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The challenges of the implementation of digital health technologies for mental health services in children: a qualitative approach

Master's thesis

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Digitaalsete tervisetehnoloogiate rakendamise väljakutsed laste vaimse tervise teenuste toetamisel: kvalitatiivne uuring

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Background: Half of the mental health disorders are established by the age of 14 years. Effective mental health promotion and prevention in childhood can prevent the onset of mental health diseases in adulthood and the strain of mental health conditions in society. Digital technologies have the potential for mental health promotion and early intervention for young people. However, the efficacy and implementation of these interventions are still under ongoing research and there are challenges to ensure their accessibility, acceptability, and effectiveness. Despite these obstacles, digital technologies warrant further investigation and investment. **Aim:** The aim of this thesis is to describe the current system of the organization of mental health services in Estonia and to identify barriers in the process of implementation of digital health technologies for mental health promotion and prevention in children. **Methods:** A qualitative study was conducted, in which a purposeful sampling of 8 experts identified from stakeholder groups was used for semi-structured interviews, and a thematic textual analysis was performed, a combination of deductive and inductive methods was used. **Results:** The qualitative analysis reveals improvements and challenges in the Estonian mental health system. Challenges include gaps in children's mental health support, limited interventions, fragmentation, and lack of person-centeredness. Prevention efforts have shifted, but accessibility and funding remain obstacles. Mental health awareness and coordination are key challenges. Digital health solutions show potential but face concerns about data protection and human interaction preference. Addressing these challenges requires collaboration and an understanding of the target group's needs. **Conclusions:** There are still gaps in children's mental health services. Digital technologies can play a crucial role in bridging these gaps by providing accessible and innovative approaches to prevention, intervention, and support.

This thesis is written in English and is 52 pages long, including 7 chapters, 4 figures and 2 tables.

Annotatsioon

Digitaalsete tervisetehnoloogiate rakendamise väljakutsed laste vaimse tervise teenuste toetamisel: kvalitatiivne uuring

Taust: Pooled vaimse tervise häiretest kujunevad välja enne 14.-eluaastat. Tõhus vaimse tervise edendus ja ennetus lapseeas aitab ära hoida vaimse tervise probleemide tekkimist täiskasvanueas ja sellega seonudvat koormust ühiskonnale. Digitaalsetel tehnoloogiatel on potensiaali noorte vaimse tervise edenduse ja varajase sekkumise meetodina. Kuigi selliste sekkumiste tõhusus ja rakendatavus on alles uurimisjärgus, siis on teada, et esineb väljakutseid tagamaks nende kättesaadavust, vastuvõtlikkust ja efektiivsust. Vaatamata nendele takistustele on põhjendatud digitaalsete tehnoloogiate edasised uurimused ja investeeringud. **Töö eesmärk:** Magistritöö eesmärk on kirjeldada vaimse tervise teenuste süsteemi hetkeolukorda Eestis ja teha kindlaks, millised takistused esinevad digitaalsete tervisetehnoloogiate rakendamisel laste vaimse tervise edenduses ja ennetuses. **Meetod:** Tegemist on kvalitatiivse uurimusega, milles osales 8 eksperti, kes olid valitud sidusrühmade esindajate hulgast pool-struktureeritud intervjuude jaoks. Kasutati temaatilist teksti analüüsi, ning deduktiivsete ja induktiivsete meetodite kombinatsiooni. **Tulemused:** Kvalitatiivne analüüs näitab paranemisi ja väljakutseid Eesti vaimse tervise süsteemis. Väljakutseteks on lüngad laste vaimse tervise toetamisel, piiratud sekkumised, killustumine ja puudulik inimesekeskne lähenemine. Ennetustöö on saanud enam tähelepanu, kuid kättesaadavus ja rahastamine jäävad takistusteks. Vaimse tervise teadlikkuse ja koordinatsiooni osas on väljakutseid. Digitaalsetel tervisetehnoloogiatel on potentsiaali, kuid esineb muret andmekaitse ja inimliku suhtluse eelistuse üle. Nende väljakutsete lahendamiseks on vaja mitmekülgset koostööd ja arusaamist sihtrühmade vajadustest. **Järeldused:** Endiselt esineb lünki laste vaimse tervise teenustes. Digitaalsed tehnoloogiad saavad mängida olulist rolli nende täitmisel, pakkudes ligipääsetavaid ja uuenduslikke ennetuse ja sekkumiste viise.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 52 leheküljel, 7 peatükki, 4 joonist, 2 tabelit.

List of abbreviations and terms

App	Application
CBT	Cognitive behavioural therapy
DHI	Digital health intervention
DHT	Digital health technology
DTx	Digital therapeutics
EMHS	The Estonian National Mental Health Study
GP	General practitioner
HARNO	Education And Youth Board
NGO	Non-governmental organization
NICE	National Institute for Health and Care Excellence
NIHD	National Institute for Health Development
ORCHA	The Organisation for the Review of Care and Health Apps
PCC	Person-centred care
RCT	Randomized controlled trial
SDG	Sustainable Development Goal
TalTech	Tallinn University of Technology
UNICEF	The United Nations Children's Fund
WHO	World Health Organization
YLD	Years lived with disability

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1 Introduction

Mental health conditions are remarkably common worldwide. In the WHO European Region, 13% of the population has mental health conditions [1]. Mental health conditions are the primary reason for years lived with disability (YLDs) and therefore causing huge economic burden [2]. Half of the mental health disorders that appear in adulthood had been established by the age of 14 years [2] [3], yet only under 25% of children with mental health conditions receive the support and treatment they need [4] [5] [6].

Mental health promotion during childhood and adolescence is essential as it can prevent risk behaviours and enhance mental health, which can help to prevent onset of the mental health disease in adulthood [7]. Effective mental health promotion and prevention can prevent the onset and strain of mental health conditions in society [2].

Digital technologies have potential for mental health promotion and early intervention for young people, as digital mental health interventions can improve access and reduce the stigma related to traditional mental health services [8]. Digital technologies might relieve the various barriers which prevent children from getting traditional professional help ranging from stigma [2], long waiting times, service availability, lack of knowledge [9] and affordability [10] [11].

For mental health services transformation, WHO has recommended mental health service digitalization to increase evidence-based psychological and remote support for people with mental health conditions [1]. Person centred care (PCC) includes promotion and prevention activities for healthy persons [12]. Estonia's National Health Plan 2020-30 [13], mental health policy document the Green Paper on Mental Health [4], Mental Health Action Plan 2023-2026 [14], and WHO policy frameworks have set their focus on person centeredness [12].

Digitalization of mental health had been adopted fast in the pandemic [15], and this has led to a greater need for accessible and scalable mental health services for well-being promotion and mental health disorders prevention [16]. Digital technologies have become more available around the world, which enables more people to achieve better mental health via websites and mobile applications [2]. Digital technology can improve

the access to the evidence-based interventions, as mobile technologies have been adopted at increasing rate [17]. Focusing on inequalities in mental health, it is crucial to provide right services in the right places and means to everyone. Digital technologies can enhance and support mental health systems by delivering tools for public education, educate health care workers, provide remote services, and empower self-care [2]. Digital technologies also carry some risks, whereas certain characteristics, such as data protection, safety, privacy, and accountability need to be considered [2]. Digital poverty and inequality are significant concerns, as many people might not have an opportunity to use digital technologies [2].

According to the author's best knowledge, there are no other studies performed in Estonia in view of the digital health technologies for mental health support in children.

The aim is to describe the current system in the organization of mental health services in Estonia and to identify barriers in the process of implementation of digital health technologies for mental health promotion and prevention in children.

The thesis consists of seven chapters. The first chapter introduces the topic of the thesis. The second chapter gives an overview of the children's mental health problems, promotion, and prevention, and sets the theoretical framework of the research, as well as introduces digital solutions, their objectives and current usability. The third chapter presents the aim and objectives of current thesis, including research problem and research questions. The fourth chapter describes the methodology and research methods. The fifth chapter introduces the results. The sixth chapter discusses the results of the study and makes further suggestions. The final chapter presents the conclusions of the study.

2 Literature overview

The following chapter is formed on a literature overview, focuses on the introduction of children's mental health problems, promotion, and prevention, and sets the theoretical framework of the research in the context of international and Estonian strategies for children's mental health. Additionally, this chapter introduces available digital solutions, their objectives and current usability.

2.1 The epidemiology of mental health problems

WHO states explicitly that "There is no health without mental health" [18]. UNICEF defines mental health as a positive, a state of health, not a disorder [19]. According to the WHO, mental health is a fundamental human right, and it is an essential part of general health and wellbeing [2]. A human right point of view is required for reacting to the worldwide burden of mental health disorders [18].

Mental health conditions are very common worldwide as almost a billion people live with a diagnosable mental health disorder and are the primary reason for YLDs [2]. In 2019, over 125 million people (13%) in the WHO European Region had mental health conditions, which accounted for 15% of all years lived with disability [1]. In comparison to the general population, people with mental health conditions bear unreasonably higher rates disability and mortality [20], whereas life expectancy is reduced by 10–15 years for individuals with mental health disorders [3]. The financial costs of mental health conditions are colossal [2], a non-communicable diseases analysis concluded that the cumulative global economic impact of mental disorders regarding to lost economic output will total 16.3 trillion US$ between 2011 - 2030 [18] [21].

Mental health problems in children and adolescents are remarkably common [22] [23], yet only a minority gets appropriate mental health support [23]. Worldwide, less than 25% of children with mental, emotional, or behavioural disorders will receive support and treatment for mental health [4] [5] [6]. According to the Estonian National Audit office, in 2019, around one third of children received mental health medical input in timely manner [4] [24].

Mental health challenges in childhood and adolescence have significant importance due their occurrence, early onset, and effect on numerous areas of the child's life [25]. High levels of anxiety and depression disorders are contributing to significant disability, and are related to lifelong intellectual, academic, and social impairments, as well as lower quality of life in adulthood [23]. Mental health disorders are related to negative consequences, such as early school dropout, decreased life satisfaction, poorer relationships, criminal justice system involvement and smaller income prospective [22].

Nearly 1 in ten pre-schoolers experience an anxiety disorder by age of 5 [26]. Worldwide 8 % of 5-9 years old children and 14 % of 10-19 years old adolescents live with a mental health disorder [2]. Half of the mental health disorders that appear in adulthood had been established by the age of 14 years, and three quarters presented by the age of 24 years [2] [3]. Mental health issues are one of the primary reasons linked to adolescents' suicide [6]. In the WHO European region, suicide is the main cause of death in low- and middle-income countries, and the second-leading cause in high-income countries for 10–19-year-old adolescents [6]. Suicides are preventable, and much can be done to prevent suicide [27]. Whereas using the internet and social media campaigns has a potential in a universal suicide prevention strategy [27].

According to the National Institute for Health Development (NIHD) data, in year 2019, there were over 94 603 psychiatric consult cases, of which 9,6% were 0–14-year-old children [4]. NIHD statistical data for newly diagnosed psychiatric cases of 0-19-year-olds children and adolescents totals 4668 newly diagnosed cases in 2019 [28]. According to the Estonian National Mental Health Study (EMHS), adolescents and young adults have greater risk for mental health disorders by self-reported data, however by registry data, they haven't received more psychiatric diagnosis in comparison with rest of the adults [10]. Adolescents and young adults are using more mental health services, but same time they experience more barriers for getting help (unsure where to go, high price, don't believe that it would help) [10].

The Covid-19 pandemic further intensified the situation, causing a global crisis, where anxiety and depressive disorders increased by more than 25% throughout the first year of the pandemic [2]. The pandemic has created significant concerns regarding the mental health of children [19] [29] [30] [31]. The pandemic has affected younger age groups more than older ones [2] [29]. A meta-analysis in JAMA Pediatrics [32]

concluded that the rates of clinically remarkable generalized depression and anxiety doubled over the course of Covid-19 pandemic, whereas 1 in 4 youth worldwide were experiencing clinically elevated depression symptoms, and 1 in 5 youth were feeling clinically elevated anxiety symptoms [32]. During the pandemic, mental health resources and treatment opportunities have been significantly disrupted, generating a bigger gap and inequality in receiving mental health services and support [2] [29] [31].

2.2 Mental health promotion and prevention

Promotion and prevention of good mental health, and early intervention prior to or by the onset of mental disorders improve outcomes [3]. Mental health promotion during adolescence is essential as it can prevent risk behaviours and enhance mental health, which can help to prevent onset of the mental health disease in adulthood [7]. EMHS in its recommendations states that mental health problems prevention is cheaper and more effective than dealing with consequences [10]. EMHS suggests analysing which prevention programs are effective, to ensure evidence-based prevention is universally available and supportive environments are created [10]. Effective mental health promotion and prevention is cost-effective and can prevent the onset and strain of mental health conditions in society [2]. The Sustainable Development Goals (SDG) resolution calls for the promotion and prevention of mental health and well-being of children and adolescents, as it helps to achieve most of the 17 development goals of the SDG resolution [19].

The scope of mental health issues in children and adolescents, have been highlighted in the Estonian Human Development Report [33], as well as in the HBCS study [34] [35]. Both reports stated that the mental health issues are increasing, and their prevalence is higher than in many other European countries [33]. Mental health is an important investment in children, and a positive state of wellbeing, which is a right to be nourished, promoted, and protected [19]. Children's and adolescents' mental health has been prioritized in Estonian and European strategy documents [36]. Mental Health Strategy 2016-2025 [36] and Estonia's National Health Plan 2020-30 [13] both state that for mental health disorders prevention is necessary to empower activities, which promote positive mental health and its protection [4]. For children and adolescent mental health promotion and prevention of mental health disorders, Mental Health

Strategy 2016-2025 [36] sets lifestyle, environment, early recognition, mental health supportive and promotive activities, wellbeing and mental health assessments, accessibility of care as important early intervention support measures [4]. Estonian Government Coalition Agreement 2023-2027 [37] has set the mental health support system in its focus, and the national goal is to improve mental health of children and young adults, by developing solutions across sectors. Mental Health Action Plan 2023-2026 [14] sets mental-health wellbeing monitoring, person-centered and innovative solutions for its aims, and is following the mental health pyramid structure (Figure 1).
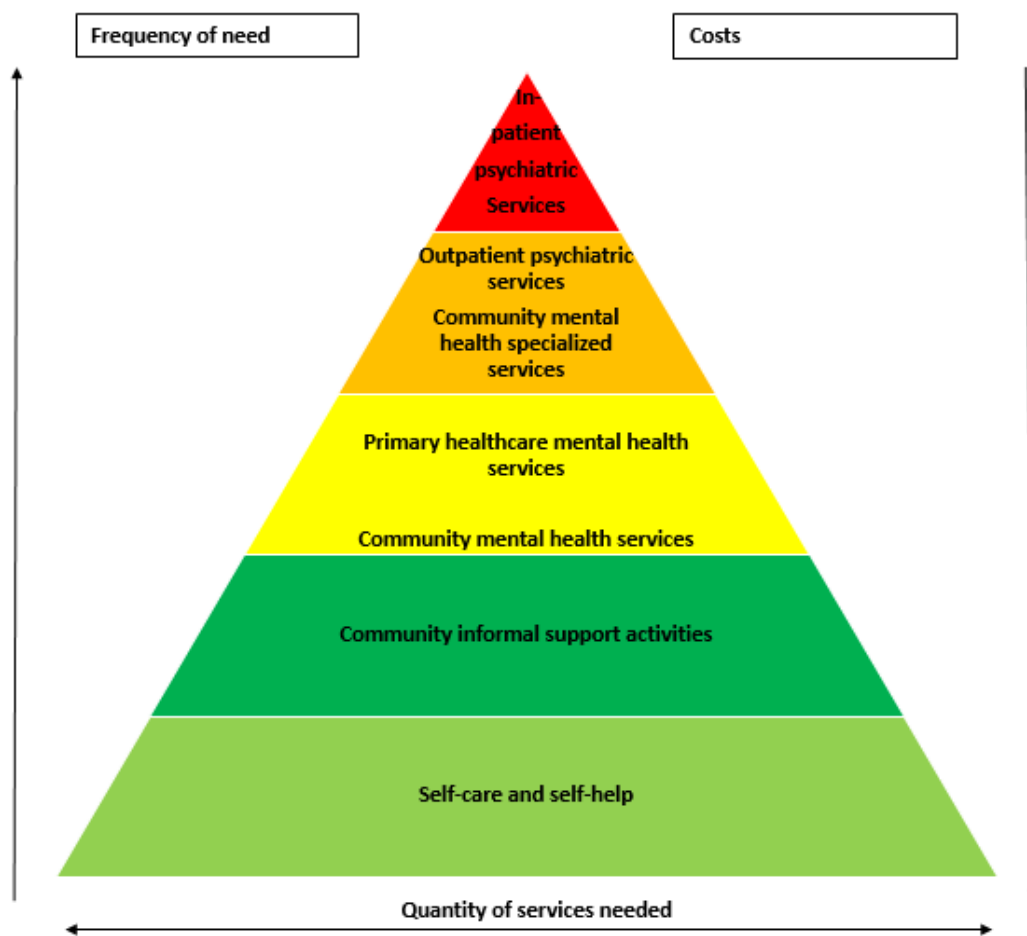
Figure 1. Mental Health Pyramid in Estonia (modified) [14] [38].

As seen from the figure 1, the optimal mix of mental health services pyramid has been developed by WHO [38], and it is recommending that higher quantity of services should be low-cost mental health services where care can be self-managed or managed by informal community mental health services. Then there should be a low quantity of high-cost services, such as psychiatric unit inpatient care. In between there should be a

reasonable amount of psychiatric outpatient and community mental health services, and primary healthcare, such as GP services [38].

Among other avenues, child and adolescent mental health promotion can be accomplished through school-based solutions and courses, and changes to the community and online environments, in addition to legislation and guidelines [2]. Schools are important platforms to deliver information regarding mentally healthy behaviours for children and adolescence [2]. Mental health promotion and protection of children and adolescents could be supported in schools, by developing and distributing mental health literacy and social-emotional learning programs [1]. School interventions can also reach to those children, who otherwise wouldn't have access to mental health services [19]. Schools should think about all the aspects in which they can impact children's wellbeing and mental health [19]. Innovative digital intervention implementation barriers in schools involve the technology, the adopter system, and the organization [39].

2.3 Mental health services access barriers

Systemic barriers of traditional mental health services include mental health professional shortages, English language competence [26] and uneven geographical distribution of services [40]. To overcome these barriers, it is argued that it is necessary to change the paradigm through which therapies are provided [26]. Algorithm-based digital technologies for mental health promotion [41] [42] and online therapies can improve the availability and use of evidence-based interventions, providing the opportunity for less therapist-intensive but efficient remote interventions [40].

Digital infrastructure inequities charting will strengthen efforts to address possible digital health technology (DHT) access barriers [43]. DHT are beneficial in mental health support, as they provide flexibility (time and location-wise), increase accessibility, and there is an option for anonymity, which helps to reduce barriers created by stigma [2].

Governmental authorities and public service providers could embrace innovation and transform their mental health-care services by promoting local innovation, applying digital new technologies and generating further possibilities for peer support [1]. Digital

technologies have potential for mental health promotion and early intervention for young people, as digital mental health interventions can improve access and reduce the stigma related to traditional mental health services [8]. Digital mental health services have been rapidly adopted during the pandemic mainly due to the lack of secure alternative options for providing and continuing fundamental mental health services [15]. There is a continued need for innovative, accessible, scalable, and cost effective, age- and context appropriate mental health solutions (e.g., mobile health) [8] [16]. As there is a potential for digital technologies, their implementation should be considered.

Nevertheless, typically mental health is a topic that is addressed reactively when serious problems have already occurred [44]. At that phase, there are various barriers which prevent children getting professional help [25]. Evidence-based information regarding the mental health promotion is not accessible for many people. The major barrier for self-care and access to mental health services is stigma, which is widespread in community and in the health sector [2]. Inadequate mental health literacy can become a barrier in help-seeking process [45], as lack of parental or caregiver knowledge and awareness regarding problem (and a need for additional support) impede help seeking for mental health problems [22]. Caregivers have vital part in identifying child's difficulties and looking for help [22]. Mental health literacy is paramount, as it is related to actions and mental health outcomes [2] [22].

Digital health literacy requires improvement, which can be achieved by user training and education, as well as designing user friendly and accessible digital health applications according to personal requirements [43]. Providing educational information at recommended reading levels, together with visual and audio guidance, might be helpful for users with insufficient digital and e-health literacy skills [43].

2.4 Mental health service transformation and person-centred care

Mental health service transformation can be achieved with strong political desire and dedication, whereas new policies, reallocation of scarce resources, and new partnerships in between new stakeholders can be helpful to overcome the barriers [2]. For mental health services transformation, WHO has recommended that mental health service delivery by digital technologies would allow to increase evidence-based psychological and remote support for people with mental health conditions [1].

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Worldwide, various health-care systems are looking to enhance their health care system efficiency and effectiveness by implementing a person-centred care (PCC) standard [12]. Estonia's National Health Plan 2020-30 [13] one of the goals is person-centered healthcare. Person-centeredness is also mentioned in the mental health policy document the Green Paper on Mental Health [4], as well as in the Mental Health Action Plan 2023-2026 [14], as it improves quality of care, and has a positive impact on persons health and satisfaction with the care.

WHO has emphasized person-centeredness in its policy frameworks, where focus has moved towards people-centred[1] health care [12]. Person-centeredness term expresses holistic approach and focuses on "the whole person in their specific familial and community contexts" [46]. It includes broader context of well-being [46] and goes beyond the terms of the care environment [47]. PCC is not restricted only to the patients with illnesses, but also includes promotion and prevention activities for healthy persons [12]. PCC involves persons and family empowerment and autonomy [46]. PCC focuses on promoting personal goals and quality of life, by addressing persons individual psychological, cultural, and social needs [46]. Core elements of PCC include appropriate information sharing via respectful communication [46], so persons can make informed decisions about their own health and health care and participate in shared decision-making process [48].

A person-centred access model can help persons who have financial and physical barriers to health care access, as it is recognizing these barriers [12]. New e-health technologies can be created, to overcome these barriers and to offer continuity of PCC. A timely access (including out of working hours availability) to care is referred frequently as one of the outcomes of PCC [12]. Through this domain, health outcomes improvement and cost saving for health care system can be achieved [48]. By encouraging persons in their own care decision-making process, it delivers better value for money, as it assures that PCC implementation costs will go for persons benefit [12]. People-centred health system can support its users to choose wiser health options [49].

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[1] Person-centered and people-centered terms are used interchangeably, as they hold same meaning, but these terms vary in different sources.

Persons needs and preferences change over time, and this would have to be considered, when delivering PCC by using most appropriate resources available. Worldwide, there is no entirely agreed definition regarding people-centred health system [49], and therefore different qualities of PCC have been prioritized and emphasized [50], as shown in table 1.

Table 1. PCC qualities in different frameworks (adapted by [48] [49] [51] [52]).

PCC qualities	Frameworks	The European Observatory of Health Systems and Policies [52]	The Framework by the Health Foundation [48]	The OECD Framework on People-Centred Health Systems [49]	The Framework in Integrated People-centred Health Service by WHO [51]
Voice		Yes		Yes	
Choice		Yes		Yes	
Co-production		Yes		Yes	
Personalization			Yes		
Coordination			Yes		Yes
Enablement			Yes		Yes
Dignity			Yes		
Respect			Yes	Yes	
Compassion			Yes		
Integration				Yes	
Empowerment					Yes
Accountability					Yes
Re-orientation care					Yes

As seen from the table 1, that there is no uniform definition of PCC. There are some overlapping concepts but also differences which outline the challenges for universal understanding about the meaning and concrete actions behind person-centred approach.

PCC approach implementation is tentative and lags more ambitious policy objectives [50]. The challenge today is that everyone understands the meaning of PCC differently [50]. Whereas the greatest barrier probably is the culture [53]. Several other barriers were identified which challenge the PCC, such as a whole system approach, healthcare professionals and management awareness, conflicting demands, delegation [50], professional practice, attitudes, beliefs, and cultural background [47]. PCC has been seen as a guiding idea and symbol of quality in health systems [54]. Digital health

serves as a facilitator of person-centred priorities, however the poor user-engagement with mobile health interventions, could become a barrier for PCC [54]. Continuity of care as one of the PCC priorities, is less clear cut with digital health [54]. Technology cannot replicate PCC traits like empathy and compassion [55]. Regarding dignity and respect, some of the technology may strengthen these PCC priorities, others could undermine these [55]. Alternative options should be available for people who need and/or want them, to ensure that health care remains person-centred [55].

Virtual platforms have significant prospective in promoting and providing information regarding PCC, as well as person-driven care (e.g., harnessing persons knowledge and experiences) [52]. A person-centred health system needs to concentrate of assuring for equity in access, quality, responsiveness and participation, efficiency, and resilience. Whereas services should be provided in most cost-effective manner, and promotion, prevention and patient care should be balanced, without wasting resources [52].

2.5 Digital interventions

Digital health interventions (DHI) involve health information digital delivery for health associated reasons via websites or apps [22]. DHI can improve universal health care coverage and provide early well-being interventions for young people with mild or low-level needs [56]. Digital therapeutics (DTx) can change the field of mental health by increasing access to quality mental health services [57]. The primary assessment of DTx is based on the value of clinical outcomes, achieved by improving the symptoms of users [57]. Multiple reasons, such as stigma, embarrassment, cultural acceptance, financial restrictions, or a preference for self-reliance can constrain a person's capability or wish to seek face-to-face therapy and access to services [57].

The rapidly changing digital world, and new innovative practices are bringing additional challenges to the current health systems and are redesigning the way persons are engaging with health care [52]. Online resources have become a main route for health information [52]. According to the 2017 Eurobarometer survey, 71 % of adults in EU think of themselves as adequately skilled for using digital technology [58]. The EU Kids Online 2020 survey found that over 80 % of 9-16 years old children use a smartphone to access the internet at least once a day in 11 European countries [59]. In Estonia, 97% of the 9-17 years old children gain access to the internet every day [59] [60]. Internet has

rooted in children's everyday lives, and used mainly for schoolwork, communication, and entertainment. Children prefer online communication about sensitive topics, where the online environment can serve as a safe environment, also, giving them a chance for better self-control of the self-presentation [59].

Younger people implement and utilize new technologies (such as mobile phones and internet) more often than older people, including for the intention of accessing health related knowledge [23] [61] [8]. Hence taking in consideration that younger people have increased digital literacy, DHI may raise accessibility to mental health services in this population [25]. Usability of the digital intervention is influenced by sufficient user instructions, simplicity, being age-appropriate, and allowing self-pace [25]. In view of user engagement, digital technology might improve to transform therapy more interactive, increase learning and skill acquisition, and prepare children for challenging and complicated treatment aspects [62]. Children's engagement with captivating technologies is continuously growing, and innovative applications are efficient in treating and enhancing their everyday skills [63].

Digital skills are essential requirement for successful engagement with the online world and are positively correlated with the diversity and occurrence of online activities. Digital literacy is important for education, general well-being, and participation in society [59]. Digital technology can improve mental health practices by offering methods to inform, educate, and support healthcare professionals and society [2] [19]. It is essential to apply awareness to the digital technologies' integration into mental health toolkits in view of regulation and professionalism [1]. DHI have the capacity to be efficient, with advantages of ease of access, quick response, anonymity, cost-effectiveness, and high-level treatment correspondence [25].

There is just a modest amount of high-quality research, which has evaluated the systematic usage of smartphone apps for treatment [64]. Mobile apps have got the potential to support the efficient delivery of evidence-based treatments in community mental health settings [65]. The increasing evidence base for mental health apps implies that apps accessed via smart devices have raising potential and significant role in mental health care promotion, prevention, and treatment [16]. The advantages of mental health apps include personalisation, privacy, cost-effectiveness, and the opportunity to use apps anytime and anywhere, with the ability to defeat barriers (such as stigma) for

seeking help [16], as well as customized content, immediate support, efficiency and equity of mental health resources [17].

The disadvantages of mental help apps remain, as that there is a significant volume of apps available with no available clinically validated evidence base [17], as scientific research (especially randomized controlled trial - RCT), cannot keep up along with the speed of the latest developments of mental health apps [16] [66]. The time requested to execute an RCT and publish outcomes does not keep up with the quick development cycle of apps [66]. Due to the digital therapeutics (DTx) agile development processes and capacity to produce real-time results, new standards and regulations should be established [67]. Conventional clinical research models must make room for innovative ideas and trial designs [68]. The NICE evidence standards for DHT comparative real-world research designs may also be adequate, as long as the selection of research design is relevant for the intended purpose of the DHT [67] [69].

Other DHT disadvantages and limitations include digital literacy, language barriers, access to technology and connectivity issues [43]. Digital health inequities need to be contemplated and tackled, and people with poorer digital and e-health literacy skills supported [43]. Also social, economic and cultural inequalities that contribute to being digitally excluded, need to be taken into account, to reduce the digital divide in society [43] [70]. Digital technologies increase users' autonomy and empowerment, on the other hand these increase the risk of digital addiction and manipulation [70].

Once confidentiality and equity concerns are enforced, and appropriate training applied, digital technologies can accelerate access to mental health care, empower self-care and strengthen peer support [1], as well as enhance and support mental health systems by delivering tools for public education, educate health care workers, and provide remote services [2]. Digital technology can improve the access to the evidence-based interventions, as mobile technologies have been adopted at increasing rate [17]. Worldwide, digital technologies have been integrated into mental health care, which could be used to scale up access to mental health services and provide remote care via digital solutions [1]. To make digital care solutions available to everyone, a lot of countries still require increased information systems funding for mental health, as well as workforce development, and service user empowerment [2].

3 Aims and objectives

The following chapter presents the research problem, the aim of the study and research questions.

Research problem: Despite an increased need for accessible and scalable mental health services for mental health promotion and prevention in children [16], the systematic implementation of digital health technologies is complex and its potential hasn't been sufficiently analyzed.

The aim of the thesis is to describe the current system in the organization of mental health services in Estonia and to identify barriers in the process of implementation of digital health technologies for mental health promotion and prevention in children.

Research questions:
1. How is mental health service provision organized for children?
2. What are the barriers hindering mental health service provision?
3. How the usage and access of digital health technologies are implemented for children's mental health support and what is their potential in systematic usage?

4 Methodology

The following chapter provides detailed information regarding the study methodology. Exhaustive summary is given on the design, sampling, study period, data collection methods and instruments, study population, data analysis, as well as ethical considerations and data protection.

4.1 Data collection methods and instruments

A qualitative approach was chosen for current study to delve into new knowledge. Data collection method used was a semi-structured interview, which offered versatility and flexibility to gain new information from participants to explore research topic. Expert interviews were used for data collection for this study. The expert interview as a qualitative empirical research method has been widely used, to gather information in specific area of interest [71]. The expert interview structure, used in this study, is semi-structured interview. Semi-structured interviews provide a range of opportunities and adapt variety of research goals [72], and these are used when the researcher has adequate knowledge regarding the subject to establish the domain but does not know all the answers [73]. Semi-structured interview as a research design method, is structured enough to concentrate on detailed topics associated with the phenomenon of study, same time leaving room for participants to provide new meanings to the study subject [72].

Semi-structured interview offers great versatility and multidimensional data flow [72]. Semi-structured interview format follows supportive structure and guide, at the same time it allows deviation from the predetermined script, as long as most of it is covered for comparative purposes [74]. The questions are open-ended to offer interviewees to describe their experiences [72]. Additional theoretically led and more detailed questions are used for expansion to the interviewee's responses [72]. The interview questions are derived from research questions, which are evolved from the research aim and topic. Two pilot interviews were conducted with mental health specialists prior expert interviews. The pilot interviews were carried out to evaluate the interview plan, study

questions phrasing, their order and usefulness [72]. Current interview format offers space for developing discussions and a balance between the interview counterparts [74].

During the semi-structured interview, opportunities may arise for researchers and participants to critically reflect data [72]. There may be occasions when participants comment suggests a distinct point of view, which is remarkably different from the theoretical framework guiding the research design and analysis [72].

A main advantage of the semi-structured interview is its attention to lived experience as well focusing on theoretically directed variables of interest [72]. The value of exploring experts' viewpoints and experiences by interviewing deliver greater insight of social reality, as experts are well-informed in certain field [71]. Experts are also recognized by their position and virtue of their expert knowledge [71].

In qualitative research, individual interview is the most frequently used data collection method [73]. Concentration during individual interview is on one person, and this allows the person to provide detailed information of personal perspective, experience, and relationship to the context being researched [74].

Synchronous interviews reflect conventional interviews, where the interface and communication between interviewer and interviewee takes place in real-time but in an online environment [73]. The instant and dynamic communication during the real-time online interviews can raise awareness between participants and researchers. As the online form real-time dialogue reduces psychological distance between participants, it promotes spontaneous interactions between them [73]. Online interviews have several advantages, such as convenience for both parties, without geographical barriers, which makes it possible to interview experts, who otherwise would be hard to interview [74]. The limitations of real-time online interviews are internet connection issues on both ends [74], as well as digital literacy, access to the internet and suitable devices, and other technical issues [73].

Expert interviews were taking place during February and March 2023. All communication with the experts were conducted through the TalTech Office 365 e-mail platform. During the first email exchange, experts were encouraged to ask additional questions regarding the study. Online environment MS Teams was used for synchronous semi-structured virtual interviews with experts for productive dialogue.

Expert interviews were recorded in MS Teams with their verbal consent and preserved in the TalTech Office 365 cloud server. Average length of the interview was 59 minutes, ranging from 41 minutes to 1 hour and 22 minutes. During the expert interviews, experts were asked questions about their views and opinions regarding the current situation of mental health support for children, as well as prevention, promotion, and sustainability of children's mental health supporting services. Digital technologies were progressively discussed. Furthermore, they were asked if at present digital technologies are implemented for mental health support in children, and who's responsibility its coordination should be. The expert interview plan is found in Appendix 2.

While digital technologies show great promise, to the best of the author's knowledge, no digital technologies beyond teletherapy have been used on a national level in Estonia so far. This is why the author introduced towards the end of the expert interview digital activity-based learning game Triumfland Saga [75]. Triumfland Saga game was selected for study case, due to its evidence based reliable content, Estonian language, and international recognition. Triumfland Saga game is approved by an international app evaluator ORCHA [76] and has won the World Summit Award in 2022 in health and wellbeing category [77]. According to the manual [75], Triumfland Saga is an interactive and engaging game that teaches children aged 7-12 about emotions, coping strategies, and self-care. Through fun and educational mini-games, children can learn through action about emotions, manage stress, and build resilience [75]. In addition to its educational component, Triumfland Saga also promotes social and emotional learning, encouraging children to practice empathy and communication [75].

The Triumfland Saga mental health game is based on a novel technology developed in Estonia, and has been co-designed and co-developed by international stakeholders' group, including clinicians, mental health experts, children and their parents [78] [79]. The ongoing Triumfland Saga game development involves stakeholders worldwide to ensure that the game is culturally sensitive and effective for the diverse audience. The earlier game versions focused on relieving the mental burden of chronically ill children, however the algorithms to cope with stress and build up resilience have remained the same, even though the stressors have changed [78] [79]. Experts were shown a short video clip from Youtube about Triumfland Saga game [80], and some images can be seen on Figure 2.
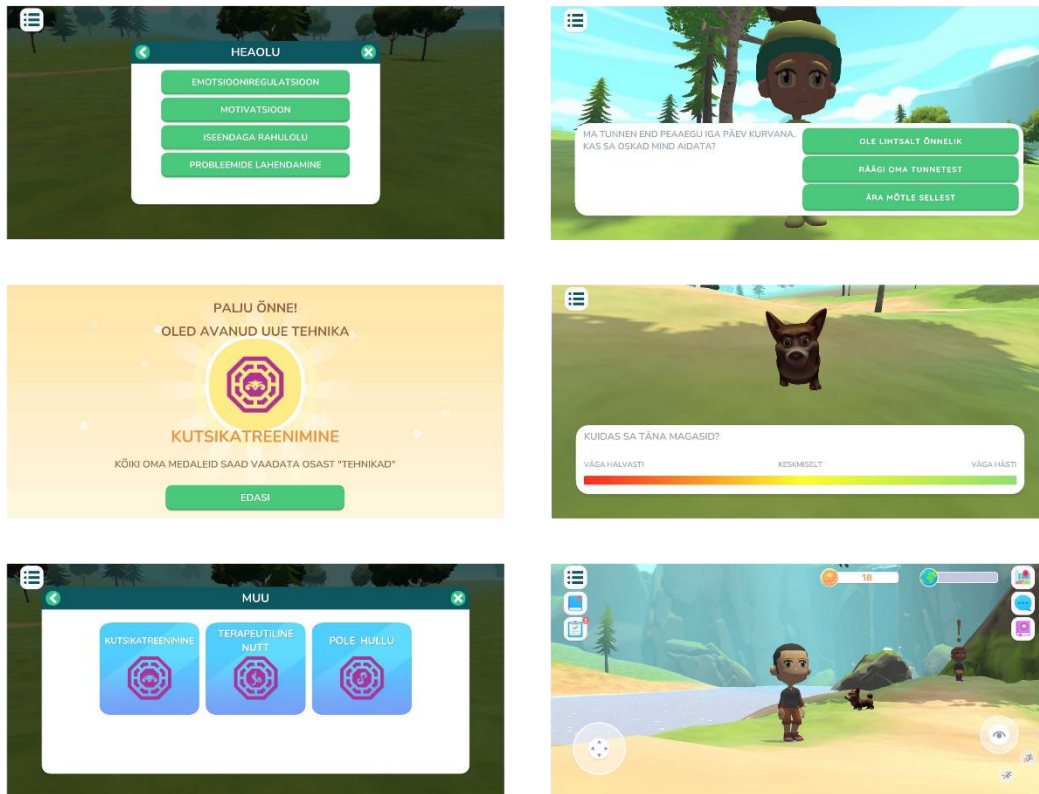
Figure 2. Screenshots from Triumfland Saga video [80].

After the instruction of Triumfland Saga game, questions and feedback were asked by researcher, to find out the expert's perception regarding the game.

4.2 Study population

The author's criteria for participant selection aimed to encompass the complexity of the research topic. The first step in determining the experts to be interviewed was guided by the research questions. The interactional essence of the questions and who can provide a context and viewpoint on the research topic were considered [73]. For this, variety of experts needed to be recruited, who would cover wide range of expertise and knowledge, and who could offer perspective for area in focus, hence purposive sampling was used. In purposive sampling researcher chooses the participants for the study, based on their expertise knowledge and experience in certain topic, therefore participants are purposefully recruited, based on specific criteria [81]. In qualitative research samples tend to be smaller than in quantitative research to support the extent of case-orientated analysis [82].

Experts for expert interviews were chosen from public institutions, who were part of the national mental health stakeholders' group. Expertise area of interviewees ranged from mental health to innovation. Experts for interviews were chosen with stakeholder's power analysis with power mapping method [83], as seen on Figure 3.

Figure 3. Powermapping of stakeholders group experts.

All relevant stakeholders from the limited pool of known mental health ecosystem experts were mapped, and experts identified from these stakeholder groups. Analysis was performed, to select the most suitable experts for this study, who were experts in their institution and had long-term experience in this field. The expert's relevance for current study was contemplated. Following the analysis, the selection of experts was narrowed down, and 10 experts were selected, from the different institutions and NGO-s. One of the experts is an independent mental health expert, who is consulting several mental health stakeholders and other bodies. Also, the NGO Head Matters (*Peaasi*), and Education and Youth Board HARNO, were contacted as stakeholders, however it was not possible to recruit experts from these institutions to the study. Hence, they are not displayed on the power mapping figure.

Experts were directly contacted by emails. Brief introduction was sent about the aim and content of the research, and researcher. Information sent also covered the degree of expert involvement expected, and the data further usage. 8 of 10 experts replied and agreed to participate for expert interviews as interviewees for this study. Invitations for expert interviews were emailed to experts for MS Teams online meeting with meeting link. Along with MS Teams invitation, an information leaflet regarding the study was sent by email (Appendix 2). Expert information leaflet contained the aim of the study, the study methods, information regarding recording, transcribing, data storing and usage, as well details regarding giving consent for the study.

Saturation principle is broadly used to establish the sample size and assess its efficiency [82]. Even though more interviews would have generated further knowledge, adequate data had been gathered with these expert interviews [72]. The methods used for this study ensured data saturation was accomplished, as in wider meaning, any new information coming in, wouldn't bring further informative value to answer the research questions [84].

4.3 Data analysis methods

In qualitative research, data analysis is ongoing process, and it takes place along with data collection [72]. Semi-structured interview engages the interviewer and interviewee in critical reflection during the interview, which generates additional texturing in the analysis and interpretation of the results, providing great scope in data collection [72]. This critical reflection offers interchange between data and theory, which contributes to the creation of main coding categories and the data interpretation, as thematic data patterns evolve [72]. Data analysis is constant, as it requires looping back frequently through data collection and ongoing analysis of collected data for further research to ensure meaning, when you become more filled with the data [72]. Thematic textual analysis (Table 2) was performed.

Table 2. Thematic analysis stages (modified) [74].

Thematic analysis stages
• Familiarization
• Coding
• Searching for themes
• Reviewing themes
• Defining themes
• Writing up

Thematic analysis contains familiarization with the data [74]. It entails listening carefully to interview recordings and thereafter transcribing interviews [74]. Interviews were digitally recorded in MS Teams Office 365 cloud based TalTech server. Recorded files were transcribed with web-based speech recognition technology [85] Transcripts were copied to MS Word for transcribed files to be checked and lightly edited (e.g., missing words filled in after re-listening the digital recording). After this, transcribed data was organized, so it became ready for analysis [72] and coding.

This study is based on a blend of deductive and inductive directed data analysis. Deductive analysis derives from a literature review which is being used as a foundation for research questions. Deductive coding was used with the predefined set of codes, which raised from the key areas set in the interview plan (Appendix 3).

Interview transcript background data included the date of the interview, participants, the medium used, and the length of the interview [86]. As some themes related to the research questions have become more evident, the main points from initial analytic observations were distinguished and referred as codes for further research [74]. Coding as a process includes generating labels and obtaining semantic and conceptual data reading [74] Once data analysis was completed, it uncovered new codes, which as a result were generated inductively. Data coding and categorization is shown on figure 4.

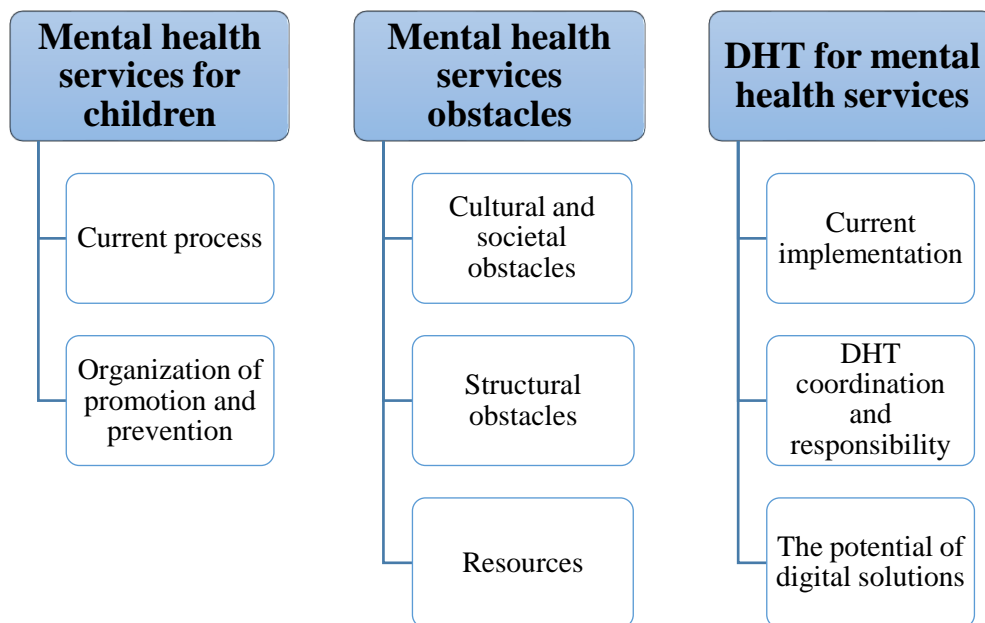| Mental health services for children	Mental health services obstacles	DHT for mental health services
Current process	Cultural and societal obstacles	Current implementation
Organization of promotion and prevention	Structural obstacles	DHT coordination and responsibility
	Resources	The potential of digital solutions

Figure 4. Data coding and categorization.

Data was coded and categorized, as the set of codes, based on the relationship regarding thematic primary codes developed and these were included into larger thematic categories. Inductive coding was chosen as a coding method to categorize and understand expert viewpoints.

4.4 Ethical considerations and data protection

Foundation of ethical conduct is to avoid harm [74]. Ethical key considerations include informed consent, have privacy, anonymity and confidentiality guaranteed and no harm caused [74]. To establish an ethical framework of process, researchers and participants must negotiate their own agreed standards for every research [73]. This ethical framework should involve "ethics of care", as a minimum, to respect online research participants values and interests [73]. Situated research ethics highlights the situatedness of interview research, as it occurs at a particular time and place, which impacts interaction in its specificities [73].

For synchronous online interviews, researchers need to obtain participants' informed consent to take part in research from the moment they join the project, as well before the online interviews have started [73]. The researcher has informed the potential

participants prior inclusion in the study via email by attached informed consent leaflet (Appendix 2). Current leaflet introduced the topic, the aim of the study and researcher, also included detailed information regarding the data usage and storage. Rights to voluntary participate in the study, as well as the right to withdraw their consent any time without further explanation were covered in the information leaflet. Before any of the interview's recording started, the researcher asked, whether they have received and read the information leaflet regarding the study and expert interview, and if they had any further questions. Also, experts were reminded of the aim of the study and that interview would be recorded with sound and video. The expert interviews were digitally recorded, based on the verbal consent of the experts prior starting the interview. MS Teams environment was used for recordings and these recordings were stored in the password protected TalTech OneDrive cloud server. After transcribing with web-based speech recognition program [85], these auto-recorded files were deleted. Participants were made aware of the data transcribing, storage, and usage purposes prior the interviews. As no sensitive topics were discussed, all participants agreed with interview recording and transcribing by web-based speech recognition tool. Therefore, ethical aspects were considered, as research standard and process were discussed and agreed with all the participants.

The recorded interviews and transcriptions are only accessible by the author and supervisors of this study. Personal data was removed from transcriptions and pseudonymized data was used instead. Transcribed analysis files would be deleted in five years from the defence of the study (May 2028), to allow publication of the data in scientific articles. Each expert was given a code to guarantee their confidentiality. Codes were based on the enrolment order in this study. The use of personal data and its processing and storage corresponding to the law and current research purposes. Estonian Personal Data Protection Act [87] and GDPR [88] requirements have been followed.

5 Results

The following chapter presents the results gained from the expert interviews. Analysed overview of the experts' opinions about the topics is given. The expert interview topics outlined three main themes: mental health services for children, mental health services obstacles and DHT for mental health services. Each of the main categories consist of smaller subcategories representing related important topics.

5.1 Mental health services for children

The codes covered under the given theme include current (mental health system) process, mental health promotion and prevention.

5.1.1 Current process

In recent years, the process to support mental health has been improved from *"/.../ the Population health development plan, adopted in 2008, when mental health topic was one line /.../"* to *"/.../ today /.../ we have whole department /.../"* (EX3). Currently mental health topics *"/.../ have been addressed more systematically than some years ago /.../"* (EX4). As referred, mental health focus and systematical thinking have increased over the last few years. Also, the importance of the mental health department establishment under the Ministry of Social Affairs has been emphasized, as well as national mental health documents, e.g., *"/.../ when we read Green Paper on Mental Health or The Estonian National Mental Health Study or Estonian Human Development Report, /.../, we can see that the mental health problems are widespread, and especially, youth has been highlighted, whose mental health needs are not covered /.../"* (EX7).

Over the last years, children's mental health has worsened, as *"/.../ from the PISA study we got such articles like Estonian children are very smart, but very unhappy /.../"* (EX8), and *"/.../ after what more attention went to the children mental health support funding. /.../ how to deal with these outcomes, and so-called mental health crisis support /.../"* (EX8) as well as *"/.../ understanding how daily teaching has an impact on mental health /.../"* (EX8). Yet, The Estonian National Mental Health Study didn't include children. *"/.../Pupils' burden /.../, is related /.../, to the societal success phenomena /.../"* (EX3), as society and families put the great expectations on their

children. This in turn has put *"/.../our children under enormous pressure /.../"* (EX3), which is one of the main reasons why children have mental health problems, as *"/.../ who are not resilient for this pressure /.../, experience significant mental health problems /.../"* (EX3). These quotes illustrate a lack of systematic approach.

There is a severe mismatch between the need for support and the number of mental health experts trained to prevent or manage those conditions, *"/.../ we don't have enough psychologists and psychiatrists anywhere /.../"* (EX1). Also, the problem is *"/.../ ageing of healthcare professionals, they are moving out from the system /.../, the growth rate is not fast enough /.../"* (EX4) – as the excerpt outlines, there are not enough newly trained professionals to take over. Another area of concern in Estonian healthcare is that *"/.../ healthcare system works through family doctor, /.../* (who) *might not have the ability to refer, /.../ mental health treatment queues are very long, and the referral is often lacking /.../"* (EX1).

A remarkable number of people will skip the lower steps of the mental health pyramid and start looking for help *"/.../ as high level as possible in the mental health pyramid and often they won't receive the* (appropriate) *help /.../"* (EX3). Thus, they use up psychiatric resources and concurrently contribute to the prolongation of queues. However, as a drawback, *"/.../ we don't have enough these low intensity interventions /.../"* (EX3). As the queues are long, people are accessing private services, and *"/.../ use their own out of pocket payments for private psychologists /.../"* (EX3). And this causes socio-economic inequalities, as *"/.../ people who can afford to pay /.../ can buy themselves front of the queue /.../"* (EX7).

Mental health services availability for children *"/.../ is poor, not sufficient. /.../ as well as poor recognition* (of mental health concerns) */.../"* (EX1). There are different interventions at schools, as "*/.../ we have school nurses, who to some extent likely are offering this kind of mental health support"* (EX4). At schools, school psychologists *"/.../ should be primary interveners. And their availability at schools is a big challenge, as we can't put a school psychologist in each school /.../"* (EX6). There is a lack of interventions for the different target groups, as *"/.../ some target groups* (are) *completely uncovered /.../"* (EX5), and there are no tools and interventions *"/.../ to support more effectively children's wellbeing and mental health /.../"* (EX5). Hence children's wellbeing and mental health are not supported the most optimal way.

The present children's mental health support was discussed with the experts, who emphasized, that *"/.../ during direct provision of services /.../* (EX7)*, there is /.../ lack of person-centeredness and fragmentation of treatment journey /.../"* (EX7), as *"/.../ service provider doesn't have an additional motivation /.../"* (EX7). What happens next to the person, once the person is referred further, is not in service providers focus anymore after someone is referred, to *"/.../ consider that this problem has been actually solved or not /.../"* (EX7). Fragmentation is one of the main reasons why, people who are looking for help won't get the right help at the right level as *"/.../ if they do* (look for help)*, they end up in various places, where they still won't get help /.../"* (EX7).

Social isolation and online learning during Covid-19 had negative impact on children, *"/.../ small children minimal socializing experience, /.../ when children went back to nurseries /.../ they couldn't communicate with their peers. This has a direct impact on the mental health, as they didn't have enough experience, they couldn't practice /.../"* (EX8). These social-emotional competencies need regular practicing in physical environment, as you cannot practice these skills same way online. *"/.../ the awareness came earlier, but crisis brought it out /.../ that teachers, parents, children don't have these skills. The reality became more visible /.../"* (EX8). Covid-19 helped to further highlight *"/.../ the bottlenecks we already previously have known /.../"* (EX2). This brought more attention to *"/.../ how much more children /.../ will need mental health support /.../"* (EX4). Also, Government office regular surveys showed that *"/.../ the adolescents, as we didn't ask from children, /.../ were the most affected group /.../"* (EX3). Survey results and statistics does not reveal the real extent of the problem, as children were left out from this survey, and conversely by exploring *"/.../ the increase of diagnoses, then this doesn't reflect the increase of problems /.../"* (EX3).

5.1.2 Promotion and prevention of mental health

Children's mental health intervention's goal in prevention *"/.../ for a long time have been in terms of risk behavior prism, /.../. No one thought about children's mental health, no one thought that children could feel better /.../"* (EX3). This answer indicates that children's wellbeing and mental health in general were secondary and did not get enough attention. This understanding has shifted now, as the goal for prevention has become more universal, and *"/.../ for different problems we already have interventions at possibly early stages /.../"* (EX3).

The experts discussed current arrangement of mental health prevention. Prevention *"/.../ is even worse than mental health accessibility /.../"* (EX1). Prevention is not available for all levels in every area we need, and all target groups, *"/.../ we have shortcomings in all these sectors. /.../ we have very big areas uncovered. And this is on different prevention levels, so maybe we have one program at universal prevention level doesn't mean that we don't need selective indicated prevention programs /.../"* (EX5).

Early recognition and prevention are important, as often, once we have enough awareness about mental health, it is possible to recognize and intervene early, likely preventing the mental health problems escalation and the need for a treatment. *"/.../ in mental health, it's not always necessary to treat, but you need to address recognition and prevention, with such as different interventions. /.../ this system could be improved on various levels /.../"* (EX4). There are learning programs available, but to deliver these broadly *"/.../ we would need extra funding, people, and time /.../"* (EX6).

Sustainability key elements are mental health promotion and prevention, and thus *"/.../ more emphasis should be on early recognition, school healthcare. /.../ to approach these topics more systematically. So, we could prevent more, as well recognize on the direction of parent's different activities, and then it is likely that the need for treatment is smaller /.../"* (EX4).

In prevention it is quite complicated to find out, what are the best interventions, in regards results, as *"/.../ when you think in short perspective, the impact will come* (later) *– as what you are doing today, you will see in five years /.../"* (EX5). The challenge in prevention is that it is not possible to predict where prevention focus will be in few years' times, so *"/.../ you are always a little bit behind of time /.../"* (EX5). Another issue is that *"/.../ local governments live in this electoral cycle and political agendas and plans, which has an impact for them* (their activities) */.../"* (EX5).

So far effective mental health prevention activities have not been in the focus, as *"/.../ greater emphasis will go towards so called erasure of the problems /.../"* (EX6). There is no universal understanding of what effective prevention in mental health is, as *"/.../ everyone understands prevention little bit from their own level /.../"* (EX5). Prevention could mean *"/.../ information or leaflet, /.../ campaign, and for some /.../ daily life what's happening around child, so these are very different viewpoints. Maybe when we*

would understand this, then maybe we would as the State to contribute to the effective prevention /.../.” (EX5). These quotes describe wellthe challenges around preferences and different views regarding effective prevention. Though, various stakeholders deliver prevention activities, highlighting again the lack of systematic approach: *“/.../ the Ministry of Education and Research /.../, the Ministry of Social Affairs through the NIHD distributes some programs. /.../ no systematic approach and these things which have proved themselves, they won't have capacity to be distributed widespread.”* (EX6)

Prevention has become cross-sector wide, and it is paramount that *“/.../ on certain horizontal topics we step the same foot – evidence based, coordinated, specialists training. /.../ under the same principles. /.../ the state resources, we would discuss in between us where the need is the biggest. And we won't pull off this small state budget blanket from each other /.../”* (EX3). Also, the action plan is essential, so *“/.../ the prevention is going to be coordinated /.../”* (EX3)*,* and there will be less duplication, as *“/.../ everyone wouldn't be carving in their own corner /.../”* (EX3).

Experts agreed that parents *“/.../ should be more involved /.../”* (EX7), in the promotion and prevention process. Children's mental health support starts already long before they are born, as *“/.../ Childrens mental health holding starts from their parents healthy and happy upbringing, as well as from sexual and reproduction education, /.../”* (EX3).

5.2 Mental health service provision obstacles

The topics covered under the given theme provided the experts opinions regarding the societal, cultural and structural obstacles, and resources.

5.2.1 Societal and cultural obstacles

The findings revealed lack of mental health awareness as a general problem. *“/.../ how our acts are influencing mental health development on someone. /.../ often, we don't know the impact of our actions /.../”* (EX6).

The attitudes are changing, and although *“/.../ the topic of stigmas has improved, but we still have them, /.../ the perception that mental health is an issue and people have problems with this /.../”* (EX8). This quote refers that stigmas and attitudes are still a problem in the society, and one of the barriers, why people won't reach for help. To

deliver wider communication in society and increase mental health awareness, *"/.../ we should offer more like these alternative channels and broader communication in society – this would definitely support mental health development for children /.../"* (EX1).

Together with raising awareness, also the services should be redesigned as *"/.../ our services have been designed at times /.../ when the stigma was high /.../"* (EX3). Additionally, it was stated that *"/.../ we don't have enough these low intensity interventions /.../"* (EX3). The experts pointed out that there is a lot of will and ideas, but *"/.../ we have a situation where there is much more will than knowledge /.../*(EX3).

Also, the institutional responsibility was outlined: *"/.../ raising awareness what mental health is and what can influence it. So, we could recognize these environmental factors /.../, it really is institutional responsibility /.../ from education system, as we are speaking about children's mental health, then this is central /.../"* (EX3). In terms of institutional it is the responsibility of schools. Teachers' skills and social-emotional competencies development was featured as a training project, as *"/.../ you can't teach what you don't have yourself – to support teachers own social-emotional competences /.../"* (EX3). These opinions indicate that school environmental factors and the teacher's awareness should be stressed, as these are substantial for children's mental health.

And, as *"/.../ for child, the first influencer is his parent, /.../ our primary learning is through our closest contacts. And the more understanding we have, /.../ the best start we would have /.../"* (EX8). This quote refers to the fact that the best start of life depends on how much knowledge parents have. The question is */.../ how to support these parents, who likely won't find this information or are not interested. This is the area where we should have more* (attention) */.../"* (EX8). Parents *"/.../should also be more interested and take more responsibility of their child's well-being. /.../ as well recognize these things, which are hidden /.../"* (EX7). Another important aspect is parental attitudes, as *"/.../ once child might have problems, then please don't stop him to reach for help /.../"* (EX7). Hence parents' inclusion and empowerment are important areas to contribute, so they could ask for support when necessary.

Another expert saw also Estonian environment as a limitation, as *"/.../ Estonian environment shouldn't be so rigid and conservative, that all the entrepreneurs are*

saying, that we can't start using these interventions /.../. The first goal is to make this environment favorable for us here /.../" (EX4).

5.2.2 Structural obstacles

In terms of the availability of the systematic support in the mental health area, it was stated that *"/.../ the system hasn't remarkably improved. Improvements have happened because of local enthusiasts and plus the work of NGOs /.../. But to ensure like the state system, that the needed help will reach, will be guaranteed for every young person, we are very far from this /.../"* (EX6). The state system hasn't notably improved and met the demand of the changing needs. Topics like mental health *"/.../ can fall between several chairs. /.../ There is space on the state institution level, how this model should work in trans area cooperation /.../"* (EX2). Thus, every Ministry has an opportunity, during their chairmanship to shift focus on their preferred areas in mental health.

However, the expert (EX2) *"/.../ considered about the roles of ministries that it certainly is sufficient, as our job is predominantly to ensure this judicial area /.../"* (EX2). Another expert (EX1) stated that *"/.../ the biggest discrepancy is between the policy makers and then the ministries agencies /.../"* (EX1). There is a hierarchy in this ecosystem, however *"/.../ the question is more about the parties' own understanding what they are doing, but why they are there. /.../ we have lots of discussion areas here and how the cooperation should be, what their exact role should be /.../"* (EX3).
Also, an expert pointed out that *"/.../ when there are lots of changes on public sector personnel, then the ratification of the draft or law takes three years. /.../ then there can't be much quality in the content /.../"* (EX1). As everyone has different opinions, which might be conflicting, then draft quality would reflect this. Also, as ratification process is lengthy in the public sector, it might be redone by several people over time.

There are several national framework documents, conversely, there is a *"/.../ mental health strategy, the Green Paper on Mental Health /.../, which doesn't have an action plan /.../"* (EX1)[2]. This refers to that there are mental health strategies, but these do not have actual action plans for implementation. *"/.../ the public sector has to be a policy*

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[2] Mental Health Action Plan 2023-2026 [14] was published after the interview

maker, but in reality, this kind of whole solution doesn't exist. When tasks are directed to the sub-office, real activities, then at the moment not a single activity has reached society or the public, and this is embarrassing /.../" (EX1).

Several experts highlighted that parental consent for minors, which is a legal requirement, could be an issue for receiving mental health services. *"/.../ when you identify someone from a school environment who needs help, then you just can't start providing these services /.../, you would still need a consent. Even then when the child or adolescent wants himself /.../"* (EX7). This answer indicates again the need to raise awareness, to minimize potential stigma, as without parental consent, some of the mental health services would not be accessible for children.

From technological perspective, there are issues with the interoperability of IT infrastructure and information systems, as *"/.../ healthcare, social sphere, education, these all are in the different information systems /.../, they are cut off from the each other and we don't have network-based support /.../"* (EX6). This quote reveals that one needs to have a strong will to endorse the cooperation of different divisions, as they all run diverse information systems, and information exchange and communication between different areas is complicated. *"/.../ we have school nurses who are keeping the connection between the E-health and health and current education system. Ideally the communication should be much smarter /.../"* (EX3). It could be more resourceful to implement more advanced technical solutions, to make the system faster and more efficient, *"/.../ so specialists could see what others have done /.../"* (EX3). As the expert describes the current digital systems in Estonia, *"/.../ I have tried to make a small change in the health system, /.../ this makes me sad to see, how slowly these changes are happening. How big is the resistance to change and how clumsy are these Estonian digital systems /.../. There is something fundamentally bad if every little change feels like Sisyphus pushing rock up a hill /.../"* (EX3).

Several experts pointed out that in case of the availability of some kind of marketplace or app library of evidence-based and recommended applications, their implementation rate would be much higher. *"/.../ we are at the beginning of this journey, and we don't have a good framework or background system, where these could begin to appear, this kind of breeding ground hasn't been created for these /.../"* (EX7).

5.2.3 Resources for mental health services

One, in what experts are having same opinion, is lack of resources. But there have been some big changes recently in the mental health field – to address more effectively barriers outlined previously: *"/.../ public institutions are thinking more /.../ what we could do for society and target groups, and /.../ allocating money with the label /.../ to help society, and how we could do it better /.../"* (EX7). This has been like an upheaval, which has increased mental health focus, and established more funding for this area.

A significant challenge, that was outlined, is healthcare funding in mental health sector, as *"/.../ all these various directions are competing for money. The state has one budget, which is divided /.../ and who receives this, is a challenge. Sustainability is guaranteed for some level /.../"* (EX5). This quote indicates that there is funding for some interventions and services: *"/.../ in healthcare sector we need resources primary to support other sectors. /.../ don't save little bit money for that later you need to use more money for treatments or support /.../"* (EX3). This refers that when more money would go for mental health promotion and prevention, then less resources would be used later. As *,"/.../ if uniformly we spend less, then everyone will win /.../"* (EX6).

The planning has become more meaningful. So, *"/.../ now we have to use this, at least to start building this system, so after a certain time period we could say, that through this we have got much better mental health services provision system and impact for this came from the current period /.../"* (EX7). One of the reasons of the lack of resources on the ambulatory and stationary level, is *"/.../ due to the bottom of the* (mental health) *pyramid is so scarce /.../"* (EX3). Therefore, *"/.../ part of the sustainability is /.../ to build a system, /.../, from lower to high intensity interventions to equip the pyramid, we won't have any barriers or like normal frameworks, where these could be created /.../"* (EX7). This refers that there is a need for a functioning mental health pyramid, which is sufficiently equipped and funded in all levels, to be able to offer low intensity to high intensity services, through the system.

It was outlined by the expert, that *"/.../ we never would have enough treatment, when these environmental conditions are continuing, which were the reason, why we got sick at first place /.../"* (EX3). This refers that awareness of mental health environmental risk factors could help with mental health system sustainability. *"/.../ there could be*

higher capacity, at the same time we need to contribute to broaden assistance-help at local level /.../. We have specialists, whom we could implement, but we don't have a system to do so /.../" (EX6). It is necessary to look at existing capacity and what intervention are available today for *"/.../in mental health the potential circle of specialists is wide /.../"* (EX6).

As these findings indicate, there are still lots of different barriers to address in order to successfully implement mental health services. The perceptions about DHT and their potential is further elaborated in the next chapter.

5.3 Digital health technologies for mental health services

The codes covered under the current theme investigated the experts' views regarding DHT. The topics included the current implementation of DHT for mental health services, areas of coordination and responsibility of innovation and DHT, as well as i the potential of implementing DHT in mental health.

5.3.1 Current implementation of DHT for mental health services

Digital resources have many benefits, and it could be used for training, information distribution, decision support etc. *"/.../ we live in the digital world, all these digital resources are something which really are helping to keep themes in the air and keep things sustainable. /.../ this could be one of the main resources which would help to reduce the lack of workforce /.../"* (EX8). Going more digital, has seen as an alternative, *"/.../as we can't produce more psychologists and psychiatrists, then to offer various digital solutions, telemedicine. /.../ which could help to support child's mental health /.../"* (EX1). Also, digital resources were highlighted, as *"/.../ more accessible, like learning platforms /.../"* (EX6). There are not enough materials for mental health support and therefore digital solutions, could be another option to consider, as *"/.../ teachers and youth workers – they want tools and resources, /.../"* (EX5).

Also, availability of digital solutions plays its role in implementation and usage, as *"/.../ we don't have too many solutions adapted in Estonian language /.../"* (EX7), however, there are lots of digital solutions in other languages. The competition is high and *"/.../ this gamification approach /.../, regardless how much you are developing it, won't*

easily win /.../" (EX6). There must be an evaluation system, to assess solutions benefits and strategies for marketing, as *"/.../ not a single game will work itself, you need a lot of lobbying and to have certain communication plan and strategy in it. You need several champions in different areas, who truly are believing in the implementation of these solutions and this way it is possible to implement this on wider scale /.../"* (EX1). When evaluating or implementing digital tools then *"/.../ the digital solution needs to be measured /.../"* (EX5).

There are also national digital solutions available, however, *"/.../ the state digital solutions, we don't use much, /.../ like various tests /.../"*, which are *"/.../ included with this mental health prevention, /.../"* (EX8). Experts mentioned various digital tools across different areas, such as e-school platforms, digital counselling and learning resources, solutions for long-distance appointments and mental health disorder recognition, , none of these are widely used. Wider implementation of these good solutions is inhibited, as there is no pathway *"/.../ how to realize them /.../"* (EX6). The state has an important role here, regarding *"/.../ the systematic view /.../"*, as well as to *"/.../ provide funding to these initiatives, which would support this /.../"* (EX8).

Important thing to keep in mind is that *"/.../ every webpage has its own target group, /.../"* (EX5). Also, when developing these digital services, the focus needs to be on *"/.../ how to reach closer to the person with your content, /.../, taking inconsideration that what is the need and who are these vulnerable target groups /.../"* (EX7). It needs to be identified where is the necessity and what is possible to digitalize, as *"/.../ there is a necessity on the prevention side and maybe then as well early interventions side. /.../ the opportunity to implement more digital solutions /.../"* (EX6). And here we could have a challenge, as *"/.../ this standard, in which we want to deal with children mental health, could be maybe in conflict with business interests. Simply it is easier to sell fun things, which sound good, than complex things, which are working /.../"* (EX6). We need to consider the state interests, to find *"/.../ these areas, where private sector interests and the state interests are not merging /.../"* (EX6). However, *"/.../ the market of healthcare technologies is complex. As the business models there are not so clear, /.../"* (EX4). Also, it is *"/.../ much more complicated in prevention to evaluate these digital interventions, in comparison to treatment, as for treatment the evidence base is stronger /.../"* (EX4).

The question is *"/.../ the safety of these technological solutions. How can we ensure that these are not harmful solutions for someone /.../"* (EX2). The Ministry of Education and Research has facilitated the deployment of safe solutions by suggesting them through their own channels, as *"/.../ all information letters, which have been sent to the educational institutions, we have given various references for different tools, which we know to be robust, like "Triumf Health" /.../"* (EX2). Nevertheless, these solutions haven't reached (enough) in the school environment. It could be due to *"/.../ user's precaution in some topics. And this is the actual reason why at schools these like evidence-based programs haven't rooted, /.../"* (EX8), also funding, as *"/.../ schools funding models are like this, that you don't have flexibility often to use these innovative things /.../"* (EX8). And due to that *"/.../ at schools' information equivalently spreads how being in web is harming your learning and mental health /.../"* (EX8). As well as *"/.../ schools' inability to understand what is efficient and what is not /.../"* (EX8).

Digital solutions use is person-specific, and it: *"/.../ depends on family's readiness, current knowledge, and skill to use digital solutions, and other side specialists' own readiness and his digital skills and previous experience with this /.../"* (EX7). As the quotation indicates, there might be some individual barriers that might hinder the usage of DHT and those (e.g., digital literacy) should be addressed. Different readiness of target groups may paradoxically increase inequalities.

These quotations outline different shortcomings to manage in order to make mental health work in different environments.

5.3.2 Areas of coordination and responsibility in DHT mental health ecosystem management

Interdisciplinary cooperation and coordination in mental health is complex, however it was said, that the state must set directions: *"/.../ the strategies need to come from politicians and government /.../"* (EX7). But the problem is *"/.../ State passivity – necessity is very high and increasing, it is important to determine, who is the responsible party, and who in real life will start coordinating these activities /.../ if I could answer how to put different specialties to work together, then I think it would be happening already /.../"* (EX1).

In view of who is coordinating innovation and digital solutions' implementation, experts had different opinions from *"/.../ it's not in someone's desk like this /.../"* (EX7), as well as *"/.../ we don't have this kind of systematic coordination /.../"* (EX6), to that *"/.../ the NIHD is coordinating little bit, certainly the state is coordinating little bit /.../"* (EX8). This refers to the fact that there is no uniform understanding regarding coordination. E.g., *"/.../ it is difficult to say, that one or the other national authority should be taking to their priority like the coordination of the digital solutions development /.../"* (EX4). This indicates that there is no clarity about certain authority, who should be coordinating, yet another expert said: *"/.../ who will manage the mental health politics, will manage technological solutions in this field. I wouldn't see them separately /.../"* (EX2). The expert described her views in the leadership level, whereas *"/.../ the Ministry of Social Affairs is leading the mental health politics in general. /.../ The conceptual level leadership is probably under the Ministry of Education and Research. On the implementation level, there are a lot of partners /.../"* (EX2).

However, another expert saw this as a shared coordination, as it is *"/.../ a combination from very different Ministries /.../"* (EX4), i.e., not only the Ministry of Social Affairs, but also *"/.../ the Ministry of Economic Affairs and Communication, /.../ and the Ministry of Education and Research /.../"* (EX4). In the context of digital technologies for children's mental health interventions and prevention, *"/.../ it could be under the Ministry of Education and Research, /.../ the competency is rather in the NIHD /.../"* (EX6). Conversely, the NIHD is an agency under the Ministry of Social Affairs, and as *"/.../ the Ministry of Education and Research, and the Ministry of Social Affairs /.../ have some disagreements /.../"*, maybe another organization is needed at the top, who could manage this on the state level /.../"* (EX8).

There was no uniform opinion by the experts, about who should be responsible for mental health ecosystem management. The findings reveal unclarity regarding the responsibility. Some of the experts considered that it has to be the State's office's responsibility, but there was no consensus regarding the responsible ministry. Some experts found that as *"/.../ we have the under-secretary in the Ministry of Social Affairs. He/she should be this person, who regulates this /.../"* (EX1).

Whereas others saw shared responsibility: *"/.../ I know that usually we are looking at the Ministry of Economic Affairs and Communication, but I think it is not enough. /.../*

we need to make fundamental decisions, and this is same as health /.../. So, everyone must take responsibility. And it seems to me that for IT, it is the moment, where this responsibility could move higher, not to wipe it under the Ministry of Economic Affairs and Communication's carpet /.../" (EX3). In addition, different assessment bodies were revealed, *"/.../ the Health Insurance Fund with its Innovation grant, its own evaluation framework for digital solutions, has taken responsibility /.../"* (EX4). As well as the responsible body *"/.../ must be the NIHD. As /.../ digital technologies shouldn't be addressed differently from other prevention programs /.../"* (EX6).

Regarding divided responsibility, it was stated that *"/.../ this is a little bit a part of the problem. /.../ the responsibility is evaporating, as for example in this children's mental health topic. As there is something to be said on the health side, and on the education side /.../"* (EX7). On the opposite, it was also stated that, *"/.../ can't see the state at all, I can see that the state has more like launching or regulating role. But the state shouldn't be responsible for all interventions funding in sense of will it be there or not /.../"* (EX7). As those findings indicate, there is a high complexity and no clear solutions, which makes introducing changes complicated. A consensus on the highest levels is needed to unify the understanding between experts in the area. The key is to decide who is the most suitable organ with the authority and power, as *"/.../ someone has to take the responsibility, who will make this matter important /.../"* (EX8).

5.3.3 The potential of digital health solutions for mental health support

The potential of digital health solutions for mental health support was discussed with the experts, and they all agreed that there is a potential. The potential *"/.../ is unlimited /.../. When we are talking about adolescents, /.../ then the digital component is likely quite important /.../"* (EX7). As *"/.../ adolescents /.../ often prefer to describe these mental health issues like on smart devices or phones /.../"* (EX4). While we live in the digital world these days, then our younger generations are growing up with digital literacy, *"/.../ as children are more and more digitally aware, they certainly are ready to use this kind of solutions /.../"* (EX1).

Digital solutions will be another option among the alternatives as in the ideal world *"/.../ everyone will choose their tool. It could be a digital tool or maybe counselling in the office /.../"* (EX4). Everyone has an opportunity to choose the most suitable solution for them and with this, the person would be *"/.../ involved in the decision-making*

process /.../" (EX7), which will be part of person-centered healthcare approach. *"/.../ digital interventions complement existing solutions and simply this selection could be bigger and take users wishes in consideration /.../"* (EX4).

Regarding reaching to the potential and deliver your solutions widespread, it is necessary to have *"/.../ a clear value proposition and the value proposition could be best rated by users. Will these solutions have real users. What is their feedback /.../. What is the adherence rate /.../"* (EX4). This indicates that knowing your target groups, and taking their user preferences into consideration, would help to reach the potential, as user adherence is one of the most important factors to be able to implement your solutions effectively. *"/.../ you need to start with big fish. Again, the knowledge, who are these vulnerable target groups and then to think what solutions we already have today. In the wider world, what has justified itself and which science or evidence base is possibly high /.../* (EX7).

However, regarding the state IT systems, the problem is *"/.../ communication between the systems, as I wouldn't say that there is potential only, but a huge need /.../"* (EX3) to modernize and develop these systems. Estonia is *"/.../ a digital nation, but /.../ we don't implement this knowledge systematically /.../"* (EX8). The limitations of digital solutions implementation could be that *"/.../ we have to deal with the health data, and ethical principles /.../, as well this area is maybe underregulated /.../"* (EX8). Also, *"/.../ we have used to refer, that something can't be done, because of the data protection /.../"* (EX3). As well as */.../ the state is very slow and weak in linking together mobile and web solutions, and various data systems /.../"* (EX5). Therefore, *"/.../ most of these solutions today have been developed by private sector /.../"* (EX2).

There are lot of applications, which already are doing good job, but *"/.../ regardless of that, these are not used much. Maybe their lifetime is not too long, and this is sad, as it is like necessity, and I think, there is a potential /.../"* (EX8). Another constraint could be, that *"/.../ as people are spending so much time anyway in these digital channels, then they want this human contact and interaction more. /.../"* (EX4).

Triumfland Saga, as a mobile health game by Triumf Health, was used as an example of the evidence-based digital solution. Experts were familiar and mentioned Triumfland Saga game during the interview prior seeing the video clip. Thereafter the potential of

the solutions was discussed, and experts' views outlined that *"/.../ absolutely there is a potential, /.../ to implement this in the right environment, maybe really like a tool, which is supporting specialists, /.../ then it can work in there /.../"* (EX6). However, this solution has seen as an additional tool *"/.../, not an entire intervention. /.../ which specifically develop some skills, but I still can see a need for human interaction. /.../ to support this, that a child actually is implementing this /.../"* (EX6). Triumfland Saga game, could be used as a part of intervention, *"/.../ to reduce workload for specialists and this would help them to observe this intervention better, and they will make these interventions more absorbing for children and more acceptable /.../"* (EX6).

Triumfland Saga game is *"/.../ based on the target group needs. /.../ it seems that children like this, and this is a good sign of satisfaction as well /.../"* (EX2). Also, potential has been seen in education, as *"/.../ this could be integrated in learning, /.../ the primary place, where you could support children's, mental health is directly through child, it is development of social-emotional competencies. /.../ it is more efficient, when it's supported by physical environment learning activities or learning, so they are like integrated /.../"* (EX5). However, due that their *"/.../ data is not published. /.../ it is a bit complicated for me to evaluate the potential. Certainly, this should be tested, experimented, and published /.../"* (EX5). This refers that an important factor regarding the potential of the solution, is the public evidence-based information regarding its efficiency.

However, the question is, *"/.../ where do they fit in the system? /.../ and without the doubt there is a place /.../. If there are users, if there are believers in this, then I don't know what the problem is, that this* ("Triumf" game)*, doesn't go in* (widespread) *use /.../"* (EX4). This indicates that even the solution with a good potential, might have implementation difficulties, and the reasons are unknown.

6 Discussion

This chapter provides a thorough discussion of the results, comparing the findings to previous studies and existing theories. As a result, answers are given to the research questions. Also, the main contributors and limitations of this study are examined. Future research, including the next steps, and conclusions completing this chapter.

6.1 Mental health services for children

The qualitative analysis conducted on mental health support in Estonia reveals both improvements and challenges within the system. During the last years, children's mental health has worsened and the pandemic has emphasized how much more children would need mental health support [2] [29] [32] [33].

At the same time, the study showed that, mental health services availability for children is not sufficient in Estonia. There is a drastic gap between the need for support and the number of mental health experts trained to prevent or manage those conditions as also noted in prior studies [33] [36]. In accordance with previous research [33] [36], this study showed that there are not enough health professionals, treatment continuum and pathways are fragmented. There is a lack of interventions for the diverse target groups, and some of them are entirely uncovered. As well as a lack of tools and interventions to support children's wellbeing and mental health more effectively and to recognize mental health concerns earlier. Therefore, children's wellbeing and mental health are not supported in the most optimal way, creating a situation where according to the Estonian National Office Audit [24] in 2019, only one third of children received mental health services they needed in a timely manner. However, lengthy waiting times are linked to worsening symptoms and poorer outcomes [23]. Moreover, long waiting times present additional problems such as socio-economic inequalities as services become more available for those who are able to pay, which has been identified in previous studies as well [10] [11] [35].

Another bigger issue arising from this study is the quality of private services, as the private market is broad and diverse, including also non-evidence-based services for

mental health support. Which possibly could cause more problems, as these alternative therapies might undermine evidence-based services and delay the access to evidence-based services, when problems have become more significant.

Everyone's mental health needs are individual, however, the person-centred approach is not yet fully integrated, despite being identified as one of the goals in Estonia's National Health Plan [13], and in the Green Paper on Mental Health [4], in the mental Health Action Plan [14], as well as in the international strategy documents. It is important to acknowledge that one of the contributing factors to this situation could be the presence of numerous conceptual frameworks for PCC, which has resulted in a lack of consensus and remains an ongoing issue in practical implementation [49] [50].

In the context of PCC, the main areas of priority are healthcare quality and primary care [12]. As the experts in this study revealed, that the fragmentation is one of the main reasons why people who are looking for help would not get the right help at the right level. One of the contributing factors might also be the fact that the Estonian healthcare system primarily relies on GPs as the primary level of care, which in a way could be a bottleneck for mental health assessment and referrals. At the same time, PCC aim is to deliver a holistic approach, and to consider persons needs and personal goals, by offering continuity of care and services [46] [54]. However, due to fragmentation and lack of systematic approach, it is difficult to deliver whole system approach and continuity of care and provide care coordination. As has been outlined, there is no incentive or motivation to evaluate, if someone who has been referred is on the right pathway and has received the help they needed. There is no follow up process, and service continuum is lacking. Additional PCC challenges here could be current health professional practices and awareness regarding PCC [47] [50], as well as that here are not enough service providers, interventions and tools throughout the mental health system. Therefore, the system is not optimal and would need structural and systematic changes to be able to support the PCC approach.

The mental health pyramid is a framework categorizing services and interventions into different levels based on their intensity and complexity [14] [38] and this study showed that the bottom of the mental health pyramid is scarce, and this inhibits promotion and prevention activities. Furthermore, it was outlined in this study that awareness regarding lower-level support services is low and therefore this hinders people to access and use

these services. As the awareness is low and there are not enough service providers offering lower intensity services, then consequently it exerts pressure on the level of psychiatric services. Based on the above, more people end up using top level resources, and this may lead to using up psychiatric resources and at the same time contribute to the prolongation of queues. It is argued in previous research that an increase in lower intensity services reduces the burden on high complexity psychiatric services [10] [14] [36].

This is further supported by the results of this study, as the experts have underlined that sustainability key elements are mental health promotion and prevention, and therefore the mental health pyramid bottom level would need more attention and services.

Hence, the study proposes that attention, resources and funding throughout the service system is needed for an effectively functioning system.

While mental health promotion and prevention is national priority, and this has been stated in several mental health strategy documents [13] [36], these activities are fragmented, and delivered by various stakeholders, there is no systematic approach in children's mental health promotion and prevention specifically, and this inhibits widespread delivery of prevention activities. One of the shortcomings identified in this research is the situation where universal prevention and promotion, has not been the goal, instead the focus has been on risk behavior spectrum. However, the study revealed that this area is going through transformations. Recently, the goal for prevention has become more universal, which is essential, as prevention and promotion of good mental health, and early intervention prior to or by the onset of mental disorders improves outcomes [3].

One of the factors impeding progress in the field is that there is no universal understanding what effective prevention is, which causes challenges due to different preferences and views. Hence prevention goals are different for various stakeholders and therefore, target groups are not appropriately and sufficiently addressed. This study proposes that would help to uniform our understanding of prevention, so everyone would use the same evidence-based principles and know what they must do as their part in prevention.

A policy making challenge outlined in this study was that in prevention it is not possible to predict where prevention focus would be in a few years' time, as well as the prevention activities are linked to the electoral cycle and political agendas. Prevention focus depends on the preferences of the party, who has won the election. The new elected government has set the mental health support system in its focus in the Estonian Government Coalition Agreement 2023-2027 [37], whereas the national goal is to improve mental health of children and young adults, by developing solutions across sectors. Thus, the current coalition focus on children's mental health improvement should have an impact on mental health services structure by delivering cross-sector mental health services and therefor improve mental health services availability and accessibility for children.

This study proposes that child and adolescent mental health promotion and prevention activities could be delivered through schools. Through school venue, these activities could also reach to those children, who otherwise would not have access to mental health services [19]. Yet parental involvement remains an issue in this avenue as indicated by the experts. One of the key elements in mental health promotion and prevention should be the school management mental health literacy improvement, and this could possibly be delivered by the cooperation of the NIHD and the Ministry of Education and Research, based on this study.

In conclusion, the experts who participated in this study agreed that mental health support for children is not sufficient and they pointed out several barriers in the current mental health system in view of supporting children.

6.2 Mental health services obstacles

The findings showed that society's awareness in mental health has improved, however stigma is not completely vanished. The attitudes are changing, however the experts in this study agreed, that stigmas and attitudes are still a problem in society. Stigma is one of the main barriers, according to the WHO [2], why people won't reach for help.

The study also outlined institutional awareness and responsibility regarding institutional environment. A lack of awareness regarding mental health protective and risk factors at schools. It is proposed that schools should have a central role in children's mental

health, as universal mental health promotion and prevention starts with a friendly school environment, where everyone should feel good. As experts have highlighted, the school arrangement is a big problem, because pupils are under pressure. Improving mental health literacy among school management could be considered as a key element which would lead to better understanding regarding mental health protective and risk factors, and mental health promotion and prevention as a whole. This could help with mental health system sustainability. The findings are in line with previous studies outlining that schools are important platforms to deliver mental health promotion and prevention [2], by developing and distributing mental health literacy and social-emotional learning programmes [1], thus schools should address all the aspects in which they can influence children's wellbeing and mental health [19]. The current study, however, highlights that the school arrangement is a big problem, because pupils are overwhelmed.

Additionally, as the results revealed, teachers' skills and social-emotional competencies need developing. Once the school culture changes and starts supporting mental health more, there wouldn't be as many mental health problems as in the first place. And this possibly could help to reduce mental health problem stream, which would in turn might increase specialists' capacity to help those who really need their help.

Outside of the school environment, there are several barriers which inhibit children from reaching professional help. One of these barriers could be parents, as they have central part in identifying child's difficulties and looking for help [22]. First, mental health literacy is vital and essential, as it is related to actions and mental health outcomes [2] [22], while inadequate mental health literacy can become a barrier in help-seeking process [45], as lack of parental knowledge and awareness regarding problem impede help seeking for mental health problems [22]. Parents, as child's primary carers and influencers, play a big role in child's wellbeing and thus parental education distribution is an issue. In this study, the experts have stated that possibly different interventions haven't reached enough of these parents, who likely won't find this information or are not interested. So, more attention needs to be concentrated on how to support these parents systematically, as these parents are likely to be the ones who would need this most. Second, parental attitude might be the area of concern highlighting the issue of general awareness and stigma again, as there are parents who could stop their children reaching for help. Third, parents should take responsibility

over children's mental health. However, to put more responsibility on parents' shoulders, a systematic approach is needed regarding parents training, support, and involvement, as otherwise they may face knowledge limitations, and this could possibly lead to even bigger problems. A diverse range of factors, such as social determinants of health [2] [52] would have impact on parenting capacity and without appropriate knowledge and support, health inequities could increase, and outcomes worsen. Thus, social and mental health topics are complex, and wider problems, which would take long-term to tackle, but these areas would need to be addressed systematically to increase parents' inclusion and empowerment.

All those findings and areas of improvement indicate the beneficence of the PCC approach. PCC supports and accepts the viewpoints of persons and responding to their individual preferences [46]. In this way person actively would be participating in the process, and by using "working with" persons approach would help to work out each person's individual needs [48].

In addition to awareness and attitudes, the findings revealed legal obstacles, namely the requirement to obtain parental consent for minors for certain mental health support services, which could become an issue for receiving adequate mental health care. Therefore, there is a need to review the legislation to see whether there are areas for improvement, which could help to enhance the availability and accessibility for mental health services, without the parental consent also everywhere else than specialist level. Currently, the parent has too big decision power regarding her/his child mental health support and access for services.

Yet, as the findings showed, topic like mental health could fall between several fields, which makes the legislative processes slower and more complex to manage as legislation ratification process is lengthy in the public sector, it might be redone by several people over time, due to the changes on workforce in public sector. The latter outlines the importance to understand what their exact role should be, in terms of different documents and from strategic to implementation point of view. Despite the availability of the Green Paper on Mental Health [4], the findings indicated the lack of actual action plans of implementation, and therefore planned mental health activities are complicated to deliver to the people.

From technological perspective, it was outlined that there are issues with the interoperability of IT infrastructure and information systems, as healthcare, social sphere, education, all use different information systems, and information exchange and communication between different areas is complicated. As resources are scarce, then more input should be going to develop and implement more advanced technical solutions, to make the system faster and more efficient, and consequently use less manpower.

One, in what experts were in same opinion, is lack of resources, which was intensified and became more visible during Covid-19 pandemic. However, there have been some big changes recently in the mental health field and some of these barriers have been addressed more. Also, funding has been more targeted and increased mental health focus has established more funding for mental health services. However, big challenge in healthcare funding in mental health sector remains, as all the health areas are competing for the same state budget. Mental health transformation can be achieved with strong political desire and dedication, whereas new policies, reallocation of scarce resources, and new partnerships in between new stakeholders can be helpful to overcome the barriers [2]. Funding and attention are also needed in the area of promotion and preventive activities to increase the amount and availability of services with lower intensity for milder problems and earlier intervention as recommended by the WHO mental health pyramid [38].

Effective mental health promotion and prevention is cost-effective and can prevent the onset and strain of mental health conditions in society [2]. Also, EMHS has stated that mental health problems prevention is cheaper and more effective than dealing with consequences [10]. But like the general process, also funding is quite fragmented and more systematic approach to plan resources and cross-sector cooperation is needed to plan better and allocate funding more efficiently.

Additionally, digital resources were outlined as a training alternative to help to reduce the lack of workforce, for prevention and early interventions. The topic of digital resources will be discussed in detail in section 6.3.

To summarize, stigmas, attitudes and poor mental health literacy are the main barriers for reaching adequate mental health support. Parental mental health awareness is one of the key elements, so they could participate more in their children's daily lives and notice, whether there are any mental health concerns. As the study showed that additional concerns to address are related to general awareness and stigmas as well as lack of resources which indicate the complexity and areas of improvement to tackle the problem.

6.3 DHT for mental health services

Previous studies have demonstrated the advantages of digital technologies [16] [17] [25], and this study was in agreement with those results. The advantages of mental health applications include personalisation, privacy, cost-effectiveness, and the opportunity to use these anytime and anywhere, with the ability to defeat barriers for seeking help [16], as well as customized content, immediate support, efficiency and equity of mental health resources [17]. However, there are also risks related to digital technologies including safety and data protection, evaluation obstacles [2], and the implementation can cause further inequalities [43].

Considering the implementation, digital solutions use is person-specific, and the usage depends also on digital literacy and the availability and preference of technology. A person's needs and preferences change over time, and this would have to be considered, when delivering PCC by using most appropriate resources available. As such, virtual platforms have significant prospective in promoting and providing information regarding PCC, as well as person-driven care [51].

However, the study brings out that there is big competition in the field, as there are lots of digital solutions available in-English and all of these are competing with the ones we have in Estonia. However, in Estonia, there are not too many solutions in Estonian language, and when it comes down to cultural and language environment, it is unknown whether foreign solutions are culturally adaptable in Estonia.

One of the obstacles identified in this study is related to the evaluation of digital technologies as also indicated in the previous research [67] [69]. This study raises questions about digital solutions implementation for mental health support, and the

question raises about their safety, effectiveness and whether these technologies have been evaluated, and these are evidence-based solutions. It is argued that the evaluation could be quite complicated, especially for digital tools, which are designed for prevention. There must be an evaluation system, to assess solutions evidence, safety, and its benefits. There is a remarkable volume of apps available with no available clinically validated evidence base [17], mainly because scientific research RCT process can't keep up along with the speed of the latest developments of mental health apps [16] [66]. Because of DTx agile development processes, and capacity to deliver real-time results, new standards and regulations should be determined, which reflect the characteristic traits of DTx [67], as an alternative to review high quality comparative real-world data as a research standard. Therefore, it may be proposed that the evaluation standards should take the agility of the mobile health applications into account, and as an alternative to review high quality comparative real-world data as a research standard as also recently proposed [67] [69].

The findings from this study reveal that there are several national and privately owned digital solutions available but often those are not so widely used. Derived from the WHO recommendations [38], it is necessary to support the implementation of solutions that assist self-care of mental health, which eventually leads to empowered people and closer to the strategic goal to provide PCC [13]. In order to increase the trust towards suitable DHTs in tackling the issues of implementation, it was proposed to create a marketplace or an app library of evidence-based and recommended applications. However, as it was hypothesized, the implementation rate of DHTs would be much higher and thus, it is an additional area that requires further development by different stakeholders and probably led by the Estonian Health Insurance Fund to develop systemic approach, specifically in establishing a framework for nurturing such applications.

While a marketplace could potentially advance the field, innovative digital intervention implementation barriers in schools are broader and involve the technology, the adopter system, and the organization [39]. The Ministry of Education and Research has facilitated the deployment of safe solutions by recommending them through their own channels. Nevertheless, these solutions remain to be underused in the school environment. This study brings out user's precaution in some topics and funding limitations, as school funding models are inflexible and unable to recognize what is

efficient in terms of mental health digital interventions. In parallel, schools' information how being online is impairing one's learning and mental health is being equally spread.

The study shows that interdisciplinary cooperation and coordination as well as the responsibility over mental health management is complex, as there are various parties involved. Thus, it is complicated to deliver digital innovation for mental health support, as homogeneous understanding regarding coordination and systemic approach are lacking but the indication for the need from the state side to set directions is present. At the state level, cross-sectoral cooperation governance has brought various ministries around the same table. Yet, continuous argumentation who should be responsible and coordinating mental health field is ongoing as different areas, e.g., promotion, prevention and treatment are managed by different institutions. Leadership is the remaining question as all the other stakeholders should be ready for this kind of management and coordination. Therefore, a consensus on the highest levels is needed to unify the understanding between experts in the area. The key is to decide who is the most suitable organisation to have the authority and power for successful leadership. One of the alternatives is to have the State Office responsible body, as it would raise the control over mental health topic above ministry and it is separate from coordinating institution. In addition, clear understanding about the roles and functions between different stakeholders this contributes to the achievement of the national strategic goals of PCC in terms of "the restructuring of the service models, and cooperation and coordination within and between the sectors" [13].

In terms of the potential of digital technologies the findings support that there is a potential, even unlimited potential regarding children and adolescents. Children are using digital solutions and technology as a natural part of their daily life [59], which supports the findings of this study regarding the need and suitability of digital solutions in children's mental health support. In addition, digital solutions represent the characteristic channel to this target group and thereby, allow the implementation of PCC [52]. In addition to general discussion, also the example of a mobile health game Triumfland Saga was used as an example of the evidence-based digital solution. The findings outlined that there is a potential to use this as a prevention tool, not entire intervention, and there is still a need for human interaction. However, Triumfland Saga may be beneficial for children, and integrated in the learning in supporting the

development of child's social-emotional competencies. Similarly, to the discussion above, the solution itself follows the preferences of the target group making intervention more engaging and acceptable for children. Thereby, it in addition to the scientific theoretical foundation of the tool, it contributes to the implementation of PCC [12] [46], but also the national strategic goal to secure the availability and funding for innovative DHTs [13].

In order to reach the potential and deliver digital solutions widespread, there is a need to have a clear value proposition, and strategies for marketing. Whereas, for the widespread and effective implementation of solutions, the user adherence is one of the most important factors. The latter is relevant also from the PCC point of view as it allows to consider user preferences [12] [46] and thereby, increase adherence to self-care of mental health.

To conclude, the potential to use digital solutions in supporting children's mental health is huge, however there are also structural barriers which need to be removed, so these evidence-based solutions could reach their full potential. In addition, the implementation process for mental health services and support needs a clear responsibility and leadership to create systematic understanding and cross-sectoral cooperation which has the potential to lead to the success in systematic management of children mental health services and support.

6.4 Main contribution to the core audience

The study contributes by offering more a comprehensive overview on how mental health is supported in children and what are these underlining systemic barriers and how digital solutions have been implemented for mental health support in children in Estonia. Also, how digital solutions have been implemented for mental health support in children. As there have been no previous studies into understanding how we are using digital technologies are implemented systematically to support children's mental health, the current study findings offer the initiative to clarify this area. Triumfland Saga evidence-based game is one of the examples, how potentially mental health prevention could be delivered through digital solutions.

The novel contribution of this research is related to the contextualization in terms of PCC [12] [51] [54], which is a healthcare goal globally and thus the understanding of current strengths and areas of improvements of Estonia as a digitalized country may have benefits also internationally in explaining what to consider when aiming for PCC implementation in the area of children's mental health.

6.5 Study limitations

This study had some limitations to address. The sample group of the study represents experts from stakeholders' group. These experts were digitally more advanced and with the greater mental health literacy, than general public.

The sampling method was purposive sampling, which may cause the situation where some of the important stakeholders or most relevant experts might have left out.

As the aim of the interview was to explore experts' viewpoints and experiences to gather information in specific area of interest, the research method was semi-structured interview. The critique to this method is that the findings are not generalizable to any of the population groups. However, although only 8 participants were involved, data saturation among this sample was reached.

Yet, the author believes that regardless of these limitations, the overall benefit of the study results is valuable, and the research provides important understandings about the topic.

6.6 Future research

Future research should and could focus on different aspects outlined by this research. First, examining the potential of digital interventions implementation in educational institutions, with the focus on the educational institution organizational culture, to detect the barriers regarding the resistance of digital solutions in the education system.

Second, to examine the digital interventions evaluation framework and principles, to see if they are corresponding to the agile process of digital technologies development, and whether real-time data could be used instead of traditional controlled clinical trials.

Third area for future research, could be the framework for digital solutions marketplace, where evidence-based digital solutions could appear. As digital applications library could possibly increase the uptake of evidence-based digital solutions, the background system and standards need to be analysed.

6.7 Final conclusions

Based on the findings of the present study the following conclusions can be drawn.

1. Mental health services for children are insufficient. There is a severe gap between the need for support and the number of mental health experts trained to prevent or manage those conditions. The state system hasn't met the demand of the changing needs. There is a lack of interventions for the diverse target groups. Some of them are uncovered.

2. The person-centred approach is insufficient, even though it is one of the goals in the strategy documents. Treatment continuum and pathways are fragmented, and systematic approach is missing leading to the lack of adequate and timely help.

3. For mental health services sustainability there is a need for an effectively functioning mental health services system, which is sufficiently equipped and funded in all levels, to be able to offer low intensity to high intensity services, through the system.

4. Stigmas, attitudes and poor mental health literacy are the main barriers for reaching adequate mental health support. Mental health literacy among general society, educational institutions and parents is one of the key elements, hence more targeted approach to raise awareness is needed on different levels.

5. There is no uniform understanding who should be coordinating DHT implementation and take the responsibility, which makes introducing changes complicated.

6. Digital resources have many benefits and huge potential; however, wider implementation is inhibited due to there is no pathway how to realize them. The app library or marketplace for evidence-based apps could increase their implementation rate.

7 Summary

The aim of this thesis was to describe the current system of the organization of mental health services in Estonia and to identify barriers in the process of implementation of digital health technologies for mental health promotion and prevention in children. The author of this thesis conducted semi-structured interviews with the experts from mental health stakeholders' group to get valuable insights of current mental health services process and possible obstacles.

Firstly, the experts were interviewed to gather insightful knowledge regarding the current situation and process of children's mental health services. Most experts agreed that mental health services are insufficient for children, and there is no systematic approach. Pathways are fragmented, and resources are lacking.

Secondly, systematic obstacles were identified, which hinder effective mental health services provision. The main barriers for reaching adequate mental health support were stigmas, attitudes and poor mental health literacy. Digital technologies could be used to overcome some of the barriers, e.g., stigmas, and deliver mental health training widespread.

Thirdly, digital health technologies implementation and potential were explored. As there is no systematic coordination and responsible authority in this area, it is complicated to make changes in this field. Digital solutions have great potential, however there is no state support, to help these to reach in their full potential.

In conclusion, a systematic approach is needed to deliver holistically person-centred mental health services for children. More low-intensity services are needed, as well as interventions for all target groups. Mental health awareness needs to be increased from parental level to whole society, including institutional awareness. Digital interventions have a great potential to be used for mental health support, however there is no national pathway, framework or online environment, which are inhibiting factors for digital solutions wider implementation.

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Appendix 2 –Informed consent for experts

Dear participant!

Thank you for agreeing to take part in this study, the aim of which is to identify the main structural obstacles in the implementation of digital solutions for children's well-being and mental health support.

During this study expert interviews would be carried out, which should enable the representatives of the stakeholder group to express their views, on how children's well-being and mental health support systems are organized today in Estonia. Which are the positive aspects and in which areas there is room for improvement. The data gathered by expert interviews will be used for the digital health master's thesis at the Tallinn University of Technology. Participation in the study is voluntary. Verbal consent can be given prior to starting the interview. You have the right to withdraw your consent at any time, however, the data gathered till leaving the study will be used in analyses.

Individual semi-structured interviews will take place during the period February 2023 – March 2023 via Microsoft Teams. The interview will last around 1 hour, depending on your answers' extent. Both video and sound of the interview in Microsoft Teams will be recorded in the TalTech OneDrive cloud server, which is password protected and accessed only by the author of the study and her supervisors. All recordings will be transcribed verbatim. Videos will be stored until the end of the transcription process and deleted from the TalTech OneDrive cloud server after that. Recorded files would be transcribed with the web-based speech recognition technology (http://bark.phon.ioc.ee/webtrans/), which is developed by the TalTech Cybernetics department.

The transcribed files would be stored in the TalTech OneDrive cloud server. The transcribed full texts of the interviews will be stored in the TalTech OneDrive cloud server for 5 years, after which these will be deleted. This is being done to allow for the publication of results. For further research, if necessary, raw analysis of impersonalized files would be used, which will be stored in the TalTech OneDrive Cloud server for an indefinite period.

Data gathered from the interviews would be analyzed and all results will be presented in a generalized and impersonalized manner both in the master's thesis and in future publications. Full interview texts won't be used in the results, only thematic quotes from your interview would be used. Data will not be relayed to third counterparts.

For any further questions, please contact Ave Hewitt via email avhewi@ttu.ee

Appendix 3 – Interview plan

Topic	Question	Extension	Time
Background info and children's mental health current situation	What is your occupation? How long have you been working in this field?	What is your biggest achievement in this field? What is your biggest challenge in this field?	20 min
	If you think about children's mental health support, then how would you describe the current situation?	How in your opinion are current processes and solutions functioning? What is your evaluation of the current situation? Why this kind of evaluation?	
	In your opinion, how is children's mental health promotion and prevention organized today?	Is this kind of arrangement optimal? Why this kind of evaluation? Has any stakeholder group been left out? How ideally should children's mental health promotion and prevention work? Who should be leading this? What are we missing from the ideal?	
Service availability and sustainability	In your opinion, how did the COVID-19 crises impact children's mental health services?	Why this kind of evaluation? In your opinion, how could children's mental health services be organized better? Improve availability?	20 min
	What is your vision of children's mental health services sustainability?	Which resources could be used to reach the goal? In your opinion, how could interdisciplinary specialists work together, the way that it is really going to work? What is your opinion on private sector inclusion for innovative solutions development and implementation in this area?	

		In your opinion, where could we be in 1 year/5 years' time?	
Digital technologies	Please tell us what the current situation is, how we are implementing digital technologies for children's mental health support.	How in the ideal world should children's mental health support happen with digital technologies? What are we missing from the ideal?	20 min
	Who in your opinion is coordinating the development in this area?	Who ideally, in your opinion should be coordinating this field and taking responsibility?	
	When are you thinking about digital technologies in this area then which ones will come into your mind first?	What is their potential for supporting children?	
	Have you heard about Triumfland Saga (https://www.triumf.health/download-saga https://www.youtube.com/watch?v=Ac1T2kJQ368)	After you have seen this Triumf game, then what impression have you got? What mark would you give from 1-10, whereas 1 is the worst and 10 is the best mark? Why this mark? Is something missing? Did you know that Triumfland Saga game is evidence-based and created by psychologists and other experts in co-production? Would you recommend this game to your child?	