



DET PSYKOLOGISKE FAKULTET



*The Needs and Experiences of Adolescents With ADHD Related to
a Digital Intervention: A Qualitative Exploratory Study*

HOVEDOPPGAVE

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Veileder:

Tine Nordgreen

Forord

Våren 2023 fikk vi mulighet til å intervju ungdommer med ADHD angående deres behov og erfaringer relatert til en digital intervensjon som skal utvikles for denne målgruppen. Tusen takk for at dere ønsket å dele perspektiver og innspill med oss.

Vi ønsker å rette en stor takk til Tine Nordgreen for god, tydelig og strukturert veiledning og faglig engasjement gjennom dette prosjektet. Vi vil også takke Maren Helene Rinke Storetvedt for nyttige innspill og oppfølging underveis. Vi ønsker dere lykke til videre med prosjektet.

Avslutningsvis vil vi rette en varm takk til våre studievenner, familie og partnere for støtte gjennom hele denne prosessen. Til sist vil vi takke hverandre for godt samarbeid og vennskap, som har gjort dette til en fin siste reise som psykologstudenter.

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Karin Berg & Ingeborg Alvheim Sundfjord

Sammendrag

Formål: Det foreligger et behov for å utvikle skalerbare og tilgjengelige intervensjoner for ungdommer med ADHD. Digitale intervensjoner kan være et lovende format for å øke tilgangen til evidensbasert psykologisk behandling for denne gruppen. Implementeringen av en digital intervensjon krever innspill fra målgruppen. Få studier har imidlertid tatt brukerbehovene i betraktning. Denne studien har som formål å utforske behovene og erfaringene til ungdommer med ADHD relatert til en digital intervensjon for denne målgruppen. Funnene vil bidra til utviklingen av en brukersentrert digital psykisk helseintervensjon ledet av et større forskningsprosjekt ved Haukeland Universitetssykehus.

Metode: Kvalitative intervjuer ble gjennomført med åtte ungdommer med ADHD. Refleksiv tematisk analyse ble brukt for å identifisere, tolke og rapportere mønstre fra de kvalitative intervjuene. **Resultater:** Fem hovedtemaer ble generert: *et økt behov for innsikt og aksept, en balanse mellom å motta hjelp og være selvstendig, håndtere energitopper og -daler, potensielle barrierer for behandling og forestilling av en ideell app.* **Konklusjon:** Studien understreker betydningen av å gi informasjon, fasilitere for interaksjon, fremme autonomi, ta i bruk fysisk aktivitet, samt tilrettelegge for etterlevelse i intervensjonen. Funnene diskuteres i lys av selvbestemmelsesteorien, Eriksons psykososiale teori og retningslinjer for behandling av ADHD. Implikasjoner av funnene blir fremhevet.

Abstract

Objective: There is a need to develop scalable and accessible interventions for adolescents with ADHD. Digital interventions may be a promising format for increasing access to evidence-based psychological treatment for this group. Implementation of a digital intervention require input from the target group. However, few studies have taken the user needs into account. This study aims to explore the needs and experiences of adolescents with ADHD related to a digital intervention for this target group. The study will contribute to the development of a user-centred digital mental health intervention led by a larger research project at Haukeland University Hospital. **Methods:** Qualitative interviews were conducted with eight adolescents with ADHD. Reflexive thematic analysis was used to identify, interpret and report patterns from the qualitative interviews. **Results:** Five main themes were generated: *a need for increased insight and acceptance, a balance between receiving help and being independent, managing energy highs and lows, potential barriers to treatment, and envisioning an ideal app.* **Conclusion:** The study highlights the importance of providing information, facilitating interaction, promoting autonomy, utilizing physical activity, as well as facilitating adherence in the intervention. The findings are discussed in light of self-determination theory, Erikson's psychosocial theory and guidelines for treatment for ADHD. Implications of the findings are highlighted.

Keywords: ADHD, Adolescents, Digital mental health intervention, Exploratory interviews, Qualitative Research

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The Needs and Experiences of Adolescents With ADHD Related to a Digital Intervention: A Qualitative Exploratory Study

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common mental health disorders among children and adolescents, affecting five to eight percent of the young population (World Health Organization [WHO], 2019). The core symptoms of ADHD are difficulties with inattention, impulsivity, and hyperactivity (American Psychiatric Association [APA], 2013). The diagnosis is also characterised by executive dysfunction, which involves difficulties with self-organization, goal-directed actions, self-regulation, inhibition, working memory, and regulation of emotions (Barkley, 2012). Related secondary difficulties include impairments in execution of daily tasks and learning ability, and challenges regarding education (Lefler et al., 2016; Watters et al., 2018; Michielsen et al., 2018). Furthermore, ADHD can affect self-esteem and self-efficacy, which may lead to social withdrawal, isolation, and impaired psychosocial functioning (Matsuura et al., 2009). ADHD is also associated with an increased risk of comorbid conditions, such as conduct and personality disorders, substance misuse, and depression and anxiety disorders (Biederman et al., 2006; Pliszka, 2003). The lifetime consequences and costs of ADHD are large for children and adolescents' development, their families, and society at large (Harpin, 2005). In recent years, an increase in ADHD diagnoses among children and adolescents have been reported (Collishaw, 2015). This stresses the importance of understanding the needs of adolescents with ADHD and developing accessible and scalable interventions to support this target group.

ADHD During Adolescence

The symptomatology of ADHD changes during adolescence (De Rossi et al., 2023; Wolraich et al., 2005; Ingram et al., 1999). Adolescence is a developmental period that constitutes of many interpersonal and intrapersonal changes and challenges (Zarrett & Eccles, 2006). One major change in this period between puberty and adulthood is changes in the

frontal part of the brain, which is responsible for self-control, emotional regulation, planning, judgement, and organization (Begley, 2000). An important part of this life stage is to manage the biological and cognitive changes in adolescence and their impact on behaviour, emotion, and social relationships (Zarrett & Eccles, 2006). Furthermore, this period includes the desire to individuate from parents, more time spent away from home, increased involvement with peers, and other life activities that can be challenging for adolescents to navigate (Hunt & Guindon, 2010; Wehmeier et al., 2010). These changes can often be stressful, and the way adolescents cope with the changes and challenges can affect their well-being (Zarrett & Eccles, 2006).

Erikson (1968) highlights adolescence as an important stage of life in his theory of psychosocial development. According to Erikson, individuals move through several stages of development that guides how they react to the surrounding world (Erikson, 1968). One of these stages takes place in adolescence and involves the development of a stable identity. Childhood identifications are replaced by new identity configurations and the balance between dependence of important others and independence is especially prominent. The formation of identity also includes self-image (Erikson, 1968). Identity and self-image are developed through interactions and relations with other people (Hollway, 2010) and aspects of sameness and uniqueness are important in this formation period (Erikson, 1968). Adolescents have questions regarding who they are, who they want to be, and where they fit into society (Erikson, 1968).

The challenges in adolescence can lead to changes and deterioration of ADHD symptoms. The core symptom, hyperactivity, often becomes a more internalized feeling of restlessness and a need to be occupied (Wehmeier et al., 2010). Moreover, global functioning, adaptive skills, emotional dysregulations, social problems, and somatic complaints worsen in adolescence (De Rossi et al., 2023). Additionally, prescriptions for ADHD medication

strongly increase during the teenage years (Lillemoen et al., 2012). As adolescents with ADHD experience great changes in identity formation and their adjustment and functioning often worsen, interventions for this age group should be prioritized.

Motivational Deficits

There is increasing evidence that motivational abnormalities play a role in ADHD (Haenlein & Caul, 1987). For instance, research on the neural basis of motivational deficits indicate that dysfunctions in the dopamine pathways is present among individuals with ADHD (Silvetti et al., 2013). Difficulties associated with having ADHD, such as difficulties completing tasks, have progressively been understood as a dysfunction in motivation, not solely as deficits in executive functioning (Volkow et al., 2010). Motivational difficulties are more prominent in tasks that are monotonous and require effort, and less prominent in new, interesting, and rewarding tasks (Raggi & Chronis, 2006). This may explain why deficits in motivation have been shown to negatively affect academic performance and school functioning for adolescents with ADHD (Smith & Langberg, 2018). Due to the motivational difficulties, reward systems are frequently used to motivate adolescents with ADHD in school settings (Young & Amarasinghe, 2010), and they often need more incentives compared to adolescents without ADHD (Luman et al., 2005; Gaastra, 2020).

Even though adolescents with ADHD often experience difficulties focusing on school tasks, parents report that their children can spend numerous hours on hobbies, such as video games (Volkow et al., 2010). This is often seen as lack of effort and laziness (Volkow et al., 2010), reinforcing negative attitudes and stigma surrounding ADHD (Mueller et al., 2012). It is likely that including motivational deficit as a core symptom of ADHD, can better explain the adolescents' challenges in school settings and reduce stereotypes (Volkow et al., 2010). Additionally, it can impact how we understand the needs and experiences of adolescents with ADHD.

Treatment Guidelines

Treatment guidelines for ADHD recommends a multimodal treatment approach (National Institute for Health and Care Excellence [NICE], 2018; Pliszka & AACAP Work Group on Quality Issues, 2007; Taylor et al., 2004). According to the NICE (2018) guidelines, treatment for ADHD should consider pharmacological, psychological, behavioural, and educational needs of the patient and his/her family. In the national guidelines in Norway, recommended treatment alternatives for ADHD are pharmacotherapy, psychoeducation, cognitive behavioural therapy, social training, neurofeedback, and nutritional considerations (The Norwegian Directorate of Health, 2016).

Pharmacotherapy

The first line treatment for ADHD is pharmacotherapy (Connor, 2006; Dodson, 2005; Prince et al., 2006) and it has been shown to be the single most effective treatment element for ADHD (Catalá-López et al., 2017). ADHD medications affect the individual by increasing dopamine levels in the brain and subsequently improve attention span (Volkow et al., 2012; Hanwella et al., 2011). The prevalence of medication use for ADHD has increased in recent years (Burcu et al., 2016). This increase has been displayed across all age groups and has been seen in several countries (Burcu et al., 2016; Dalsgaard et al., 2013; Visser et al., 2014). In the United States, an estimated 62 percent of children currently use ADHD medication (Danielson et al., 2018). Patients treated with ADHD medication in Norway doubled in the period between 2004 and 2007, and according to Norwegian Prescription Database this trend continued from 2009 to 2011 (Lillemoen et al., 2012).

Although pharmacotherapy alone may improve core symptoms, it can be insufficient in treating ADHD for adolescents (Sibley et al., 2014). Pharmacotherapy does not necessarily lead to normalization or improvements in domains of daily functioning (Ramsay, 2010). Furthermore, many individuals with ADHD show intolerance to medication, lack of response,

or residual impairments (Spencer et al., 2000). Several children discontinue medication within the first year of treatment, often due to inadequate effectiveness (Toomey et al., 2012), and psychological side effects, such as headache, loss of appetite, insomnia, and anxiety (Graham & Coghill, 2008). Treatment alternatives in form of non-pharmacological options are therefore increasingly requested (Solberg et al., 2019; Vidal et al., 2013).

Non-Pharmacological Treatment

Although the management of ADHD symptoms have mainly been pharmacological, non-pharmacological interventions are also effective (Catalá-López et al., 2017). For instance, psychosocial treatments for adolescents with ADHD are more strongly related to improvements in academic and organizational skills, compared to pharmacological treatment (Chan et al., 2016). Non-pharmacological treatments are often separated into psychological and education oriented interventions (Serrano-Troncoso et al., 2013).

Several approaches of psychological treatments exist; cognitive behavioural therapy (CBT), behavioural therapy, parent training, cognitive therapy, and social skills training (Serrano-Troncoso et al., 2013). The majority of psychological interventions for ADHD are based on principles of CBT. The aim is to target functional impairment by providing compensatory strategies and skills for deficient attention, executive functioning, impulse control, and emotion regulation to help people with ADHD to cope with their daily lives (Solberg et al., 2019; Weiss et al., 2008). In behavioural therapy, the child is encouraged to change certain practices in their behaviour and improve hyperactivity, impulsivity, and inattention, by using rewards and positive reinforcement (NICE, 2009). Parent training is a treatment programme that involves teaching the parents about ADHD and techniques from behavioural therapy to improve the communication and relationship between the parent and child, as ADHD often is associated with more conflictive relationships and higher stress levels in the family (Serrano-Troncoso et al., 2013; Deault, 2009). The aim of cognitive

therapy is to help the child develop more adaptive and planned ways of thinking and behaving, by identifying and replacing maladaptive cognitions that have a negative impact on their behaviour and emotions (NICE, 2009). Social skills training involves helping the child develop behaviours and abilities to create positive social relationships. It utilises techniques from cognitive behavioural therapy (De Boo & Prins, 2007).

Education oriented interventions involves practices within the school through academic interventions and teacher training (Serrano-Troncoso et al., 2013). Academic interventions aim to improve school functioning and performance by having specific teaching sessions and adaptations of tasks, expectations, school materials, and the physical environment in line with the child's characteristics (Young & Amarasinghe, 2010). In similarity with parent training, teacher training involves providing teachers knowledge about ADHD and techniques from behavioural therapy that can be put into practice in the classroom, such as establishing constructive rules, time out, and positive reinforcement (Young & Amarasinghe, 2010).

Despite the potential for non-pharmacological treatment to be effective in improving daily functioning for adolescents with ADHD (Ramsay, 2010), there are some limitations. Non-pharmacological treatment is often not available due to limited resources, and lack of knowledge and qualified trained mental health therapists (Weiss et al., 2008; Kohn et al., 2004). Furthermore, few seek out treatment (Kohn et al., 2004). This is likely related to several factors, such as geographical distance and stigma associated with mental health treatment (Kohn et al., 2004).

Overall, a combination of pharmacotherapy and non-pharmacological treatment has been shown to be more effective than pharmacotherapy alone (Catalá-López et al., 2017). Moreover, it has been reported higher satisfaction of treatment among patients who received non-pharmacological treatments in addition to pharmacotherapy (Solberg et al., 2019).

However, few are offered multimodal treatment in routine clinical practice (Vidal et al., 2013). This may indicate a need for scalable and accessible non-pharmacological interventions that can serve as an addition to face-to-face treatment, and thereby providing multimodal treatment in accordance with the treatment guidelines.

Digital Interventions

Digital psychological interventions may help to overcome the problems regarding accessibility and lack of recourses. There is a potential for digital technology to improve mental healthcare, as online and mobile applications can offer greater accessibility to information, reaching more people, as well as being time- and cost-effective (Hollis et al., 2015, Catalá-López & Hutton, 2020). Digital interventions can be guided internet-delivered, with the support of a therapist, or self-guided, without therapist support (Titov et al., 2008). Self-guided interventions can help people manage daily life, by providing reminders and feedback, as well as give general information, support, and skill training via technology (Titov et al., 2014; Andersson & Titov, 2014). Digital interventions can also be provided through virtual reality for targeting cognitive rehabilitation for people with ADHD (Romero-Ayuso et al. 2021). As the transition into adulthood is an important period for implementing self-management skills (Lakes et al., 2022), digital interventions can be useful for adolescents. Given that many people frequently use digital self-management strategies, such as calendars and notifications, these tools could provide support for adolescents with ADHD without the associated stigma (Lakes et al., 2022).

The efficacy of digital interventions for mental health disorders has been demonstrated in several studies (Etzelmueller et al., 2020; Jakobsen et al., 2017; Nordgreen et al., 2019). Moreover, research on the efficacy of digital interventions for people with ADHD show promising results (Nordby et al., 2021; Lakes et al., 2022). In a self-guided internet-delivered intervention for adults with ADHD, the participants who completed the intervention

reported good credibility and satisfaction (Nordby et al., 2021). Results from a randomized controlled trial found that self-guided intervention for adults with ADHD reduced ADHD symptoms and increased quality of life (Kenter et al., 2023). A handful of digital interventions for youth with ADHD have evidence supporting their use (Myers et al., 2015; Kollins et al., 2020; Benzing & Schmidt, 2019), however the research is limited (Golberstein et al., 2020). Furthermore, few studies have addressed the needs of adolescents with ADHD (Lakes et al., 2022). The long-term implementation and ultimate success of digital interventions requires the input and perspectives of those who experience the conditions (Lakes et al., 2022). Valuable user perspectives of adolescents with ADHD should therefore be considered in research and the design of new digital interventions (Lakes et al., 2022).

Person-Based Approach

Person-based approach is an evidence-based framework for systematic involvement of user needs in the development of digital interventions (Yardley et al., 2015a; Yardley et al., 2015b). User involvement is attained through conducting qualitative research with users in the different phases of intervention development (Yardley et al., 2015b). These phases include planning, design, development and evaluation of acceptability and feasibility, and finally implementation and trials in a real-life context (Yardley et al., 2015b). The initial planning phase involves exploratory qualitative interviews, where the focus is on acquiring in-depth knowledge about the users' experiences, needs, and perspectives (Morrison et al., 2018; Yardley et al., 2015a). Results from this initial phase are used to further select intervention elements (Yardley et al., 2015b). Additionally, this phase involves creating logic models, which provides a detailed description of the goal, content, and mechanisms of change for the specific intervention (Yardley et al., 2015b).

The exploratory interviews also guide the development of guiding principles. These are principles that formulate needs, objectives, and design features of the intervention (Band

et al., 2017). The guiding principles can guide the goal of the intervention for adolescents with ADHD, as well as the steps involved to achieve the goal (Yardley et al., 2015b). For instance, making shortened text features and videos and including elements of gamification to support engagement and adherence for adolescents with ADHD. Generic to all interventions, common guiding principles are recommended (Yardley et al., 2015b). These are autonomy, competence, and relatedness proposed by self-determination theory (Ryan & Deci, 2000b). The theory describes a continuum of motivation. When the three basic needs; autonomy, relatedness and competence are fulfilled, this results in the facilitation of intrinsic motivation (Ryan & Deci, 2000b). Ryan and Deci (2000a) defines intrinsic motivation as “doing of an activity for its inherent satisfaction rather than for some separable consequence” (pp 56). Autonomy refers to the feeling of being in control of one’s own behaviours and goals, as well as the sense that actions emanate from oneself rather than from external pressure (Ryan & Deci, 2000b). Relatedness involves the feeling of belonging and connecting with others. Competence refers to the feeling of mastery, by being able to achieve one’s tasks and goals (Ryan & Deci, 2000b). In addition to being the basis for the development of interventions, self-determination theory has also been proposed as a motivational framework for understanding how motivation plays a role in ADHD (Morsink et al., 2022). This framework can influence how we understand the adolescents’ needs and experiences, and the way treatment guidelines and interventions are developed.

Objective

The objective of this study was to qualitatively explore the needs and experiences of adolescents with ADHD related to a digital intervention for this target group. By gaining insight into the adolescents’ needs and experiences, this study will contribute to the development of a user-centred digital mental health intervention led by a larger research project at Haukeland University Hospital, called UngMeistring.

Methods

Study Setting

This qualitative study was situated in Bergen, the second largest city in Norway. The study is a part of a larger research project conducted at Haukeland University Hospital. The research project is called UngMeistring, and started 01 April 2022. It is funded by the Norwegian Research Council and cooperates with nine research partners: DigiUng (Directorate of Health), Stavanger University Hospital, University Hospital of North Norway, Norwegian Hospital Procurement Trust, Helse Vest IKT, University of Bergen, The Municipal of Bømlo, Youwell, SkillUp, and Attensi (Forskningscenter for Digitale Psykiske Helsetjenester [Forhelse], n.d.). The aim of the UngMeistring project is to develop and evaluate eight online and game-based self-help and treatment programmes for young people. One of the digital treatment programmes will be directed at adolescents that struggles with ADHD (Forhelse, n.d.).

The ADHD project in UngMeistring includes four main steps: understanding the user needs, reviewing the research literature, developing the intervention, and evaluating the intervention (Forhelse, n.d.). The present study is part of the first step, understand the user needs of adolescents with ADHD, led by PhD candidate Maren Helene Rinke Storetvedt and includes qualitative exploratory interviews conducted with adolescents diagnosed with ADHD.

Methodological Procedure

Adolescents living in Bergen and the surrounding area were recruited between November 2022 and January 2023 (see flowchart: appendix A). QR code poster (see appendix B) with additional information about the study were made and distributed on social media and other suitable recruitment sites, such as Child and Adolescent Psychiatric Out-patient Clinic (BUP), Haukeland University Hospital, and Health Centers. Most of the

adolescents were recruited from Facebook and Instagram, and some heard about the study from friends and family. Few were recruited from posters and information at BUP or other recruitment sites.

Inclusion and Exclusion

Interested adolescents visited the website and answered online screening questions. The following criteria for inclusion and exclusion were: 1) the adolescents needed to be diagnosed with ADHD by a health professional, 2) they had to be between the ages of 13 to 16, 3) since the digital intervention initially will be developed in Norwegian, adolescents with insufficient language capabilities were excluded, 4) the adolescents included had to follow age-appropriate school progression, 5) they had to meet in-person for an interview in Bergen, and 6) adolescents diagnosed with comorbid autism spectrum disorder or 7) in treatment for other mental health diagnoses were excluded.

The adolescents who met the inclusion criteria and left their contact information was contacted by telephone for further screening and confirmation of inclusion. The adolescents over the age of 16, and parents of adolescents under 16 years, signed an informed consent digitally. The complete sample of participants who were invited and attended an interview was 16. The participants met for an in-person interview at Haukeland University Hospital. Participants could be accompanied by parents if needed.

From this sample, a subsample of eight participants were selected for this study based on practical considerations, such as the interviewer's availability.

Interviews

Interview Procedure

Face-to-face interviews were conducted between 02 January to 11 January 2023 at Haukeland University Hospital in Bergen. The authors conducted three interviews each, while two of the interviews were led by PhD candidate Storetvedt. The average length of the

interviews was 45 minutes (range from 33 minutes to 58 minutes), and all interviews were audio-recorded. The eight interviews were transcribed by both authors in a slightly modified verbatim mode based on Malteruds' guidelines for transcriptions (Malterud, 2001).

Interview Guide

The aim of the interview guide (see appendix C) was to explore adolescents with ADHD's needs and experiences regarding the development of a digital mental health intervention for this target group. We used a semi-structured interview guide, which primarily consisted of open-ended questions. Additionally, the adolescents were asked to give feedback on concrete examples of digital treatment. The interview guide was flexible, and alterations were made throughout the interview process, given the exploratory nature of the study.

Analytic Approach

Data were analysed using reflexive thematic analysis, which is a suitable approach for qualitatively exploring the needs and experiences of adolescents with ADHD related to a digital intervention. We used reflexive thematic analysis, as this is an easily accessible and theoretically flexible approach that facilitates identification and interpretation of patterns across a qualitative dataset (Braun & Clarke, 2022). Reflexivity is an essential part of all qualitative research, and reflexive thematic analysis particularly highlights this aspect (Dodgson, 2019). In reflexive thematic analysis, the researcher's subjectivity is a tool and an integral element of the analytic process, rather than something to remove or minimize (Braun & Clarke, 2022). This implies that we as researchers reflected on how our pre-existing knowledge, experiences, and social position influenced our interpretations and insights to the qualitative dataset. For this reason, reflective writing was an essential part throughout the analytic process (Braun & Clarke, 2022).

The analytic approach was situated in a relativist-constructionist framework, which considers that there is no objective reality to be extracted from the data, because reality is a

manifestation of individuals and societies sense making (Braun & Clarke, 2022). In the reflexive approach, there is a distinction between different orientations to the data: inductive and deductive. When analysing the dataset, an inductive approach was utilised, to generate a bottom-up based data analysis, rather than using a deductive approach to explore theoretical ideas. This allowed us to explore topics that appeared beyond the research question.

Furthermore, there is a polarity between different focus of meaning when using a reflexive thematic approach: semantic and latent. In our analysis, a semantic focus of meaning was emphasised, to explore the dataset overtly and explicitly, rather than latently seeking to find an implicit and underlying meaning. In the relativist-constructionist framework, Braun and Clarke (2022) note that there is a tendency to use a deductive and latent focus of meaning. However, there are no definite rules in relation to this, and the different domains are non-dichotomous and will often overlap in the analytic process (Braun & Clarke, 2022).

In the analytic approach of thematic reflexive analysis, Braun and Clarke (2022) proposes six phases: data familiarization; systematic coding; generating initial themes; developing and reviewing themes; refining, defining, and naming final themes; and writing the report. Still, our analytical process was non-linear as stages were revisited. In the following, the six phases in the analytic approach will be described:

1) Data familiarization: This involves immersing oneself in the data to understand the content and begin searching for meaning and patterns (Braun & Clarke, 2022). In order to become familiarized with the data, we read and reread all transcripts, and listened to the audio recordings while taking notes on initial impressions.

2) Systematic coding: This phase includes generating initial codes to organize the dataset (Braun & Clarke, 2022). We individually coded the first two interviews, giving equal attention to each data item. NVivo was utilised for coding and organizing the data to facilitate the analytical process. We met to discuss and compare initial codes from the two interviews

to ensure we had a shared judgement of the coding process and corresponding levels of coding. We made sure that the coding categories were close enough to what the adolescents said, while sufficiently abstracting the statements to group together what was seen as related. All remaining interviews were then coded separately to capture the range and essence in the data. The authors and the PhD candidate in the research project subsequently discussed the codes. A second round of systematic coding took place to capture evolutions in our codes and coding labels and to give a fresh perspective on the dataset. While coding the interviews, we moved back and forth between interviews, taking notes alongside the coding process.

3) Generating initial themes: This phase involves categorisation of codes into themes, as well as searching for meaning and connections between the codes (Braun & Clarke, 2022). The project group met to extensively discuss the codes, and collaboratively developed initial themes that were the most salient aspects of the adolescents' needs and experiences. Following the meeting, we separately abstracted codes to tentative themes, to ascertain whether we captured similar meanings and patterns in the dataset.

4) Developing and reviewing themes: This phase includes checking the coherent patterns of the dataset and reviewing the themes (Braun & Clarke, 2022). We used the initial themes to draw thematic maps to visualize the structure within and between the themes, always keeping the youth and study objective in mind.

5) Refining, defining and naming themes: This phase involves an ongoing refinement of the content and description of each individual theme. Additionally, it involves generating descriptive names for all themes (Braun & Clarke, 2022). Refinements and renaming of the themes were made several times before reaching a final thematic structure. Some of the refinements were discussed within the project group.

6) Writing the report: This is the final phase of reflexive thematic analysis, which includes writing, selecting appropriate extracts and discussion of the analysis (Braun &

Clarke, 2022). This phase was interwoven into our analytic process. Braun and Clarke (2022) state that separating the results and discussion can work poorly in thematic analysis, as there is often a strong connection between results, the interpretation of these, and their connection to the wider context. However, we chose to write the results and discussion in our report separately, as this is more common in the traditional scientific model. Additionally, it is beneficial because the implications of findings are more accessible for the reader and for the research project in the further development of a digital intervention (Braun & Clarke, 2022). Despite our effort to write the results and discussion separately, we note that these sections might not be distinguished completely.

Reflexivity

Reflexivity remained an important part of the research process by acknowledging our influence on the data collection and interpretation of the dataset (Braun & Clarke, 2022).

The two authors are trained psychology students at their final stage of their education. Through our education, we have acquired knowledge about ADHD that influences how we understand the diagnosis. Our pre-existing knowledge is not necessarily accordant to the adolescents' experiences with ADHD, and it can influence how we read and interpret the dataset. In our practice as psychology students, we have experiences with treating adolescents and adults with ADHD. Reflecting on these experiences, we acknowledge that our presumptions of the treatment of ADHD can shape our focus in the interviews.

The authors had different pre-understanding of digital treatment. One of the authors has a part-time position as a research assistant at the research centre for digital health services, Forhelse at Haukeland University Hospital. Through this, the author has gained positive experiences with the use of digital treatment, which can lead to a more positive attitude towards the current research project and a further desire for the project to succeed. The second author has less experience with digital treatment and offers a more critical

perspective going into the project. Overall, we used these experiences as a gateway to important reflections and discussions in the analytical process.

Ethics

The current study was approved by the Regional Committee for Medical Research Ethics in Western Norway (Number 520625). Advantages and disadvantages of the study were taken into account. For the individual, possible benefits can be that this study can serve as a gateway for the use of digital treatment, they benefit from the developed intervention, they experience that their insight and perspectives are valuable, and their voices are being heard in questions regarding their diagnosis and treatment. Benefits for the target group and society at large can be that research consider the experiences, knowledge and unmet needs of adolescents with ADHD, as well as making treatment more accessible and cost-effective.

We consider no remarkable risks or disadvantages of this study for the individual or society. However, we note that some might experience negative emotions by talking about their diagnosis to a stranger. We also note that the digital intervention is not to replace face-to-face treatment in health services, but rather serve as an addition. A possible disadvantage can be an excessive trust in technology that might result in the expectations of digital solutions exceeding the usefulness of the intervention.

We initiated measures to reduce risk and inconvenience. Information about the study was provided to all of the adolescents, and they were informed that the collected data were to be used in research reports and the further development of a digital mental health intervention for adolescents with ADHD. Confidentiality was ensured through protection and anonymization of personal identifiable information and secure storage of data. Pseudonyms will be used for the adolescents' quotes in this study to ensure anonymity. To minimize the disadvantages for the adolescents, we focused on creating a safe environment in the interview

setting and emphasised the adolescents' resources. Additionally, the adolescents had the opportunity to be accompanied by parents if they desired.

The adolescents signed a written informed consent to participate in research and received a gift card of NOK 300 for their contribution.

Results

Participants

The adolescents had a mean age of 14.4 years. There was an equal number of male and female adolescents included in the study, and we did not find a distinction between the genders in the interviews. Five of the adolescents were on medication for ADHD. One had previously used medication but stopped due to side effects. None of the adolescents had experiences with digital interventions. However, there was a widespread use of digital technology among the adolescents, e.g., mobile devices, computers, games, and extended reality. The use of this technology specifically tailored for ADHD was limited. Some adolescents described using mobile applications such as lists, reminders, alarms, and calendars in their lives to support daily activities. A few of the adolescents had experienced that games not intended for ADHD could be beneficial for their ADHD symptoms, such as having a calming effect and increasing concentration. All of the adolescents expressed a positive attitude towards a digital treatment for ADHD, making them a suitable target group for such an intervention.

Findings

The analysis resulted in the development of five primary themes: *1) a need for increased insight and acceptance 2) a balance between receiving help and being independent, 3) managing energy highs and lows, 4) potential barriers to treatment, and 5) envisioning an ideal app.* The themes and related subthemes are presented in the following section.

1. A Need for Increased Insight and Acceptance

The theme *a need for increased insight and acceptance* captures the adolescents' need for an increased sense of self and acceptance. This entails receiving information about ADHD, as well as relating and interacting with other peers with ADHD. Additionally, it involves learning more about themselves as adolescents, and the challenges that follow in this phase of life. This provides the following subthemes: a) *Me and my ADHD* and b) *Me as an adolescent*.

1.1 Me and my ADHD. The first subtheme pertained the adolescents' need for increased understanding and acceptance of their ADHD through information and interaction with others.

The adolescents expressed an experience of feeling different to others and feeling out of place. They talked about how ADHD influenced their relationships with other people, often feeling misunderstood and alienated. One of the adolescents, Jakob, desired that his classmates and teachers understood him better: "For example, energy level. That if I'm bouncing off the walls one day, then it's just because of who I am, for example."

Some of the adolescents had positive experiences of learning about ADHD symptoms on the social media platform Tiktok. Others pointed out that they found it interesting to learn fun facts about ADHD, such as Anna: "More than just the core symptoms ... I think it is fun with small things that you are actually not aware of. Like, 'Oh, that's why!' I think that is quite fun."

More specifically, it became evident that learning about feelings would be particularly useful, as all of the adolescents talked about having strong and fluctuating feelings. The adolescents struggled with having stronger feelings than their peers, and expressed how this negatively impacted their interactions with others and how they dealt with certain situations. One of the adolescents, Leah, described:

Perhaps that you can learn about different feelings, what is kind of normal ... Or how it is normal to react in different situations and how you maybe should deal with different situations if you get a feeling. And maybe how people with ADHD react a bit differently than others.

Many adolescents had already learned a lot about their diagnosis and had a positive attitude towards their ADHD. It was clear that receiving information about ADHD could lead to a greater acceptance for themselves. Viktor talked about this aspect: “And maybe if you feel very different just because you have ADHD, that you can read a bit about it and stuff and see that you can be a great human being regardless, I think.”

Furthermore, being able to see that other people share similar struggles can be an important part in gaining acceptance for oneself with ADHD. Jakob expressed the importance of relating to others with ADHD: “You recognize yourself in something in a way and feel like it isn’t just you that’s all ‘coo-coo in the head’ for example [...] it is normal, that other people also experience it.”

Many adolescents suggested that the intervention could include the opportunity to interact with other peers with ADHD. Some of adolescents suggested that the intervention could include things like polls, chat functions, and social games, to create a sense of belonging and a community. Jenny suggested:

You could’ve just had something like different people with ADHD could send out their complaints, and perhaps you don’t even need an answer, or that others with ADHD could answer.

Interviewer: Yes. That there will be some kind of community?

Jenny: Yes! Kind of.

Through information and interactions with other peers with ADHD in the intervention, they can acquire a better understanding of ADHD and what it entails, and thereby a greater acceptance for themselves.

1.2 Me as an Adolescent. While the adolescents talked about feeling different to others and needing information about ADHD, they also talked about experiences commonly shared with other adolescents. They discussed the challenges that are present for adolescents today. Being a teenager involves several challenges regarding school, hormones, peers, parents and self-esteem. Jenny described some of these challenges:

If you ask me, I think everyone should focus on that (regulation of emotion), because that's something everyone struggles with. Especially adolescents actually, because of all the hormones and stuff. And there is a lot of stress.

Oliver talked about how there is a tendency today for young people to self-diagnose due to misinformation and overgeneralization of ADHD symptoms on the social media platform Tiktok: "Yes, because many people on Tiktok for example say that they have ADHD or watch videos of someone saying some things about the diagnosis and symptoms, and also say that they have it." Despite the desire for information about ADHD, there was also a need for the digital intervention to normalise regular experiences common for adolescents and to separate these from ADHD symptoms. By doing this, the intervention might help them gain a greater insight and understanding of who they are as an adolescent and as a person with ADHD.

2. A Balance Between Receiving Help and Being Independent

The theme *a balance between receiving help and being independent* captures the adolescents' expressions of ambivalence related to the purpose of the intervention. They described a need for external guidance, while at the same time wanting to manage everyday life on their own. This provides the basis for the two subsequent subthemes: a) *a need for*

external help and support and b) *a need to cope with everyday life in own terms*. Anna summarized the essence of these polarities:

Interviewer: Yeah. So that they (the parents) get some insight in the app in a way?

Anna: Yes, but not like a hawk-thing like, “have you taken your medicine?” That’s a bit much, you want to be able to manage this on your own.

2.1 A Need for External Help and Support. This subtheme captures a need among the adolescents for external help and support in their lives. Many of the adolescents struggled to keep up with their daily tasks and portrayed feelings of inadequacy. Several expressed that parents and other family members have been a helpful support in dealing with challenges accompanied with ADHD. For instance, helping them remember to take medicines, planning homework, and providing emotional support. There was a strong desire among the adolescents for the intervention to fulfil several functions in their everyday lives. Some wanted reminders through alarms for eating, drinking, and taking medicine. Others found it useful for the app to help them with planning and guidance with their homework through planned pauses and work sessions, such as Jenny:

Just to have something that helps you remember to actually do things like homework, shower, and that type of stuff that you almost have to do, but I know I struggle with a lot ... To remember to do it on my own.

2.2 A Need to Cope With Everyday Life in own Terms. Despite the wish for external help and guidance, it is evident that the adolescents desire to manage everyday life on their own terms. The digital intervention should not undermine their experience of independence and autonomy. Oliver did not want to rely on notifications and reminders to remember things:

I think it is okay, but I don’t use it (notifications) myself. Because it kind of ruins your brain. Because you don’t feel ... Your body doesn’t want to do it by itself anymore. It kind of needs ... I don’t know.

Interviewer: Hm. In what kind of way do you feel that it ruins your brain?

Oliver: No, like, you get used to it and then your brain won't work the same way any longer.

Furthermore, many of the adolescents disliked being told what to do and emphasised the importance of non-commanding formulations in the app, like Anna: "I don't know, it depends on how you guys do it. Because if it is some kind of annoying app that says, 'you need to be patient!', then I can't be bothered." In extension to this, Anna described that a personal desire is a prerequisite to action: "If I don't want to take my medicines at all, it is only annoying, no matter how well the app is made." Several stressed that being able to choose should be an important function in the intervention. They wanted to be able to choose who should have access to the app, to what extent parents should have access, and to choose what they wanted to be reminded of. For example, Emma said: "That you can limit this yourself in a way, how much they (parents) can have access to. That you can choose for yourself." The possibility of choices in the intervention could ensure that the adolescents feel empowered to gain mastery over their own situation. This function might be a gateway to navigate the balance related to receiving help and being independent.

3. Managing Energy Highs and Lows

The theme *managing energy highs and lows* encompasses responses were the adolescents described having fluctuating energy as a central part of having ADHD. With this, many challenges followed. The adolescents had experiences dealing with this in the past and gave suggestions on how the digital intervention could account for their fluctuating energy. This theme is intertwined, and subsequently dividing subthemes are omitted.

Many of the adolescents described having a high energy level and pointed out several advantages of this, such as being able to work for a longer period with things of interest and bringing positive energy into social situations. However, they also pointed out the

disadvantages of a high energy level in certain situations. Some pointed out difficulties and dissatisfaction with the school environment, where sitting still for longer periods is customary. Viktor conveyed some frustrations surrounding this:

The whole arrangement with school is lame, because how can a normal human being with, and even without ADHD, be able to sit still on a bench for several hours? [...] I get annoyed just thinking about it. We have two hours of gymnastics a week, and besides there are no physical stuff. Too much sitting still.

Additionally, several expressed the burden of how energy highs are often accompanied by energy lows. Some talked about how hard it was to run out of energy in certain situations. Others had experienced how social situations could leave them feeling exhausted and empty, such as Emma: “As soon as I get in the car for example on my way home, I then feel like I have used everything I have. So that’s not that practical [...] It is kind of unpractical that you get so tired after.”

Anna had experienced how using her energy on physical activity had a positive effect on her ADHD symptoms: “Physical activity. I have heard that it can help a lot for people with ADHD to get your energy out and concentrate the energy in one place, kind of. Um, it has helped me a lot as well.” The adolescents suggested some elements in the app that is likely to help manage their highs and lows in energy. One of the adolescents proposed a possibility to track her energy level in the intervention, to help her visualize and balance out her fluctuating energy. Several had a desire for the intervention to include some kind of physical activity. Many had positive experiences with the AR game Pokémon Go, and how it motivated them to stay active. Leah suggested some elements for including activity in the digital intervention:

I know that for many with ADHD it can be difficult to sit still for a longer period. And then it could be an idea if it is an app where you do a physical activity, for example like Pokémon Go or that you ... It can be an app where you get a reminder about, for

example say you have a countdown, and then you need to work for 15 minutes and then you get a message that ‘now you have completed 15 minutes, now go for a little walk or do 20 jumping jacks’ [...] and then you get to use your energy a little before sitting down and continuing working.

It is evident that the digital intervention should tailor to the adolescents’ energy level, as high energy level is a central part of the disorder. It is likely that tailoring to this aspect could lead to a greater motivation and engagement for the adolescents.

4. Potential Barriers to Treatment

The theme *potential barriers to treatment* contains elements that can prevent engagement in the intervention. Although the adolescents were positive to the development of a digital intervention, they also conveyed doubts. The theme contains two subthemes a) *what is the point of the digital intervention?* and b) *failing to understand a multifaceted target audience*.

4.1 What is the point of the digital intervention? If the aim of the digital intervention is not conveyed properly to the adolescents, this could potentially serve as a crucial obstacle for the intervention. Some adolescents had questions about what the intervention can offer that goes beyond what already exists, and why such an intervention should exist at all, hence the name of the subtheme. Many expressed that several mobile functions, like alarms, lists, and planners, as well as websites that can help with ADHD symptoms, already exists. One of them was Oliver:

Interviewer: And then, an app where you can plan your week and get reminders and notifications?

Oliver: Well, that already exists. There are many like that.

By emphasising that potential functions suggested for the intervention already exists, it seems

that the intervention is perceived as unnecessary. The intervention must therefore offer something new to ensure engagement.

Some of the adolescents expressed uncertainties concerning what treatment of ADHD is:

Interviewer: In what way do you think digital treatment can increase motivation for treatment?

Viktor: What do you mean? Treatment of?

Interviewer: Do you think such an app could increase motivation for treatment of ADHD?

Viktor: What is the treatment for that?

It appeared that treatment for ADHD is somewhat unknown among several of the adolescents. It is possible that they have received little information about psychological treatment for their diagnosis, or they might have an underlying attitude of not needing to be treated. Regardless, this uncertainty might serve as a barrier to engagement.

4.2 Failing to Understand a Multifaceted Target Audience. The adolescents expressed several different characteristics of the target audience that might be challenging to cover in the intervention. Consequently, this can lead to lack of engagement. Among other things, they described a tendency to easily become distracted and bored, as well as difficulties with concentration and focus. Remembering daily tasks was a common challenge. Jenny pointed out how this can negatively impact her engagement in the intervention:

Um, just remembering that it exists. Because that happens often, that you kind of hear about it and then you forget [...] or perhaps you end up not using it anymore, just because you don't realise that you still have it.

Furthermore, the adolescents described themselves as a diverse group with various

interests. Leah expressed that reaching such a diverse group in the digital intervention could be challenging:

Um ... Well, it is difficult to make something that suits absolutely everybody. So for those that it does not suit, either because they find it boring or don't find it helpful or don't see the point with it, then I think it can be difficult to use it and have a motivation to carry it out. And yes, that you basically can't be bothered or don't want to, if you don't find it useful or interesting enough.

The digital intervention should be careful to judge people with ADHD alike, as it seems important for the adolescents to be regarded as unique individuals with their own personal interests. In the further development of the intervention, characteristics of the target group should be considered.

5. Envisioning an Ideal app

Envisioning an ideal app captures instances where the adolescents suggested specific wishes of design and functionality of a potential app. The theme contains the subthemes a) *design and layout* and b) *motivational factors*, which separates elements that may initiate utilisation of the app versus elements that facilitate prolonged engagement in the app.

5.1 Design and Layout. According to the adolescents, design and layout is important. They had specific wishes concerning the layout of an app and there were many similarities in their preferences. Several of the adolescents emphasised concise and shortened text features and the inclusion of appealing colour combinations. Anna said: "Not too much text and not many colours that are ugly together." In addition, they wanted the app to be neatly organised and user-friendly. Emma talked about this aspect: "Like, just in general that the app is very easy to use. Because it is very un motivating to use an app that is quite messy." It is clear that the design and layout of the digital intervention is an important factor that will influence utilisation of the intervention.

5.2 Motivational Factors. The adolescents expressed struggles with maintaining motivation in different areas of their lives, including digital technology. It was important for the digital intervention to help them stay motivated by including fun and interesting elements. They had several suggestions on how the intervention could facilitate motivation in this way. Many of the adolescents expressed a desire for variation in the intervention. Viktor suggested: “That there might be different kind of games. One game where you can be a bit more active and one where you don’t have to move as much.”

They also wanted to include levels and streaks, the possibility to check out accomplished tasks, visible progress and the use of objectives. Leah stressed the need for positive feedback and avoiding negative formulations: “You can do this! That it’s not very much like ‘you failed at this or you couldn’t do it’, because you might get a bad feeling and lose motivation.”

Moreover, many of the adolescents discussed that the intervention should include positive reinforcement such as rewards for completion and game-like features to facilitate motivation. All of the adolescents had positive experiences with games and thought it would be fun to include levels in the app. They also emphasised that the intervention should include rewards and a possibility to achieve points or trophies. Leah put it this way:

It is of course, especially in everything that has to do with games and such, that when you kind of get through a level that you achieve some kind of ... I mean, there are a lot of different types of games, that you achieve something, win something, that you find something, I mean all sorts of stuff, that you accomplish something in the game.

These functional elements, which might contribute to engagement and motivation, can possibly help overcome the obstacles described in the previous theme.

Discussion

The main aim of this study was to explore the needs and experiences of adolescents with ADHD related to a digital intervention for this target group. Eight adolescents with ADHD between the ages of 13-16 have given us insight into some of these needs and experiences. Through semi-structured interviews and reflexive thematic analysis, five themes and related subthemes were generated: 1) *a need for increased insight and acceptance* 2) *a balance between receiving help and being independent*, 3) *managing energy highs and lows*, 4) *potential barriers to treatment* and 5) *envisioning an ideal app*. In the following, we will discuss our findings in relation to the existing research literature and clinical guidelines. As a framework for understanding the adolescents' needs and experiences, we will use self-determination theory (Ryan & Deci, 2000b) and Erikson's theory of psychosocial development (Erikson, 1968). Subsequently, we will reflect on methodical issues and finally outline implications.

Normalisation of Experiences Related to ADHD and Adolescence

The first theme, *a need for increased insight and acceptance*, involves the adolescents' need for a better understanding and acceptance of themselves, by learning about ADHD symptoms, interacting with other peers and separating symptoms from experiences of adolescence. The most prominent finding within this theme was that the adolescents experienced a need for more information about their diagnosis. This is in line with the literature, where the need for information is described (Johnsen et al., 2007; Ostby-Deglum & Dahl, 2004). For example, a question-based survey with 171 adult patients with ADHD, found that the strongest predictor for the overall satisfaction of received health care was whether they were content with the received information regarding ADHD and treatment (Solberg et al., 2019). Receiving information can lead to a more correct and normalised view of one's condition, symptoms, and expectations, and can reduce the potential impact of social stigma, increase self-esteem and improve coping skills (Dudley et al., 2007).

The adolescents in our study also expressed a feeling of being different to their peers. Research has shown that people with ADHD are more likely to be met with stigma and prejudice, which may cause feelings of shame and can lead to an experience of feeling different to others (Watters et al., 2018; Young et al., 2008). Barkley (1997) stated that children with ADHD often receive more judgement, punishment and social rejection compared to other peers. They are regularly seen as impulsive, reckless, unmotivated, and irresponsible, which likely affects their self-esteem and increases the feeling of shame (Barkley, 1997).

Due to the feeling of being different, the adolescents desired a sense of relatedness with other peers who had similar struggles and wanted to interact with them in the digital intervention. This in accordance with the literature, which states that the possibility to interact with others who share similar burdens can be supporting, reassuring, and enlightening (Solomon, 2004; Murphy, 2005). Relatedness can easily be facilitated in a group therapy setting, where the individual can hear how others manage their symptoms, realise they are not alone, and have a safe place to ask questions (Murphy, 1998). Moreover, relatedness can be facilitated through interactions with peers online, where it has been shown to decrease feelings of loneliness and promote emotional support and social connectedness (Naslund et al., 2016). Interacting with other peers has also been shown to motivate for change and can be therapeutic (Solomon, 2004). The desire for relatedness can be linked to self-determination theory and the facilitation of intrinsic motivation (Ryan & Deci, 2000b). One study that focused on relatedness between adolescents, found that connection to others and the fulfilment of relatedness promotes psychological functioning and satisfaction (Inguglia et al., 2018).

The literature states that adolescents often focus on aspects of sameness and uniqueness (Levy-Warren, 1996). This may be because they are in a stage of life where

development of a stable identity takes place (Erikson, 1968). By this, the needs of the adolescents in our study can possibly be understood as them negotiating issues of their identity. Research has shown that adolescents with ADHD often struggle to develop a stable identity (Cantor, 2008). As adolescents with ADHD are often victims of stigmatisation and experience feelings of shame (Watters et al., 2018), this may affect their identity exploration. Interaction and discussion with other adolescents with ADHD may open for exploration of issues of identity and shame (Cantor, 2008).

Another finding in the first theme was the distinction between experiences of adolescence in general and experiences related to ADHD. Many adolescents today turn to the internet for health-related information and support (Odgers & Jensen, 2020). Several of the adolescents in our study searched for information about their diagnosis through social platforms, such as Tiktok. Some expressed how Tiktok videos about ADHD increased their insight and understanding of the diagnosis and themselves. Social media has become a popular platform for sharing information on diagnoses online. ADHD content generated by TikTok users is one of the most popular health topics on the platform (Yeung et al., 2022). However, studies show that information displayed on TikTok may describe non-specific symptoms, overgeneralizations, and characterizations about ADHD that can be misleading (Yeung et al., 2022). One of the adolescents in our study talked about the tendency for young people to self-diagnose, by watching videos about characteristics related to ADHD. Many of the symptoms presented are often common human experiences, risking the pathologization of experiences common during adolescence (Yeung et al., 2022). Recently, this has awakened concern among psychologist and health professionals in Norway (Keilen, 2023). This indicates that reliable information about ADHD should be included, as well as distinguishing this information from experiences common to adolescents.

The Desire for Independence in Light of Self-Determination Theory and Erikson's Psychosocial Theory of Development

The second theme, *a balance between receiving help and being independent*, describes that the adolescents have daily challenges they want assistance with, but at the same time want to manage their lives independently. These desires could be conflicting regarding the development of the intervention, as excessive use of helping aids might limit the adolescents' initiative, independence, and empowerment. Still, the adolescents had difficulties with organizing, remembering, and planning. This is consistent with studies that show that people with ADHD experience greater executive difficulties compared to the general population (Lambek et al., 2011; Boonstra et al., 2005) and have a stronger need for help and guidance because of these difficulties (Barkley, 2012). Furthermore, they wanted the intervention to include notifications, alarms, planners etc. This aligns with a study that examined compensatory strategies among 49 adults with ADHD. The study found that the use of compensatory strategies, such as alarms, to-do lists, and planners, can help people with ADHD to manage their symptoms (Kysow et al., 2017).

The second theme also highlights the need for independence and autonomy. Autonomy is proposed in self-determination theory to facilitate intrinsic motivation (Ryan & Deci, 2000b). The more the surroundings can satisfy the basic psychological needs, such as autonomy, the higher levels of well-being and life satisfaction will be experienced (Morsink et al., 2022; Reis et al., 2000). One study found that higher levels of ADHD symptoms in a sample of 117 primary school students were associated with lower satisfaction of the basic psychological needs (Rogers & Tannock, 2018). This may imply that an intervention that promotes autonomy can increase feelings of independence, well-being and decrease ADHD symptoms. To provide and enhance the experience of autonomy in the intervention, the adolescents in our study suggested non-commanding language and the possibility of choices.

This is consistent with a study of 80 undergraduate University students, which found that increasing options and choices also increased the participants' feeling of autonomy and consequently intrinsic motivation (Zuckerman et al., 1978).

The adolescents' desire to be independent can also be understood in light of the basic psychological need competence as described in self-determination theory (Ryan & Deci, 2000b). This desire for independence seems related to a perceived competence of having the skills needed to manage their lives with ADHD. For instance, being able to take medication, remember appointments, and self-regulate.

Furthermore, the ambivalence between the need for help and desire for independence can be understood in accordance with Erikson's psychosocial theory of development, due to the specific life period they are situated in (Erikson, 1968). Adolescents experience an increased need for detachment from caregivers and often desire to feel that they are their own person. In other words, we can understand our findings both from a motivational framework, but also from the adolescents' stage of life.

The Value of Activity

In the third theme, *managing energy highs and lows*, the adolescents described difficulties regarding fluctuating energy and the following consequences. Many adolescents talked about using their energy sensibly, for instance on physical activity. Some expressed how physical activity was beneficial for their ADHD symptoms. This is in line with a systematic review of 30 included studies that supports the benefits of physical activity for ADHD symptoms for children and adolescents (Ng et al., 2017). One study showed that moderate to high intensity exercise for 45 minutes, three times a week, for 10 weeks, can improve behaviour and cognitive functions, such as more efficient information processing and better sustained auditory attention in children with ADHD (Verret et al., 2012). For children and adolescents with ADHD, physical activity has been shown to be significantly

effective for emotion and mood (Cornelius et al., 2017). The effect of physical activity on ADHD can scientifically be explained by research that have found that moderate to high intensity training induce some of the same changes in neurochemicals and brain structures as ADHD medications (Lara, 2012).

The adolescents in our study talked about positive experiences with Pokémon Go, which is a game that facilitates walking and takes place in environments outdoors. The adolescents' positive attitude to Pokémon Go might be related to both physical activity and being outside in nature. Research indicate that nature and green environments can be beneficial for individuals with ADHD (Kuo & Taylor, 2004). One study found that children playing in green and naturistic settings experienced milder symptoms than children who played in built indoor settings (Taylor & Kuo, 2011). Another study found that a 20-minute walk in a park increased attention performance compared to a 20-minute walk in other settings for people with ADHD (Taylor & Kuo, 2009). Activity outside can serve as a safe, low-cost and accessible tool, and should therefore be considered in the digital intervention for managing ADHD symptoms.

The adolescents' desire for physical activity in the intervention can also be understood in light of the transition from childhood to adolescence. The changes in this transition include less play and more sedentary behaviour (Kontostoli et al., 2021). As mentioned by one of the adolescents in our study, school is associated with inactivity to a greater extent than in childhood years. This may explain the change in symptomatology, where hyperactivity becomes a more internalized sense of uneasiness and restlessness (Wehmeier et al., 2010). It is likely that the adolescents have fewer outlets for their high energy level in this developmental period and consequently have a greater need for adaption to this in the environment. If the digital intervention fails to tailor to these aspects, we may risk that the adolescents' energy level might become an obstacle for engagement in the intervention.

In the Norwegian guidelines for treatment of ADHD, several alternatives are recommended (The Norwegian Directorate of Health, 2016). However, physical activity/exercise is not clearly highlighted as a treatment alternative for managing ADHD symptoms. As research points to physical activity as a promising tool to reduce ADHD symptoms and improve mental health (Ng et al., 2017; Verret et al., 2012; Cornelius et al., 2017), and it is an accessible and low-cost intervention, it may be that physical activity should to a greater extent be emphasised in the treatment guidelines for ADHD.

Consideration of low Adherence in Treatment of ADHD

The fourth theme, *potential barriers to treatment*, involves different aspects that might become a barrier to engagement in the digital intervention. The adolescents conveyed some doubts towards the digital intervention and expressed uncertainties regarding what the intervention can offer beyond what already exist. Studies show that some individuals with ADHD already use several features on their smartphones, such as timers, schedules and reminders (Moëll et al., 2015). However, one survey found that individuals with ADHD find digital helping tools to be poorly adjusted to their needs (Desrochers et al., 2019). This indicates that although several digital tools already exist and are being used, there is a need for further adjustment to the target audience if the digital intervention includes such elements.

In the fourth theme, the adolescents also expressed uncertainty to what treatment for ADHD is. The literature shows that standardised treatment for ADHD is primarily pharmacological, and that psychological treatment is less common (Solberg et al., 2019; Kooij et al., 2019). Our findings can be understood as a result of this. The uncertainty towards treatment can also indicate that there might not be a strong need among the adolescents for treatment for ADHD symptoms, or that there is an underlying idea that treatment is related to negative aspects, such as stigma. Stigmatisation represents a barrier to seeking treatment for mental health disorders (Godfrey et al., 2021). Perhaps the intervention

should avoid using treatment as a descriptor, as this may be perceived negatively or unnecessary for the adolescents. This can further imply that the focus of the intervention should be at coping with daily life, rather than treatment of symptoms.

Additionally, the adolescents in our study highlighted characteristics related to ADHD, such as procrastination, distractibility, and forgetfulness, as a barrier to engage in the intervention. In accordance with the literature, lack of adherence to interventions is a common challenge for people with ADHD (Nordby et al., 2021; Biederman et al., 2019). For instance, adherence to medication, particularly among adolescents, is poor (Adler & Nierenberg, 2010). Studies have demonstrated low adherence for internet-delivered interventions for adults with ADHD (Nasri, 2017; Pettersson et al., 2016), which is problematic as it relates to treatment outcome (Simpson et al., 2012). Furthermore, the adolescents in our study stressed that people with ADHD are dissimilar. This aligns with a current literature review, which proposes that ADHD is an especially heterogeneous disorder (Gnanavel et al., 2019). Overall, compliance of digital interventions can be challenging (Moshe et al. 2021), possibly even more challenging for this target audience. Consequently, it is essential to find solutions that ensure the utilisation of the app.

Optimising the Digital Intervention

In the fifth theme, *envisioning an ideal app*, the adolescents stressed the importance of functionality. Optimising the functionality of the intervention is a critical step in the development of self-guided interventions (Yardley et al., 2015a), where adherence is often low (Karyotaki et al., 2017). The adolescents made it clear that design and layout of the intervention was an important factor. This is consistent with a usability study of an internet-delivered self-help intervention for adults with ADHD, which found layout and functionality to be central for utilisation (Kenter et al., 2022).

The fifth theme also captured that the adolescents wanted help to stay motivated in the digital intervention by including certain elements, such as levels and rewards. The literature demonstrates that it is common for schools to accommodate for pupils with ADHD by using rewards (Kelley & McCain, 1995). Research has shown that individuals with ADHD are more sensitive for rewards and require higher rates of reinforcement (Luman et al., 2005; Gaastra, 2020; Haenlein & Caul, 1987). This can be seen in the context of self-regulation, and that people with ADHD may have a weakened ability to generate sufficient motivation for tasks that are not experienced as motivating (Gaastra, 2020). Theories and research of ADHD have primarily focused on reinforcing behaviour, with limited attention to intrinsic motivation (Morsink et al., 2022). In light of Ryan and Deci (2000b) self-determination theory, rewards can be seen as external motivation. Based on the basic need for autonomy as a prerequisite for intrinsic motivation, controlled external motivation is initially described as less optimal (Deci & Ryan, 2000). As the use of rewards can undermine intrinsic motivation, it might not be the most optimal solution for people with ADHD. The digital intervention should therefore primarily strive to facilitate the adolescents' intrinsic motivation, rather than reinforcing behaviour solely with rewards.

The Adolescents' Needs and Experiences in a Broader Context

Across the themes, commonalities can be identified. Regarding the adolescents' needs and experiences for a digital intervention, it appears that the basic psychological needs from self-determination theory; autonomy, relatedness and competence are prominent throughout our findings. These needs are universal and facilitate motivation and growth (Ryan & Deci, 2000b), but are likely especially important for people with ADHD, due to their motivational deficits. In light of this motivational framework, our findings can offer a broader understanding of the user needs for interventions for ADHD in general and suggest that self-determination theory should carry value in the further development of the digital intervention.

Additionally, Erikson's psychosocial theory (1968) can provide an additional understanding of the adolescents' experiences and needs, in light of their developmental stage. Adolescents experience distinctive challenges that further enhances the need for aspects like relatedness and independence.

Methodological reflections

In the following, we will reflect on several methodological considerations in this study including limitations and analytical choices.

Methodological limitations

Recruitment. When developing an intervention using exploratory interviews, it is recommended in the person-based approach to purposively sample a diverse range of individuals who vary in characteristics that are regarded as important (Yardley et al., 2015b). This ensures that all relevant perspectives are considered to enable that the intervention is tailored to the diversity of the target group. Our study utilised a convenience sample, which is a type of sampling method where the participants are included in the study based on the convenience to contact and recruit them (Stratton, 2021). This constitutes methodological limitations, as important and relevant perspectives might have been omitted.

Firstly, none of the adolescents in our study had a minority background and different ethnic groups were not represented. Studies show that cultural differences in ADHD are small, but significant (Gómez-Benito et al., 2019). Research points to a need for increased cultural competence in the assessment and treatment of ADHD in minority communities (Slobodin & Masalha, 2020). In this study, we have not explored the user needs of adolescents with a minority background, and we therefore recommend an additional focus on this aspect in the further user testing of the intervention.

Secondly, the interviews were conducted in The University Hospital in Bergen, which required participants to live in close proximity to Bergen. This could have led to a more

homogenous sample, as adolescents from more rural areas are not included in the study. By doing the interviews digitally or by telephone, a greater number of participants could be included, increasing the diversity. However, face-to-face interviews could feel more personal and facilitate a more natural conversation, enabling the interviewers to explore the adolescents' needs and experiences to a greater extent.

Interview setting. The interview situation is a relationship between the adolescents with ADHD and us as researchers. This relationship might have influenced the findings in different ways.

First, the adolescents may have presented answers that are more socially acceptable than their true opinions. It is not rare for participants to describe an ideal situation, rather than reporting the reality that they experience daily (Bispo Júnior, 2022).

Second, we experienced that in-depth elaborations on experiences were somewhat limited compared to expressions of needs. It might be challenging for the young adolescents to elaborate on personal experiences to a stranger. We can question whether the adolescents expressed what was especially painful for them, as these experiences are often more associated with shame and stigma. It is possible that conversing with peers, as in a focus group format, can facilitate other discussions and elaborations, limited in individual interviews. On the other hand, by doing the interviews individually we ensured confidentiality.

Third, the interviews were led by three different interviewers, which might have influenced the focus and direction of the interviews, as it is possible that the interviewers emphasised different aspects. However, we made sure to discuss and reflect on our interviewing styles throughout the interviewing process. Nevertheless, we wanted to avoid the interviews becoming too determined, potentially missing important follow up questions of elaborations from the adolescents. A semi-structured interview and reflections between the

interviewers ensured a somewhat joint focus, while simultaneously opening for in-depth exploration.

On the other hand, the semi-structured interview guide may have narrowed the scope of the ideas and discussion of what could be useful in the digital intervention. For instance, by asking about the adolescents' thoughts on specific topics, we may have guided their suggestions and thoughts in a certain direction. However, many important reflections were proposed by the adolescents that went beyond our interview guide, suggesting that they had their own specific ideas of what would be helpful for them.

A fourth limitation related to the relationship between the researcher and the adolescents regarded a slightly leading interviewing style with the youngest adolescents of 13 years. We noted that we became more eager to probe these adolescents, as their responses were often one-worded and primarily affirmative. Reflecting on this experience after our first interviews, we consciously considered this in the following interviews. Despite increased awareness of our influence on the adolescents' answers, we still noticed a distinct age difference regarding the scope of their reflections. For further research, it might be useful to recruit older adolescents for exploratory interviews, or to a greater extent adapt the interview setting to the younger adolescents.

Finally, some of the adolescents were accompanied by their parents in the interview. This could have led to a variation in the responses of which we do not know the consequences of. One possibility is that the adolescents' answers might have been compromised, especially on subjects regarding self-disclosure.

Analytical choices

Through the analytic process, conscious choices of the final themes were made, where some potential important categories were opted out. Regulation of feelings was considered a final theme, as the adolescents frequently mentioned this as an important aspect to focus on.

However, it was considered too deficit, because the adolescents did not provide further reflections and information beyond the questions of the interview guide. Although managing feelings did not become a final theme in our analysis, it should be considered an important element in the further development of the digital intervention. This is because mastery of regulating feelings seemed to be an important gateway to mastering other aspects of everyday life, such as social situations and improving quality of life.

Other initial themes discussed in the analytical process, yet not included in the final thematic structure, were substance use, learning about social skills, and impulsivity. These categories were highlighted in the interview guide as something the digital intervention potentially could include. However, several adolescents expressed that they mastered the social arena, and it seemed that learning about social skills was less important. This is somewhat contradictory to the clinical guidelines for recommended treatment, where social training is a central treatment alternative. There is a possibility that social training for adolescents with ADHD is less important, or that this aspect was to a smaller extent captured by our exploratory interviews. A few of the adolescents in our study described some difficulties in social situations. Our reasoning for the exclusion of this topic was related to these difficulties being talked about in the context of common struggles for youth, and because these struggles had taken place in their previous years.

Impulsivity is described as a core symptom of ADHD, but it was not adequately highlighted by the adolescents as difficult. Impulsivity related to substance use was also brought up in the interviews, but it did not seem relevant for the target group. It is likely that their young age can be a contributing factor. Nevertheless, the adolescents might have undermined the relevance of substance use while parents were present.

Implications

Based on the needs and experiences of the adolescents in this study, some implications can be delineated for the further development of a digital intervention aimed for adolescents with ADHD. Across the themes, the basic psychological needs from self-determination theory, autonomy, relatedness, and competence are prominent. Self-determination theory is proposed as a motivational framework to understand the motivational deficits in ADHD (Morsink et al., 2022), as well as being the basis for common guiding principles for developing digital interventions (Yardley et al., 2015). This implicates that a digital intervention should strive to facilitate autonomy, relatedness, and competence. Moreover, our findings suggests that specific guiding principles for a digital intervention should include psychoeducation, elements of functionality, and tailoring to energy level by including elements of activity. By considering the adolescents' needs and experiences in the further development of a digital intervention, it can potentially improve the low adherence in treatment of this target group.

In general, this study also has implications for the clinical practice of ADHD treatment for adolescents. In today's clinical practice, the guidelines involve primarily recommendations regarding pharmacotherapy, subsequently psychological treatment. The adolescents in our study expressed needs that went beyond what pharmacotherapy can offer, such as normalisation and relatedness. Implications of this study points in the direction that greater emphasis on psychological treatment in the guidelines and clinical practice is needed. Moreover, the adolescents pointed out physical activity as beneficial for their ADHD symptoms. Clinical guidelines for treatment for ADHD have limited emphasis on physical activity, despite the increasing evidence of its benefits. Overall, clinical guidelines might be too deficient in tailoring to the needs of adolescent with ADHD today.

The development of a digital mental health intervention is a way of providing multimodal treatment for adolescents with ADHD, thereby meeting the recommendations in

the clinical guidelines. This study points to the adolescents as a suitable target group for a digital intervention, since the majority frequently use technology in their daily lives and conveyed a positive attitude towards such an intervention. The success of a digital intervention for adolescents with ADHD could result in important support of their coping with daily challenges, without the associated stigma related to treatment. A digital intervention can also potentially ease the demand in Norwegian health care and increase availability by reaching more patients.

Conclusion

The current qualitative study aimed to explore the needs and experiences of adolescents with ADHD related to a digital intervention for this target group. The findings highlight the importance of providing information, facilitating interaction, promoting autonomy, utilizing physical activity, as well as facilitating adherence in the intervention. Erikson's psychosocial theory points out that adolescents go through an important developmental stage with unique needs and experiences, that should be considered in the development of a digital intervention. Additionally, self-determination theory can offer a broader understanding of the user needs of adolescents with ADHD, by emphasising that autonomy, relatedness, and competence should carry value in the development of a digital intervention for this target group. Overall, this study shows the value of exploring user needs and that adolescents have important perspectives and reflections regarding a digital mental health intervention for adolescents with ADHD.

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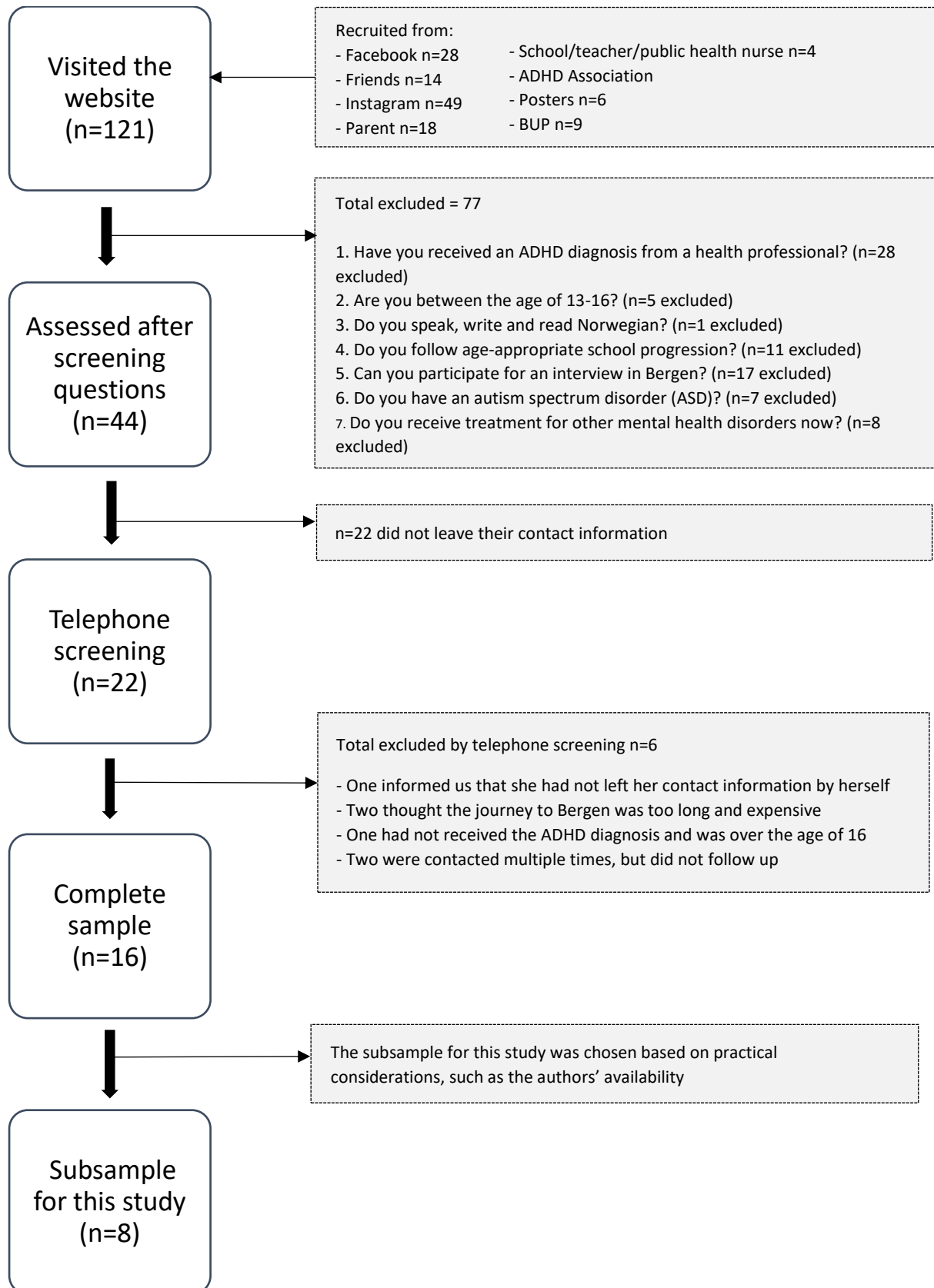
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Appendix A

Flowchart



Appendix B

QR Code Poster



Ung ADHD

BLI MED I STUDIE!

**Er du mellom 13 og 16 år og har ADHD?
Haukeland Universitetssykehus trenger din
hjelp til å lage et digitalt mestringsprogram for
ungdom med ADHD.**

Scann QR-koden for mer informasjon og
påmelding. For spørsmål ta kontakt på mail:
ungmeistring@helse-bergen.no

Deltakere kompenseres med gavekort!

Hilsen Ung ADHD teamet



Appendix c Interview Guide

Informasjon

«Jeg heter Maren/Ingeborg/Karin og jobber i Ung ADHD-prosjektet. Kjempeflott at du kunne være med på dette intervjuet. Jeg tenkte vi kunne starte med at jeg forteller litt om denne studien, og så tar vi litt praktiske ting, før vi begynner på intervjuet.

I Ung ADHD-prosjektet skal vi utvikle et digitalt mestringsprogram for ungdom med ADHD. Vi vet at ungdom med ADHD kan ha mange fordeler som masse energi, kreativitet og nysgjerrighet. Også vet vi at ADHD kan føre til utfordringer med å konsentrere seg på skolen, sitte lenge i ro, huske på avtaler eller styre følelsene sine når det skjer noe urettferdig.

Vi vet at det finnes ulike måter å mestre/øve på de utfordringene som man kan oppleve med ADHD og vi tror at et digitalt mestringsprogram for ADHD kan være et nyttig hjelpemiddel. Og derfor har vi invitert deg, og andre ungdommer med ADHD, til intervjuer, fordi det er dere som er eksperter på hvordan det er å ha ADHD, og også på hvordan det er å være ungdom.

Dette intervjuet tar cirka 20-30 minutter, og det er ikke noen «rette eller «feile» svar. Spørsmålene handler om dine erfaringer eller tanker om å bruke nettet, apper eller annen teknologi til å mestre ADHD, og hva det kan være nyttig å ha med i et digitalt mestringsprogram.

Som nevnt i informasjonsskrivet så kommer vi til å ta lydopptak av intervjuet, sånn at vi er sikker på at vi får med oss det som blir sagt. Vi tar ansvar for at informasjonen du deler med oss oppbevares trygt og sikkert, og at navnet ditt ikke blir knyttet til dette intervjuet.

Har du noen spørsmål før vi går i gang?

Sett på opptakeren

Kartlegge brukernes kunnskap og erfaringer med digital behandling:

1. Har du hørt om eller sett noen av disse digitale teknologiene før (Vis eksempelbilder s. 2):

VR	JA	NEI
AR	JA	NEI
Spill på mobil/tablet	JA	NEI

2. Har du noen gang prøvd apper eller annen teknologi for å få hjelp med ADHD eller brukt andre hjelpeapper? JA NEI

- Ikke prøvd digital behandling

Har du hørt noe om digitale behandlinger? JA NEI
Hvis JA: Hva har du hørt?

- Prøvd digital behandling

Hvordan syns du det var?
Hva var det som var positivt/negativt (adjektivet deltakeren bruker)?
Vil du fortelle litt mer om det?



Kartlegge brukernes behov og tanker knyttet til digital behandling

3. Jeg vil nå lese opp noen eksempler på hvordan en digital behandling for ADHD kan se ut og be om at du gir tilbakemelding på hva du syns/tenker om eksemplene



En app hvor ungdommen kan lære om ADHD

Dette høres: _____



En app for å planlegge uken sin og få påminnelser/varsler



Dette høres: _____



En app for konsentrasjonsøvelser

Dette høres: _____



En app hvor ungdommen kan chatte med terapeuten



Dette høres: _____

En app hvor ungdommen i en virtuell virkelighet (VR-briller) kan f.eks. teste ut ulike situasjoner som for eksempel i skoletimen, eller når de er sammen med venner



Dette høres: _____

Et dataspill rettet mot ADHD hvor ungdommen gjennomgår ulike nivåer



Dette høres: _____

4. a.) Hva bør vi fokusere på i mestringsprogrammet?

b.) Vi vet ungdommer med ADHD er forskjellige og kan streve med ulike ting. Derfor vil vi høre hva du tenker om disse temaene. (vis frem s. 4) Er det noe spesielt her som kan være viktig for ungdom med ADHD? (gå gjennom hvert tema)

Sosialt _____

Følelser _____

Planlegging, organisering og fokus _____

Vurderinger, kontroll, grensesetting _____

Medisiner _____

Mestring og selvtillit _____

Kunnskap om ADHD _____

Energi(nivå) _____

Annet? _____

Sosialt

Forhold til andre
Vennskap Familie
Kjæreste Skolerelasjoner
Samarbeid Fremmende
Gaming

Følelser

Sinne Begeistring
Kjedsomhet Iver
Tristhet Ensomhet
Tålmodighet

Planlegging, organisering og fokus

Konsentrasjon Planlegging
Organisering Holde avtaler
Komme tidsnok Problemløsning

Medisiner

Medisinbruk
Informasjon
Påminnelser

Vurderinger, kontroll og grenser

Impulskontroll Risikovurdering
Rusbruk Grensesetting
Fristelser Nysgjerrighet
Konsekvenser

Mestring og selvtillit

Mestring Selvtillit
Selvfølelse

Annet

Hverdagslige situasjoner
Fysisk aktivitet/trening
Spising Søvn
Energivivå

Kunnskap om ADHD

Lære om ADHD
Hvordan snakke om egen ADHD med andre

Du har kanskje hørt om komikeren Herman Flesvig? Fra førstegangstjenesten? Han har også ADHD og han sier at diagnosen kan være en fordel.

Hva tenker du er viktige fordeler eller styrker ved ADHD?

Kartlegge brukernes interesse/tanker om et digitalt mestringsprogram

6. På hvilken måte tror du digital behandling kan gjøre hverdagen lettere for ungdom med ADHD?

7. På hvilken måte tror du det kan være vanskelig for ungdom med ADHD å bruke et digitalt program?

8. På hvilken måte tror du en digital behandling kan være med å øke lysten/motivasjonen for behandling?

9. Hva tenker du mestringsprogrammet for ungdom med ADHD ikke bør inneholde?

10. Hva annet kan være nyttig når vi skal lage et digitalt mestringsprogram for ungdom med ADHD?

11. Helt tilslutt; Er det noe vi har glemt å spørre deg om? Noe du vil legge til eller spørre om?

- Tusen takk for kjempegode innspill. Dette vil hjelpe oss mye i den videre utviklingen!

GAVEKORT