, a healthy diet and dental hygiene products. In addition, low oral health literacy can lead to neglecting dental treatment.

Title: Psychological distress, oral health behavior and related factors among adolescents: Finnish school health promotion study

BMC Oral health Vol 21 No 6
https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-020-01357-3

Author & publication year: Pohjola, V., Nurkkala, M., Virtanen, J. 2021, Finland.

Aim of study: To observe the connection between tooth brushing, social phobia and anxiety among Finnish adolescents.

Sample: 45877 Finnish students, 15 years old. Questionnaire study based on the data of the Finnish Health Promotion study.

Results: Those adolescents who had anxiety disorders brushed their teeth twice less daily often than those without such issues. Psychological issues affect oral health and should be treated.

Title: Mobile devices and apps for healthcare professionals: uses and benefits.

Available on PMC https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4029126/

Author & publication year: Ventola, C. 2014, US.

Aim of study: Observe the effect of mobile phones on health care and map out the prevalence, use and benefits of mobile phones among health care professionals

Results: Mobile phone use provides increased efficiency and time, better quality documentation, less errors, quick access to information, more complete patient records and increased workflow. Focusing on apps quality and safety and health care professionals understanding and approving towards apps is a key issue.

Title: The impact of mhealth interventions: systematic review of systematic reviews.

JMIR Publications vol 6, no 1. https://mhealth.jmir.org/2018/1/e23/

Author & publication year: Marcolino, M., Oliveira, J., D'Agostino, M., Ribeiro, A., Alkmim, M., Novillo-Ortiz, D. 2018, Brazil & US

Aim of study: To study the effectiveness and quality of mhealth interventions on various health conditions: how mhealth affects the management of chronic diseases and rehabilitation, health related behaviour and presence on appointments

Results: Text messaging interventions produced better symptom management of asthma, more doctor's visits and less hospitalizations. For those in cardiac rehabilitation, capacity for physical activity improved. Less reported symptoms from congestive heart failure. Risk for death or hospitalization from congestive heart failure reduced. Respiratory symptoms alleviated and sleep improved. Some positive effects also on diabetes and overall lifestyle habits.

Title: What is the clinical value of mhealth for patients?

NPJ Digital Medicine 3, Article number 4 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6957674/#

Author & publication year: Rowland, S., Fitzgerald, J., Holme, T., Powell, J. 2020, UK.

Aim of study: To gain understanding about those features of mhealth apps that add value to patient care and are supported by evidence. To find out what kind of benefits mhealth can provide in the future for patients, how healthcare professionals can promote the use of mhealth in care and what are the challenges of mhealth.

Results: Mhealth can support patient diagnosing and adherence to treatment and facilitate the change of lifestyle habits into a positive direction with the help of educational and therapeutic apps.

Title: Adolescence as a unique developmental period

Journal of Psychiatry and Neuroscience 40(5): 291–293.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4543091

Author & publication year: Jaworska, N., MacQueen, G. 2015, Canada

Aim of study: To define the characteristics and neurological development of adolescents as a developmental period to understand how treatments could be directed specifically to this group.

Results: The study found out that there is a need for more research to know what treatment option is most suitable for adolescents with mental illness. Developmental science is needed to find the best practices for youth regarding eg. substance use.

Title: Challenges in implementing mHealth interventions: a technical perspective

Mhealth Vol 3, No 8 https://mhealth.amegroups.com/article/view/16006/16153

Author & publication year: Gurupur, V., Wan, T. 2017, US.

Aim of study: To identify key challenges in mhealth and find solutions to them.

Results: There are five main areas that are challenges for mhealth and need more attention for implementation. These include privacy concerns, usability of apps, network issues, reliability and system integration. These could be partly solved eg. by identification of data locations and analysis of usability and reliability before use.

Title: Healthy behavior trajectories between adolescence and young adulthood

Advances in life course research Vol 17, issue 2
https://www.sciencedirect.com/science/article/pii/S1040260812000044?via%3Dihub

Author & publication year: Frech, A. 2012

Aim of study: To define what kind of factors affect health behavior in adolescence. The study observes social, family and psychosocial aspects.

Results: Those resources had during adolescence, including social support, increase the likelihood of healthy behavior. It should be assessed how social factors affect health in different life stages.

Title: Multiple Health Risk Factors in Vocational Education Students: A Systematic Review

International journal of environmental research and public health 18 (2)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7828627/

Author & publication year: Atorkey, P., Byaruhanga, J., Paul, C., Wiggers, J., Bonevski, B., Tzelepis, F. 2021, Australia

Aim of study: To study the co-occurrence and clustering of health risk factors in adolescence, because in this developmental stage the risk for unhealthy behaviors is increased.

Sample: Systematic review of quantitative studies.

Results: Vocational students had two or more health risk factors with the engagement from 29 % to 98%. This means that several vocational school students employ health risk factors. Genger, age, socioeconomic status, ethnicity and education have an effect on this.

Title: Beyond stereotypes of adolescent risk taking: Placing the adolescent brain in developmental context

Developmental cognitive neuroscience Vol 27 **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5626621/**

Author & publication year: Romer, D., Reyna, V., Satterthwaite, T. 2017, US.

Aim of study: To study adolescent risk taking behaviors in relation to that kind of risk taking which monotonically decreases when growing from a child to an adult. To find out how brain development affects sensation seeking and self control.

Results: Adolescent risk taking can be seen as an adaptive behaviour to fit in an adult role. This behavior can be caused by sensitivity for rewards or lack of self control and it is an individual factor. Behavior in adolescence allows the adolescent to learn from experience and use those skills learned from exploration in the future.

Title: A virtual reality exergame to engage adolescents in physical activity: mixed methods study describing the formative intervention development process

JMIR Publication Vol 23, No 2
https://www.jmir.org/2021/2/e18161/

Author & publication year: Faric, Smith, Hon, Potts, Newby, Steptoe, Fisher. 2021, UK.

Aim of study: To create a physical activity intervention for adolescents using VR exergaming.

Sample: A quantitative survey study of 511 adolescents. A qualitative interview study of 31 adolescents. Application was tested among 5343 participants.

Results: The participants reported enjoyment, motivation, reduction in negative opinions towards physical activity, improved mental health. VR exergaming was appealing for adolescents.

Title: Design of an mhealth app for the self-management of adolescent type 1 diabetes: a pilot study

JMIR Publications Vol 14 No 3
https://www.jmir.org/2012/3/e70/

Author & publication year: Cafazzo, Casselman, Hamming, Katzman, Palmert. 2012, Canada.

Aim of study: To develop a mhealth application to help adolescents with the management of type 1 diabetes

Sample: 20 adolescents, 12-16 years.

Results: Blood glucose measurement increased 50%. Satisfaction with the app was remarkable, 88% reported that they would continue to use the application.

Title: Mobile-based asthma action plans for adolescents

Journal of asthma Vol 52 No 6
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5292936/#

Author & publication year: Burbank, Lewis, Hewes, Schellhase, Rettiganti, Hall-Barrow, Bylander, Brown, Perry. 2015, US.

Aim of study: To determine the usability of an asthma action plan for adolescents.

Sample: 20 adolescents, 12-17 years old. Feasibility and proof-of-concept study.

Results: The application was used approximately 4 days a week. Satisfaction was high, with 93% reporting that that control of asthma improved. There was also improvement in asthma control test scores.

Title: Smartphone applications for mental health

Cyberpsychology, behavior and social networking Vol 19, No 7
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5335803/

Author & publication year: Radovic, A, Vona, Santostefano, Ciaravino, Miller, Stein. 2016, US.

Aim of study: To find out how adolescents and adults use mental health mhealth applications.

Results: Apps are used for relieving symptoms, with techniques involving relaxation methods (49%), management of stress (40%), calming sounds (33%) and tracking of symptoms (22%), such as keeping a diary about your moods. People were attracted to those apps that were described as easy to use, educational and insight-increasing.

Title: Developing mental health mobile apps: exploring adolescents perspectives

Health informatics Journal Vol 22, No 2
https://journals.sagepub.com/doi/10.1177/1460458214555041#bibr23-1460458214555041

Author & publication year: Kenny, Dooley, Fitzgerald. 2014, Ireland.

Aim of study: To find out what qualities adolescents consider important in mental health mobile apps.

Sample: 34 adolescents aged 15-16 years. Qualitative study.

Results: The study found eight core values: safety, engagement, functionality, awareness, social interaction, gender, accessibility and the fact of young people being in control.

Title: A virtual mental health clinic for university students: a qualitative study of end-user service needs and priorities

JMIR Publications Vol 2, No 1
https://mental.jmir.org/2015/1/e2/

Author & publication year: Farrer, Gulliver, Chan, Bennett, Griffits. 2015, Australia.

Aim of study: To determine what kind of functions and features university students want from a virtual health clinic.

Sample: 19 undergraduate students. 19-24 years old from Australia. Question and discussion based study.

Results: The participants viewed positively the concept of a virtual health clinic. They wanted the virtual health clinic to address issues that might be common among university students and a possibility to contact professionals and for peer-interaction.

Title: Young men's attitudes and behavior in relation to mental health and technology: implications for the development of online mental health services

BMC Psychiatry Vol 13 No 119
https://bmcpsychiatry.biomedcentral.com/articles/10.1186/1471-244X-13-119

Author & publication year: Ellis, Collin, Hurley, Davenport, Burns, Hickie. 2013, Australia.

Aim of study: To determine the attitudes of young men in Australia towards mental health and technology use to develop online mental health services for young men.

Sample: 486 males of a national online survey 16-24 years. There were 17 focus groups with 118 males. Mixed-methods study in Australia.

Results: Young men use technology a lot, but are not that likely to seek professional help for themselves. Some report that they have seeked help for a problem online. Young men seem to prefer self-help and methods based on action.

Title: A mobile health solution complementing psychopharmacology-supported smoking cessation: randomized controlled trial

JMIR Publications Vol 8 No 4
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7215523/

Author & publication year: Carrasco-Hernandez, Jódar-Sánchez, Núñez-Benjumea, Conde, González, Civit-Balcells, Hors-Fraile, Parra-Calderón, Bamidis, & Ortega-Ruiz. 2020. Spain.

Aim of study: To determine if a mhealth intervention is useful for smoking cessation in Spain.

Sample: 240 participants. Randomized controlled trial.

Results: Motivational text messages combined with traditional approaches produce a greater effect for smoking cessation than conventional methods alone.

Title: Adolescents' perspectives on using technology for health: a qualitative study

JMIR Publications Vol 1 No 1
https://pediatrics.jmir.org/2018/1/e2/

Author & publication year: Radovic, A; McCarty, C; Katzman, K; Richardson, L. 2018, US.

Aim of study: To find out how adolescents use technology to support their healthy lifestyle.

Sample: 31 adolescents, 13-18 years old. A qualitative interview study.

Results: Mostly adolescents use information technology to learn new information, view others experiences and share their own experiences and monitor health behaviors and goals.

Title: The effect of using a mobile application ("WhiteTeeth") on improving oral hygiene: A randomized controlled trial

International journal of dental hygiene Vol 18, No 1
https://onlinelibrary.wiley.com/doi/full/10.1111/idh.12415

Author & publication year: Scheerman, J; van Meijel, B; van Empelen, P; Verrips, G; van Loveren, C; Twisk, J; Pakpour, A; van den Braak, M; Kramer, G. 2020, Netherlands.

Aim of study: To assess if a mhealth application is beneficial in improving adolescent oral health.

Sample: 132 adolescents. Parallel randomized controlled trial.

Results: Dental plaque reduced remarkably in the intervention group. Mouthwash usage increased and hemorrhage from gums decreased. The application improved adolescent oral health.