GENDER DIFFERENCES IN USAGE AND USER EXPERIENCE OF OIVA APP

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Previous research has indicated that gender is an important demographic to consider when designing effective and tailored technology interventions. Despite this need, gender differences is still an understudied topic in the field of technology interventions. The objective of this study was to study gender differences in usage and user experience of a mental wellness app called Oiva. Gender differences in the app's effect on the participants' mental well-being were also investigated. Oiva is a stand-alone mental wellness app that aims to increase its users' psychological flexibility by teaching Acceptance and Commitment Therapy (ACT) based skills.

The study population of the current study was a subset of the study population of Salwe's Mind and Body Programme. Matched pairs design was used to study *gender differences* in usage and user experience of the Oiva App during a two-month mobile intervention. The study population ($N = 20$) consisted of 10 men (*age range* 33 – 55, *mean* 44.56, *SD* 7.11) and 10 women (*age range* 34 – 54, *mean* 44.43*, SD 6.81*). Each pair was matched on age and education, the distinguishing factor being gender. The main variables were an online questionnaire assessing usage and user experience of the Oiva App and mental wellness measurements using psychological questionnaires (PSS, RAND-36 emotional well-being, FFMQ and AAQ-II; pre = week 0, post = week 10, follow-up = week 36). In addition, objective technology usage data from the log files generated by the mobile application was investigated.

The results indicate that men and women used and experienced the Oiva App and its functionalities in a similar way. There was no statistically significant gender difference in the usage data from the log files or in the online questionnaire answers regarding usage and user experience of the Oiva App. The results also suggest that the intervention had a positive effect on the participants' mental well-being and that the effect was similar for men and women. There was a statistically significant change from pre to post intervention in PSS (psychological distress) and RAND-36 (emotional well-being) and between post and follow-up measurements in AAQ-II (psychological flexibility) but this change did not differ statistically significantly across gender.

To the best of my knowledge, this is the first study to investigate gender differences in usage and user experience of a mobile mental wellness app. The results of the current study indicate that the design of the Oiva App is sufficiently gender-sensitive, as there was no gender difference in usage and user experience of the app, and the effect on mental well-being was similar across gender.

Keywords: mental well-being, gender differences, health behavior, mobile phone, mobile application, acceptance and commitment therapy, user experience, mobile design

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Aiemman tutkimuskirjallisuuden mukaan sukupuoli tulisi huomioida suunniteltaessa tehokkaita ja kohdennettuja teknologiavälitteisiä interventioita, mutta tutkimusta aiheesta on toistaiseksi hyvin vähän. Tämän tutkimuksen tavoitteena oli tutkia sukupuolieroja Oiva -mobiilihyvinvointi-sovelluksen käytössä ja käyttökokemuksissa sekä sovelluksen vaikuttavuudessa tutkittavien hyvinvointiin. Oiva-sovellus pohjaa Hyväksymis- ja omistautumisterapiaan (HOT) ja tähtää psykologisen joustavuuden, ja tämän myötä psyykkisen hyvinvoinnin, lisäämiseen.

Tutkimusaineistona oli Oiva-mobiilisovellusta koskeva osa *Mielen ja kehon eliksiirit* -tutkimusohjelman (www.salwe.fi) aineistosta (N = 78, miehiä n = 12, naisia n = 66). Tutkittavina tässä tutkimuksessa oli 10 miestä ja 10 naista, joista iän ja koulutustaustan perusteella muodostettiin yhteensä 10 paria. Tutkittavien ikäjakauma oli miehillä 33 – 55 vuotta ja naisilla 34 – 54 vuotta ja korkeasti koulutettuja tutkittavista oli 6/ 20. Tutkimuksen päämuuttujina olivat Oiva-sovelluksen käyttöä ja käyttökokemusta koskeva verkkokysely sekä hyvinvointia mittaavat psykologiset mittarit PSS (psyykkinen kuormittuneisuus) RAND-36 (emotionaalinen hyvinvointi), FFMQ (tietoisuustaidot) ja AAQ-II (psykologinen joustavuus). Tutkittavien hyvinvointia mitattiin kolmella eri mittauskerralla ennen (vko 0) ja jälkeen (vko 10) intervention sekä seurantamittauksessa (vko 36). Sukupuolieroja Oiva-sovelluksen käyttömäärässä tutkittiin lisäksi sovelluksen lokitietojen avulla.

Tutkimuksen tulokset osoittivat, että miehet ja naiset käyttivät Oiva-sovellusta ja kokivat Oivan samalla tavalla. Tilastollisesti merkitseviä sukupuolieroja ei havaittu lokitietojen mukaisissa käyttömäärissä eikä verkkokyselyn käyttöä ja käyttökokemuksia koskevissa vastauksissa. Tulosten mukaan Oiva-sovelluksella oli myös positiivinen vaikutus tutkittavien psyykkiseen hyvinvointiin. Tilastollisesti merkitsevä muutos tutkittavien hyvinvoinnissa havaittiin PSS- ja RAND-36 emotionaalinen hyvinvointi –mittareiden tuloksissa intervention alku- ja loppumittauksen välillä sekä AAQ-II -mittarin tuloksissa intervention loppumittauksen ja seurantamittauksen välillä. Tilastollisesti merkitsevää sukupuolieroa hyvinvointimuutoksissa ei havaittu.

Tämä tutkimus on parhaan tietoni mukaan ensimmäinen, joka keskittyy sukupuolieroihin hyvinvointisovelluksen käytössä ja käyttökokemuksissa. Tulosten perusteella voidaan todeta, että Oiva-sovellus on riittävän sukupuolisensitiivinen, sillä sukupuolieroja käytössä ja käyttökokemuksissa tai sovelluksen hyvinvointivaikutuksissa ei havaittu.

Avainsanat: psyykkinen hyvinvointi, sukupuolierot, terveyskäyttäytyminen, mobiilisovellus, hyväksymis- ja omistautumisterapia, käyttökokemus, mobiilisuunnittelu

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INTRODUCTION

Background

Global disease burden is shifting from communicable to non-communicable diseases and from premature death to YLDs (i.e. years lived with disability), mental health and substance use problems being the leading cause of non-fatal burden of disease (Whiteford et al., 2013). Access to quality mental health care is limited for nearly all populations and especially for vulnerable populations such as young people, rural populations, racial/ ethnic or sexual minorities (Clarke & Yarborough, 2013; Gulliver, Griffiths, & Christensen, 2010; Rozbroj, Lyons, Pitts, Mitchell, & Christensen, 2014). Also men could be said to be a vulnerable population when it comes to seeking help for mental health concerns (Vogel, Wester, Hammer, & Downing-Matibag, 2014). In wealthier countries the male-to-female suicide death ratio is 3:1 (World Health Organization, 2014b) and for example male military personnel are at increased risk for suicide (Kang & Bullman, 2009) partly because of masculine gender norms (e.g. being strong, independent and in control of ones emotions) that prohibit men from using mental health services when needed (Addis & Mahalik, 2003; Burns & Mahalik, 2011). Not seeking help when distressed because of gender role conflict can make men vulnerable to mental health and behavioral problems such as depression, anxiety or alcohol abuse (O'Neil, 2008). Underreporting of physical or emotional distress and not seeking help when needed leads to delayed intervention which might help to explain, for example, why men's mental health conditions are more severe when they finally do seek mental health care (Courtenay, 2011).

Information technologies (HITs) such as smart phones, apps or desktop software and the Internet can expand the reach of mental health care (Clarke & Yarborough, 2013; Donker et al., 2013) to a more diverse and larger group of users, cut costs of quality mental health care and very importantly reduce stigma related to mental health concerns (Rebello, Marques, Gureje, & Pike, 2014). Utilization of electronic and mobile technologies to reduce the treatment gap in the field of mental health care is also one of the objectives in the World Health Organizations Mental Health Action Plan 2013 - 2020 (World Health Organization, 2013). As mobile- and smartphone ownership increases exponentially worldwide and mobile subscriptions reached nearly 7 billion in 2014 (International Telecommunication Union, 2014) it has become feasible to deliver mental health and wellness interventions via mobile- and smartphones.

There is no standardized definition of mHealth (World Health Organization, 2011), but recent definition by Adibi (2015, 2) states that *mHealth* (i.e. mobile health) refers to health care practice "*supported by mobile devices and smartphones*", and, according to mental health care, the concept

"*mH*^{2}" (i.e. mobile technology-based *mental* health care) has also been launched (Farrington, Aristidou, & Ruggeri, 2014). Mobile- and smartphones are especially well-suited for delivering mental health interventions since people carry their mobiles with them wherever they go which makes it easy to integrate interventions into the everyday lives of people and provide treatment via SMS, voice and interactive multimedia features when and where it is most needed (Atienza & Patrick, 2011; Farrington, Aristidou, & Ruggeri, 2014). Mobile- and smartphones also enable people to use mental health services more anonymously (Rebello et al., 2014; Shore et al., 2014), which is an important factor if an individual considers help-seeking for mental health concerns as stigmatizing or somehow inconvenient, as for example younger populations or men often do (Courtenay, 2011; Gulliver et al., 2010). Farrington et al. (2014, 3) also note that the smartphone itself might even encourage patients to engage in mobile mental health care, especially in poorer countries, since the "prestigious technological device" could help to diminish the stigma of mental illness.

To be effective, technology interventions should be first of all evidence-based (Donker et al., 2013), but also personalized and identity-congruent, in other words tailored to a certain user group (Oinas-Kukkonen & Harjumaa, 2009; Orji, Vassileva, & Mandryk, 2013; Orji, 2014). For example the user's gender is an important demographic to consider when designing effective, tailored interventions (Orji et al., 2013; Orji, 2014) but despite this need for gender-sensitive interventions, gender differences is still an understudied topic in the field of technology interventions (Perle, Langsam, & Nierenberg, 2011; Zhang, Guo, Lai, Guo, & Li, 2014). Also in a traditional health care context Mahalik and Burns (2011, 9) note, that for example men's cardiac-related health-behavior should be addressed with "*multimodal interventions that address health beliefs, gender roles, and social norms*" and it has even been said that mHealth could be seen as potential asset "to bridge the gender health discrepancies" (Adibi, 2015, 224). Proudfoot et al. (2010) did not find any gender difference among those interested in using mobile phones for mental health monitoring and self-management, but a study of Zhang, Guo, Lai, Guo and Li (2014) indicates that men have higher mHealth adoption intention than women do, and Malvey & Slovensky (2014) state that app users in the mHealth context skew male. Could this indicate that mHealth has something to offer to men who are reluctant to seek help for somatic and/ or mental health concerns? Could it even be, that mobile interventions could cut through some barriers for men's help-seeking? If so, mobile interventions could be one way to gender-sensitively and effectively approach gender differences in health and wellness (see also Adibi, 2015, 224), help-seeking behavior being the crucial link to getting help (on time) for one's somatic and/ or mental health concerns (Addis & Mahalik, 2003). The health consequences are luckily not unavoidable, since the distinct gender roles, norms, values

and behaviors that give rise to them are not fixed, but change over time, which again can change the health consequences, one of the change agents being technology and especially mobile technology (Adibi, 2015).

Many questions regarding effective mobile intervention design still remain open, e.g. which mobile phone functionalities are the most effective or how user demographics influence the effectiveness of mobile intervention (Free, 2013). Also usability and acceptance issues are important to consider when designing mobile applications in the behavioral health care context and some applications already allow end-user customization, for example adjusting visual design or narrator voice (male/ female) according to user preferences (Luxton, McCann, Bush, Mishkind, & Reger, 2011).

Gender differences in health and health behavior

Gender is an important variable in determining longevity and healthy life expectancy (HALE) (Salomon et al., 2012; Salzman & Wender, 2006; Wang et al., 2012). Men die younger than women (World Health Organization, 2014a) and are more likely to experience fatal diseases (Crimmins, Kim, & Solé-Auró, 2010). Women, on the other hand, live longer and are more likely than men to have disabling but non-fatal conditions such as arthritis (Crimmins et al., 2010).

Overactivity of the HPA axis and poor regulation of this system has been linked to many health problems such as cardiovascular disease (Lundberg, 2005; Spatola et al., 2014) and type 2 diabetes (Lundberg, 2005). Psychological distress has also been linked to a stronger drive to eat as a coping mechanism (De Vriendt, Moreno, & De Henauw, 2009; Groesz et al., 2012), to a decrease of physical activity, both leading to obesity, and to the accumulation of visceral fat leading to abdominal obesity due to a large number of cortisol receptors in the abdominal fat cells (De Vriendt et al., 2009; Lundberg, 2005). Obesity and especially abdominal obesity on the other hand are linked to metabolic syndrome (Eckel, Grundy, & Zimmet, 2005) which is again a strong risk factor for type 2 diabetes (Eckel et al., 2005) and cardiovascular disease (Eckel et al., 2005; Galassi, Reynolds, & Jiang He, 2006). In addition to type 2 diabetes and cardiovascular disease, being overweight or obese is also associated with other chronic diseases such as hypertension, arthritis, hyperlipidemia and asthma (Mokdad et al., 2003). From a *gender* difference point of view it is interesting that *sex* differences in stress responses depend more on gender roles and psychological factors than on biological factors (Lundberg, 2005), and that modifiable risk factors, including life-style-habits and psychological factors (e.g. psychological distress), play an important role for example in the prognosis of cardiac patients (Spatola et al., 2014) and account for 90% of

population attributable risk (PAR) for acute myocardial infarction in men and for 94% in women (Yusuf et al., 2004).

A wealth of research indicates that men are less likely to seek help for their health-problems than women, especially for emotional or mental problems (Galdas, Cheater, & Marshall, 2005a; Möller-Leimkühler, 2002; O'Brien, Hunt, & Hart, 2005). A review of sociocultural and clinical literature about barriers to men's help-seeking for depression (Möller-Leimkühler, 2002) states that according to empirical evidence low treatment rates among men cannot be explained by their better health, but must rather be linked to help-seeking behavior and perception of the need for treatment. Especially illnesses that cannot be seen (e. g. depression) are not considered a masculine enough reason to consult a healthcare professional. According to this review, men need physical manifestation of an illness to preserve their masculinity when seeking medical help. This kind of masculine culture naturally leads to concealment of mental health problems and makes men's mental health problems invisible (O'Brien et al., 2005) which is manifested as high depression rates among women and on the other hand high suicide rates among men, depression being the most frequent reason for suicide (Möller-Leimkühler, 2002).

According to gender theory (Courtenay, 2000) men's health is determined by social and cultural norms of masculinity that in turn lead to health-damaging behavior such as decreased help-seeking, risk taking (leading to injuries or accidental deaths), or unhealthy habits (drinking alcohol, smoking) (Bates, Hankivsky, & Springer, 2009; O'Brien et al., 2005; Pinkhasov et al., 2010). However, contemporary gender theory admits that there are differences among men and not only between men and women, indicating that there are intersections with other social factors as well (Bates et al., 2009) and Addis and Mahalik (2003, 7) also stress the need to recognize "*within-group*", "*within person*" and "*across-situation variability*" to avoid supporting "*stereotypes of men and women that constrain both genders*". For example, when it comes to seeking help for problem gambling, women are underrepresented in treatment for problem gamblers despite evidence indicating that men and women are equally likely to gamble in United States and Australia (Clarke, Abbott, DeSouza, & Bellringer, 2007), suggesting that help-seeking is decreased among women in this particular context. Likewise, men who have normatively masculine professions (e. g. fire-fighter) and who wish to preserve their masculinity via this profession, seek help more quickly (O'Brien et al., 2005). However, United States military personnel, in spite of having a traditionally masculine profession, are at a higher risk for suicide due to social and military duty -bound obligations to masculine behavior that prohibit utilization of mental health services (Burns & Mahalik, 2011). Though, according to Mahalik, Burns, & Syzdek (2007) masculinity and perceived normative health behavior of other men predict men's health behaviors even more than socio-

demographic variables (e.g. education). Nevertheless, research literature indicates that health behavior is predicted most consistently by gender differences (Mahalik & Burns, 2011), which indicates that gender-sensitivity is needed when designing gender-specific interventions for better health promotion and disease prevention (Courtenay, Mccreary, & Merighi, 2002). This is also something that mobile wellness app designers should take into consideration.

Use of mobile- and smartphones in mental wellness and health behavior change interventions

The most researched mobile phone tool is text messaging, which seems to have promising results especially in appointment adherence and smoking cessation (Fiordelli, Diviani, & Schulz, 2013; Whittaker et al., 2012). According to a review by Buhi et al. (2013) mobile phone-based behavioral health interventions utilizing mainly short text messages (SMS) have been shown to be effective in diabetes management, weight loss/ obesity prevention and asthma self-management, as well as in smoking cessation. Compared to mobile phones, smartphones offer a wider variety of features that can be used in mobile interventions or as part of therapeutic processes. With smartphones patients can for example capture real-world situations through audio or video recordings and review them later with their therapist (Aguilera & Muench, 2012). Also physiological activity and location tools are being used in behavioral health mobile interventions (Luxton et al., 2011). For example GPS has been used to locate and contact high-risk patients when, for example, a person recovering from alcohol dependence enters an area that is linked to alcohol abuse in the patient's history (Gustafson et al., 2011).

In mental health care apps have been used for example for self-monitoring, psychoeducation, screening, motivational support and as guided interventions or stand-alone self-help programs (Aguilera & Muench, 2012; Donker et al., 2013). Mobile devices can be especially helpful in self-monitoring, since people can track their thoughts, behaviors and feelings in real time instead of tracking them retrospectively with paper and pencil (Aguilera & Muench, 2012; Heron & Smyth, 2010). According to Aguilera and Muench (2012), different graphical summaries of patient progress can also be very powerful tools to be used by therapists.

The focus of mHealth research and development has in recent years been on health behavior change to fight physical chronic conditions such as obesity, diabetes and heart disease (Klasnja & Pratt, 2014). Luxton et al. (2011) also include mental illness into behavioral health and conclude that smartphones can "*make behavioral health care more accessible, efficient --- and can improve the delivery of evidence-based interventions*". Although mobile mental health is a more slowly

developing field than medical mHealth, there are, for example, three leading mobile mental health programs in United States military context alone that focus especially on post-traumatic stress disorder and related symptoms, such as stress and anger management problems, and are hoped to provide a means to combat the stigma related to mental health help-seeking (Shore et al., 2014). Mobile mental health interventions using advanced functionalities of mobile technology (e.g. apps, multimedia messaging) have also been developed for young people and are becoming an effective part of youth mental health care (Seko, Kidd, Wiljer, & McKenzie, 2014). To the best of my knowledge, the only researched Acceptance and Commitment Therapy (ACT) -based mental wellness mobile applications to date are the Oiva App, presented in the current study, and an application developed by Ly et al. (2012) that aims to function as a self-help intervention consisting of a smartphone application and web-based psychoeducation helping people to live in accordance with their chosen values. Bricker et al. (2014) have developed SmartQuit, an ACT-based behavioral health app for smoking cessation, which consists of four ACT-based features (*"Staying Motivated", "My Quit Plan", "Having an Urge", "I Slipped"*) and a tracking feature to help users quit smoking. In addition, the US Department of Veterans Affairs has developed an app called ACT Coach (https://mobile.va.gov/app/act-coach) for veterans, servicemembers and people who want to use an ACT app in conjunction with their Acceptance and Commitment therapy sessions. Acceptance and Commitment Therapy (Hayes, Strosahl & Wilson, 1999) is described in more detail in the next section.

Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (Hayes et al., 1999) belongs to the behavior therapy tradition and represents the third wave of behavior therapy. According to Hayes, Strosahl, Bunting, Twohig and Wilson (2004, 13) ACT is "*a therapy approach that uses acceptance and mindfulness processes, and commitment and behavior change processes, to produce greater psychological flexibility*". The philosophy behind ACT and its theoretical basis, Relational Frame Theory (RFT), is *functional contextualism* that has been encapsulated in the sentence "*do whatever works to achieve your life goals*" (Bricker & Tollison, 2011, 544). Relational Frame Theory, from which ACT is derived, is a basic behavior analytic theory of human language and cognition (Hayes, Barnes-Holmes, & Roche, 2001). According to RFT humans learn to arbitrarily relate events by different contextual features of a situation and to change the meaning of events based on these relations (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). People create "relational frames" already in infancy and these frames serve as an essential aspect of normal language development (Hayes, Levin, Plumb-Vilardaga, Villatte, & Pistorello, 2013). Hayes et al. (2013, 182-183) name two

features that regulate relational framing: *the relational context*, which "*determines what people think*" and *the functional context* determining "*the psychological impact of what you think*". Clinically the implication is not to concentrate on the content of cognitive networks that are controlled by contextual features, but rather on their functions (Hayes et al., 2006).

The six core processes of ACT (*acceptance, defusion, the present moment, self as context, values,* and *committed actions*) all aim to increase *psychological flexibility* (Hayes et al., 2013). Literature supports the proposal that psychological flexibility is connected to psychological health and well-being and that, on the other hand, *in*flexibility relates to psychopathology, although it is unclear whether inflexibility is an antecedent or a consequence of psychopathology (Kashdan & Rottenberg, 2010). Although the six core processes of ACT interact with each other (Hayes, Strosahl, Bunting, Twohig, & Wilson, 2004), they are presented here in order. The focus of *acceptance* is on the willingness to experience thoughts, feelings and bodily sensations as they occur, without trying to change them (Hayes et al., 2004). *Defusion* exercises help people notice that, for example, thoughts are just thoughts and feelings are just feelings, and to treat them as observed events rather than absolute truths while *the present moment* refers to being present from moment to moment with full and willing awareness (Chiarrochi, Bilich, & Godsell, 2010). ACT also encourages people to view *the self* as a context for thoughts, feelings and events or as a place where these experiences occur but which is independent of these experiences. In other words *self as context* is "*I*" that is a stable place where one experiences events of the inner and outer world that come and go (Chiarrochi et al., 2010; Hayes et al., 2004). Finally, according to ACT, *values* are chosen life directions and *committed actions* refer to value-directed behavior that has to be chosen again and again in order to live a value-based life (Stoddard & Afari, 2014).

Objectives of this study

As described in this introduction, it is important to consider user demographics, such as gender, when designing effective mobile mental wellness and health behavior change interventions but despite this need, gender differences is still an understudied topic in the field of technology interventions (Perle, Langsam, & Nierenberg, 2011; Zhang, Guo, Lai, Guo, & Li, 2014). In this study, the main objective was to study gender differences in usage and user experience of a mobile mental wellness app called Oiva to investigate if there is a need for a more gender-sensitive version of the Oiva App. In detail, the objectives were to: 1) *investigate gender differences in the use of Oiva App* (e.g. was there a gender difference in the participants' average usage time of Oiva App in days/ minutes; was there a gender difference in how (for example when and where) the participants used the Oiva App); 2) *explore gender differences in the user experience of Oiva App and its*

functionalities (e.g. was there a gender difference in how Oiva App helped to sustain and improve the participants' personal well-being; was there a gender difference in how the participants experienced Oiva's graphic design); 3) *study gender differences in the effect of Oiva App on the participants' mental well-being*.

METHODS

Study population and participants of the current study

The overall study population (*N*=399) in the randomized controlled trial (RCT) which is currently underway as part of SalWe's Mind and Body Programme (www.salwe.fi) consisted of either overweight or obese individuals who reported having psychological stress symptoms (Lappalainen et al., 2014). The participants took part in the study voluntarily (they responded to an advertisement in local newspaper) and were randomly allocated into one of the three intervention groups (Internet, Mobile, Face-to-Face) or into a control group if they met the inclusion criteria (Lappalainen et al., 2014). Altogether 298 (48 male and 250 female) participants were selected for the interventions. There were three inclusion criteria: Body Mass Index (BMI) between 27–34.9 kg/m^2, perceived psychological stress (at least 3/12 points in General Health Questionnaire; Makowska, Merecz, Mościcka, & Kolasa, 2002) and access to a computer with Internet access (Lappalainen et al., 2014). The exclusion criteria, according to Lappalainen et al. (2014, 4) were: a diagnosed severe chronic illness (symptomatic cardiovascular disease, Type 1 or 2 diabetes, severe psychiatric conditions or substance abuse), medical surgery within the past 6 months, heart attack/ stroke within past 6 months, kidney disease requiring dialysis or other disabilities/ illnesses affecting considerably physiological or mental health, regular use of cortisone pills, pacemaker, eating disorder (bulimia), disability pension for psychological reasons, pregnancy or breastfeeding within the past 6 months, shift work (in three shifts) or night work, psychotherapy or other psychological or mental treatment at least twice a month, and participation in other intervention studies during the present study.

Participants of the current study were selected from the Mobile-intervention group (*N* = 78, men *N* = 12, women *N* = 66). One of the male participants dropped out of the study and another male participant was excluded as he omitted most of the questions in the usage and user experience questionnaire. All participants in the Mobile-intervention group were given android smartphones with a pre-installed stand-alone mental wellness app called Oiva and instructed (in a short meeting that included a brief overview of Acceptance and Commitment Therapy, ACT) to use the app on their own for the next 8 weeks. A hyperlink to a public nutritional website was also provided via email.

The intention of the current study was to study gender differences in usage and user experience of the Oiva App, and therefore matched pairs design was used and the final study population (*N* = 20) consisted of 10 men (*age range* 33 – 55, *mean* 44.56, *SD* 7.11) and 10 women (*age range* 34 –

54, *mean* 44.43, *SD* 6.81). Each pair was matched on age and education (Figure 1), the distinguishing factor being gender.

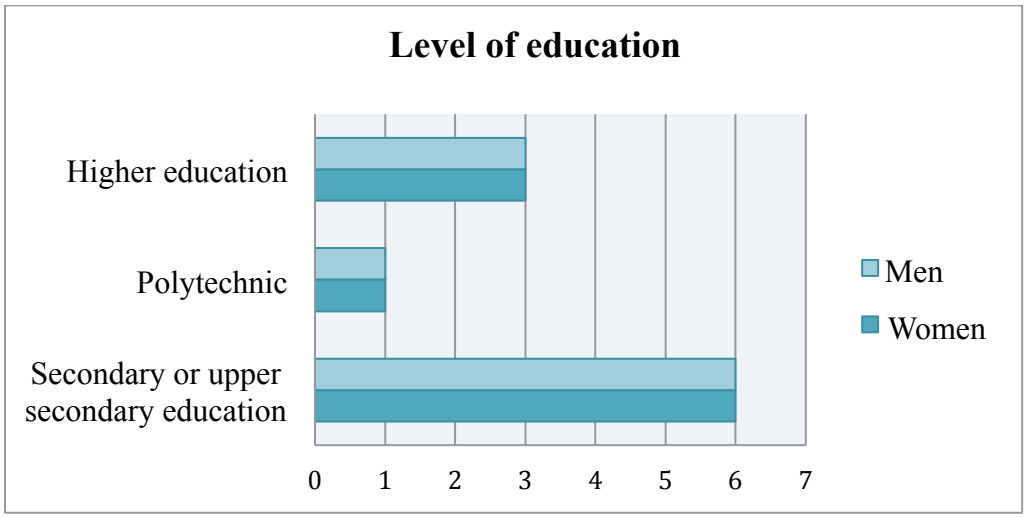

Figure 1. Level of education of male (n = 10) and female (n = 10) participants

Intervention

Oiva is a stand-alone mental wellness app that aims to increase the users' psychological flexibility by teaching Acceptance and Commitment Therapy (ACT) based skills that can be integrated into daily life. The ACT-based intervention delivered through the Oiva App consisted of four intervention paths: Mindful Mind, Wise Mind, Values, and Healthy Body. *Mindful Mind* contains five mindfulness exercises, *Wise Mind* aims to teach skills related to observing an accepting one's thoughts and feelings, *Values* includes seven value exercises that help clarify one's own values and commit to values-based action and *Healthy Body* concentrates on relaxation, mindful eating and physical activity. The first three paths are built on the core processes of ACT and the fourth path addresses physical well-being from an ACT-based point of view.

The user interface is presented in Figure 2. On the main screen (a) there was a flower-shaped menu where each of the petals represented one path and were numbered according to the recommended order. The next suggested path (i.e. petal) or exercise (e) was dynamically highlighted to gently guide users through the intervention while still allowing free navigation. On the main screen (a) there was also access to a diary (b), a list of favorite exercises (c) and text and audio introductions to the application (d, g). Each path consisted of 1–4 (sub)sections which included 5–8 exercises each (f). Altogether the app consisted of 46 exercises in text and audio format. In addition each path and section had an introduction (in text and audio format) informing the user of the processes and skills covered, and every exercise began with an introductory text

about the purpose, duration and instructions of the current exercise (h). Most of the exercises were short (1–3 minutes) and could be performed in a variety of situations via reading (i) or listening (j). After the exercise a reflection screen (k) opened, summarizing the skills learned and giving the opportunity to reflect on the exercise by writing and saving notes for possible later use in a diary provided by Oiva. Progress in the intervention was displayed by a change in background color when a new step or exercise was completed and users were also given a virtual rose as a reward for completing an exercise. Pictures of nature, animals and landscapes were designed to create a calming visual effect and the amount of text was minimized by using pictures, audio and video in order to make the user experience of Oiva more pleasurable and less demanding (Ahtinen et al., 2013).

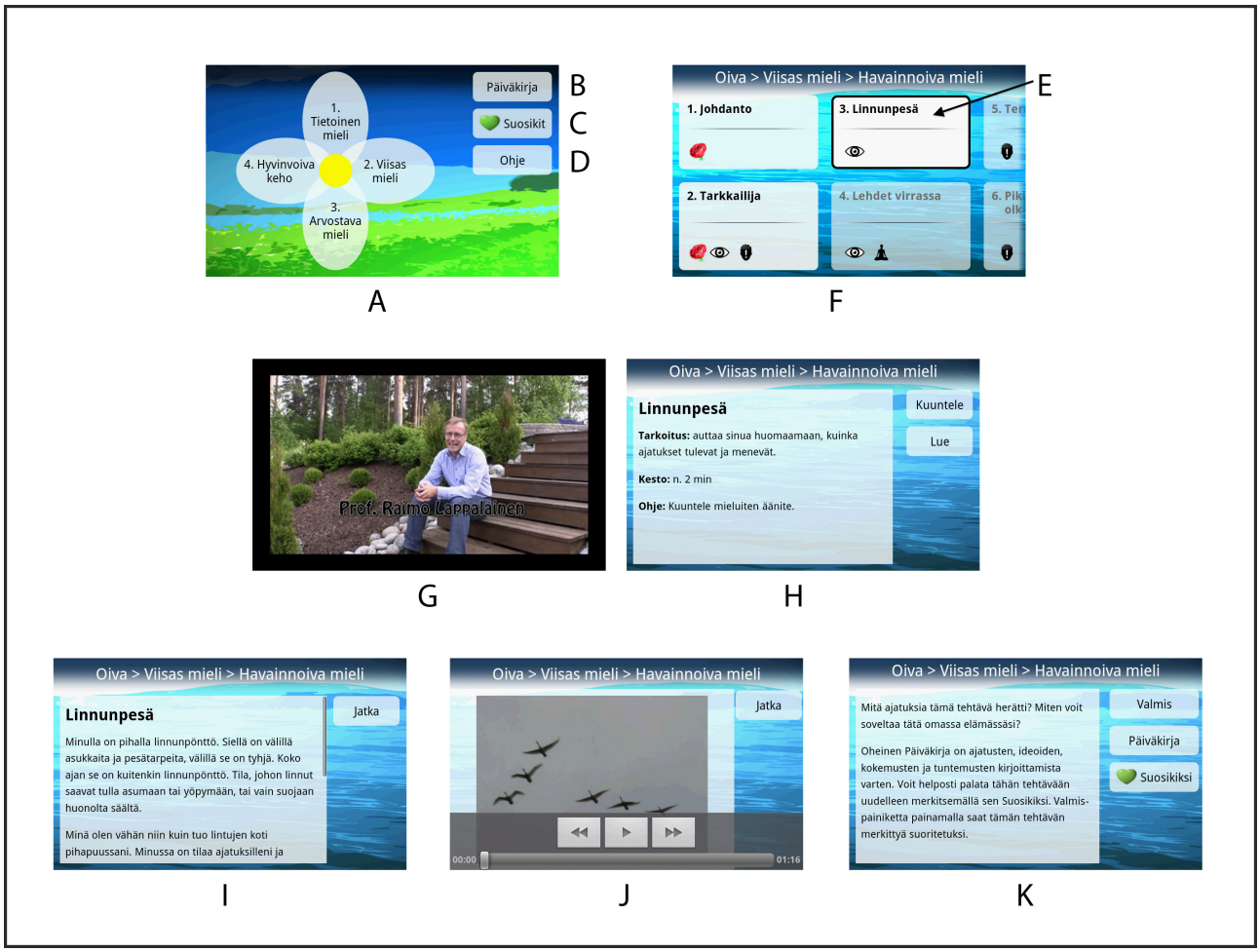

Figure 2. Screenshots of Oiva App: a) main screen, b) diary, c) list of favorite exercises, d) text and audio introductions to the application, e) highlighted exercise, f) subsection of exercises 5-8, g) introduction video to the application, h) text exercise introduction, i) text exercise, j) audio exercise, k) reflection screen

Measurements

Participants completed online usage and user experience questionnaires regarding the Oiva App two weeks after the beginning (initial experience) and after the mobile-intervention (post-measurement). Only the post-measurement data will be investigated in this study because the aim is to study *gender differences*, not *change*, in usage and user experience. The data concerning initial experience will be used additionally when relevant. Regarding psychological measurements, participants were measured in the beginning of the study (pre-measurement), after 10 weeks (post-measurement), and after 36 weeks (follow-up measurement). In addition objective technology usage data from the log files generated by the Oiva App was collected and investigated. The main variables, the post-measurement questionnaire assessing usage and user experience of the Oiva App and the mental wellness measurements using psychological questionnaires are presented below.

The post-measurement questionnaire regarding usage and user experience of Oiva App assessed usage in long-term use, usability, acceptance, motivational factors and perceived benefits of the mobile intervention. The questionnaire consisted of questions or statements on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), e.g. "*Oiva has helped me to achieve my goals related to well-being"*, and 3-6 -point ordinal scale questions (with a variety of response options), e.g. "*Did you use Oiva in your own smartphone? (yes, no, occasionally)*". The questions on usage and user experience questionnaire are presented in detail with the results.

The Perceived Stress Scale (PSS) was used to measure self-reported stress experienced by the participants. The PSS is a standardized self-report questionnaire of perceived nonspecific stress with good reliability (Golden-Kreutz, Browne, Frierson, & Andersen, 2004; Sheldon Cohen, Kamarck, & Mermelstein, 1983)

The quality of life, in this case especially *emotional well-being*, was measured with the RAND-36 questionnaire, a highly reliable measure of health-related quality of life (Aalto, Aro, & Teperi, 1999; VanderZee, Sanderman, Heyink, & de Haes, 1996). The questionnaire assesses eight health concepts: physical functioning, role limitations caused by physical health problems, role limitations caused by emotional problems, social functioning, emotional well-being, energy/fatigue, pain, and general health perceptions. In line with one of the research questions of this study regarding gender differences in the effect of Oiva on the participant's mental well-being, only the emotional well-being scale (five 5-level Likert items) was investigated in isolation from the RAND-36 questionnaire.

The Five Facet Mindfulness Questionnaire (FFMQ) and Acceptance and Action Questionnaire (AAQ-II) were selected as measures to see whether Oiva helped participants learn core ACT-based

skills (i.e. mindfulness and acceptance skills) and further increase their psychological flexibility. The FFMQ is a self-report questionnaire that contains 39 questions addressing five factors of mindfulness. A factor analytic study of several mindfulness questionnaires (MAAS, FMI, KIMS, CAMS, MQ) suggested that they contain five facets of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The AAQ-II (Bond et al., 2011) is a 7-item Likert-type questionnaire that assesses individual differences in psychological flexibility and its counterpart, i.e. experiential avoidance. The AAQ-II is the second version of AAQ measuring the same concept but with better psychometric consistency than the previous AAQ-I (Bond et al., 2011).

Data analysis

First, the log files of the participants ($N = 20$) were analyzed counting the number of usage sessions, the amount of days when Oiva was used, the duration of the usage period from first to last session and the days the smartphone, on which Oiva was preinstalled, was in use. The total duration of application use in minutes was also counted. Next, a statistical analysis of the usage log files, the usage and user experience questionnaire and the psychological questionnaires was performed, as described below. SPSS 22.0 for Mac was used and the statistical significance level was set at $p < 0.05$.

The usage log files and the questionnaire regarding usage and user experience of the Oiva App were investigated using descriptive statistics (frequencies, relative frequencies and medians). Then the usage data from the log files, the 7-point Likert items and the 5- to 6-point ordinal scale questions from the online questionnaire were analyzed using Mann-Whitney U-test to see whether there was a statistically significant gender difference in usage and user experience of the Oiva App.

Finally, the change in the male and female participants' mental well-being between pre, post and follow-up measurements was analyzed with repeated measures analysis of variance (ANOVA). A repeated measures ANOVA was conducted to evaluate the null hypothesis that there was no gender difference in the change in the participants' well-being when measured before and after Oiva use and in follow-up measurement. Because the assumptions of sphericity and normality were violated in PSS, RAND (mental well-being), FFMQ and AAQ-II, a Mann-Whitney U-test was also performed to test the statistical significance of gender difference in the change scores of these psychological measures. Since there were four outliers in the data (in the follow-up scores of the

psychological measurements), additional analysis using repeated measures ANOVA was conducted after imputing a reasonable value for the detected outliers.

RESULTS

The usage data from the log files and ratings from the online usage and user experience questionnaire, described below, were analyzed using the Mann-Whitney U-test and no statistically significant gender difference was found. The data is described below in detail to inform future development of the Oiva App.

Gender differences in the use of Oiva App

Usage

According to the log files the smartphone, on which Oiva App was preinstalled, was used by male participants for on average 57.9 (SD 9.0, *range* 37-73) days and by female participants for on average 58.9 (SD 5.2, *range* 55-73) days. The usage period of the Oiva App from first to last session was for men on average 46.4 (SD 18.7, *range* 10-66) and for women on average 53.0 (SD 8.8, *range* 41-72) days. Male/ female study participants used Oiva, on average, on 11.1 (SD 5.9, *range* 4-23)/ 20.0 (SD 14.9, *range* 9-59) days. During the study there were on average 16.3 (SD 10.7, *range* 7-44) usage sessions per male participant and 28.4 (SD 23.6, *range* 10-91) usage sessions per female participant, total usage time per male/ female participant being, on average, 228.4 (SD 148.6 *range* 55-510)/ 422.7 (SD 564.9 *range* 75-2001) minutes.

Usage of mobile intervention in the long-term

Participants did not tire of the Oiva App. When asked to rate a statement "*I'm tired of Oiva*", 77,7% of both men's (7/9) and women's (7/9) ratings were below the midpoint of 4.0 (from 1 strongly disagree to 7 strongly agree). Participants (men $n = 9$, women $n = 9$) considered Oiva to be suitable for several months of use: 66,6% of male and 77,7% of female participants' ratings were above the midpoint of 4.0. The usage period of Oiva during the study was considered to be too short by 62,5% of male and 70% female participants.

Usage situation

Nearly half of the participants (9/19, 47,4%) kept the phone on which Oiva had been preinstalled (the "Oiva-phone") in one place (e.g. at home or at work) almost continuously. This was reported by five men (55,6%) and four women (40%). Four women (40%) reported keeping the phone with them almost always, wherever they where. The participants did not typically insert their own SIM card into the phone where Oiva was preinstalled (17/19, 89,5% of participants did not do this), only

one man (11,1%) and one woman (10%) used their own SIM card in the "Oiva-phone" and only one man (11,1%) used Oiva in his own phone.

Figure 3 shows relative frequencies for men and women regarding the location where Oiva App was used (participants could choose multiple places). Most often Oiva was used at home (19/20, 95% of participants). Usage in a mobile situation while traveling (6/20, 30% of participants) or at work (4/20, 20% of participants) was scarce. Four participants (20%) used Oiva elsewhere, two men (20%) and one woman (10%) reported using Oiva outdoors and one woman (10%) reported using Oiva on a holiday trip.

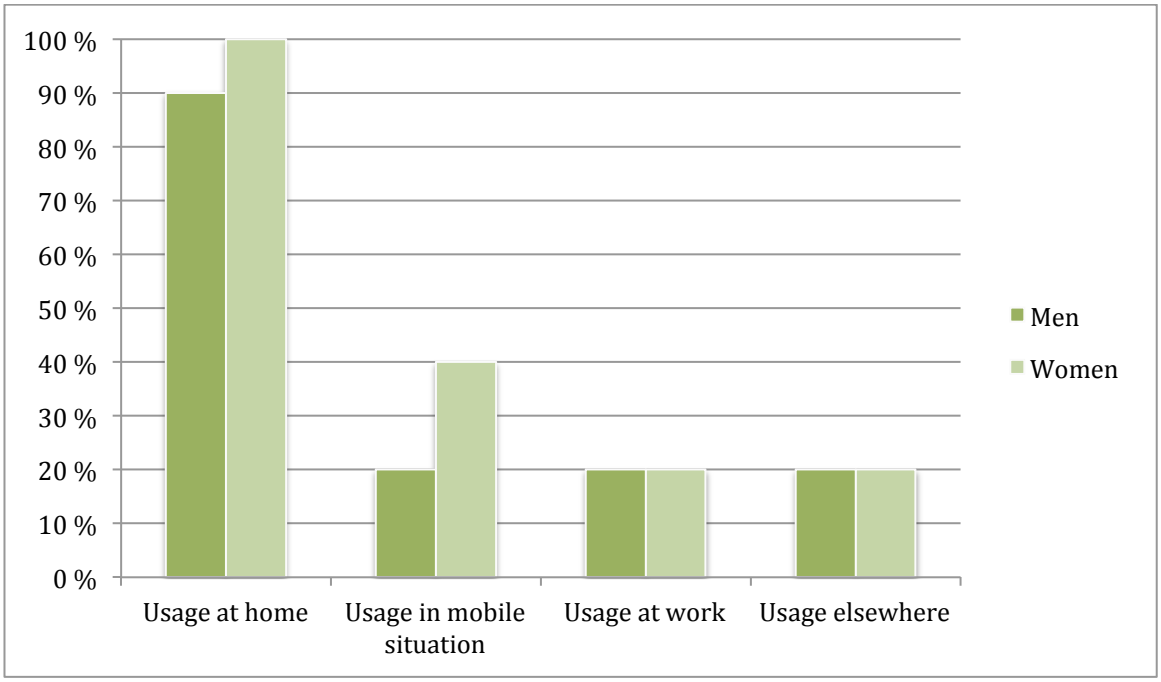

Figure 3. Relative frequencies for men (n = 10) and women (n = 10) regarding location where Oiva App was used

Oiva was used slightly more on weekends (50% of participants) than on workdays (45% of participants). Five men (50%) and five women (50%) used Oiva on weekends, and on workdays the male/ female usage ratio was 40% (4/10)/ 50% (5/10).

The most popular time of day to use Oiva, as reported by 80% (16/20) of participants, was the evening. Forty percent (8/20) of the participants used Oiva in the morning and 35% (7/20) of the participants used Oiva during the day. Only one (5% of participants) male participant used Oiva at night. Relative frequencies for men and women are shown in detail in Figure 4.

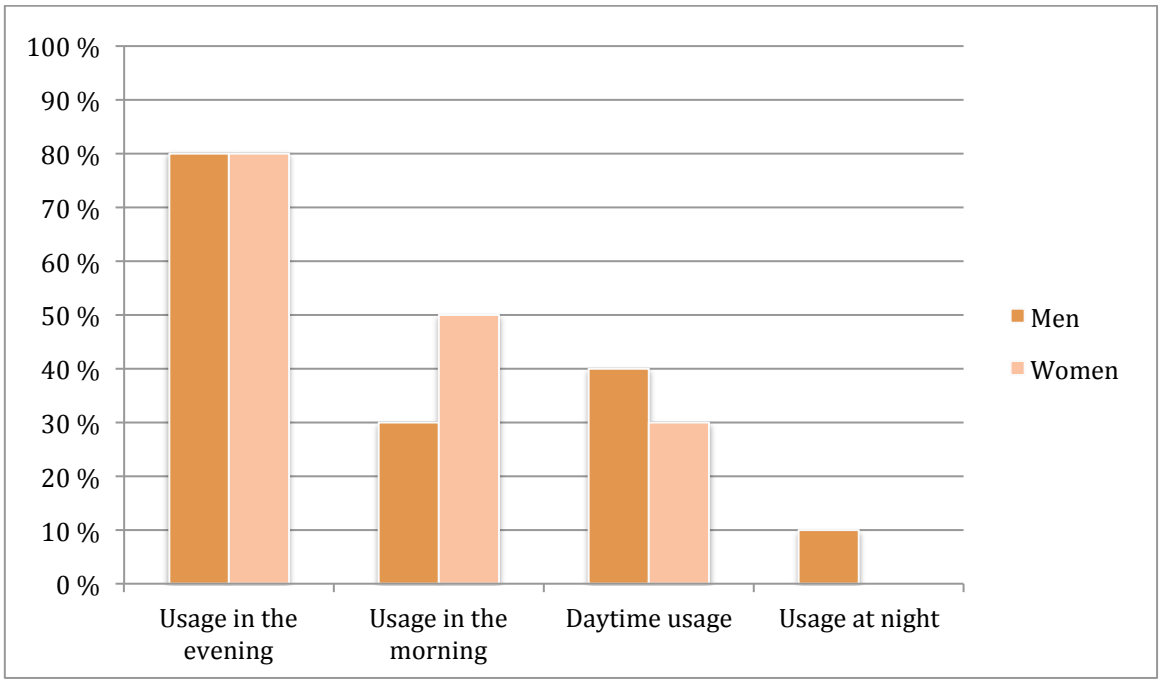

Figure 4. Relative frequencies for men (n = 10) and women (n = 10) regarding time of day when Oiva App was used

Motivational factors

Participants were generally willing to use Oiva App. When asked to rate a statement "*I don't want to use Oiva*" (seven being "strongly agree") 66,6% (6/9) of men and 80% (8/10) of women gave the statement a rating below the midpoint of 4.0. The reported user activity among participants was not very high. When asked to rate a statement "*I have used Oiva actively*" the median rating for men (*Md* = 3.0, *range* 1-6, *n* = 9) and women (*Md* = 2.5, *range* 1-7, *n* = 10) was under the midpoint of 4.0 and the participants reported having trouble remembering to use Oiva, the median rating for men (*Md* = 5.0, *range* 1-7, *n* = 9) and women (*Md* = 5.5, *range* 1-7, *n* = 10) being above the midpoint of 4.0 when asked to rate the statement "*I do not remember to use Oiva*".

A typical amount of practice was a few times per week (55%, 11/20 of participants) in the beginning of the intervention (initial experience), but according to post-measurement only 26,3% (5/19) practiced as much, and most of the participants (10/19, 52,6%) reported practicing sporadically, which was reported by an equal amount of men (5/9) and women (5/10). More than half of the participants (11/19, 57,9%), five men (55,6%) and six women (60%), practiced all the way through the period of research.

Two male (22,2%) and two female (20%) participants independently sought additional information on the topics covered in Oiva (e.g. Acceptance and Commitment Therapy, mindfulness). For example one man commented that he had sought information from the Internet on

mindfulness skills in general, and two women commented on having sought information on mindful eating and mindfulness courses. Some of the participants (6/19, 31,6%) also followed the link to a public nutritional website sent to them by email. Two (22,2%, *n* = 9) men and four (40%, *n* = 10) women followed the link and two men (2/6, 33,3%) and two (2/8, 25%) women considered the information on a healthy diet useful.

Ways to practice with the Oiva App

The most common way to perform Oiva' s exercises was in an intentional and focused manner and by following instructions given by the app (12/ 19, 63,2%). This was reported by 55,6% (5/9) of male participants and 70% (7/10) of women. (In comparison, in the initial questionnaire, two weeks after the beginning of the intervention, such behavior was reported by 70% (7/10) of men and 80% (8/10) of women). A typical way to perform the exercises was, among women, to perform them in accordance with the instructions given by Oiva (7/10, 70% of female participants). Men, on the other hand, performed the exercises equally often by following the instructions (3/9, 33,3%), doing their own adaptations of the exercises (3/9, 33,3%), or doing both (3/9, 33,3%). Two men and five women also told that they had performed Oiva's exercises (e.g. mindfulness or relaxation exercises) without the help of the app.

Most of the participants (13/19, 68,4%) performed exercises in the order recommended by Oiva. This style of practice method was reported by 88,9% of men (8/9) and 50% of women (5/10). In comparison, according to the initial questionnaire (two weeks after the beginning of the intervention) only 26,3% of participants (5/19), 40% of men (4/10) and 11,1% of women (1/9), reported following the order recommended by Oiva.

Only five participants (26,3%), two men (22,2%) and three women (30%), reported using Oiva's diary and 52,6% (10/19) of the participants made no notes in Oiva or on paper. In the initial measurement the male/ female ratio of the participants using Oiva's diary was 3/10 (30%)/ 1/9 (11,1%).

Gender differences in the user experience of Oiva and its functionalities

Usability

According to the median ratings of participants, Oiva was easy to use. The median rating of the statement "*Oiva is easy to use*" was 6.0 among men (*range* 5-7, *n* = 9) and women (*range* 3-7, *n* = 10). When the participants were asked about the usefulness of the different functionalities of Oiva, the median ratings regarding usefulness were mainly above the midpoint of 4.0, the only exception

being the median rating for being able to write notes in Oivas' diary, which was under the midpoint. At the midpoint of 4.0 was the median for being able to mark exercises as favorite (among men) and being able to use reminders (among women). The median ratings for the perceived usefulness of the different functionalities among men and women are shown in detail in Table 1.

Table 1. Median ratings for usefulness of the different functionalities of Oiva for men and women

	Median	
Usefulness	Men	Women
Introductions	5.5 (*range* 4-7, *n* = 8)	6.0 (*range* 4-7, *n* = 10)
Videos	5.0 (*range* 4-6, *n* = 9)	5.5 (*range* 2-7, *n* = 10)
Exercises in text format	5.0 (*range* 3-6, *n* = 8)	6.0 (*range* 2-7, *n* = 10)
Exercises in audio format	6.0 (*range* 5-7, *n* = 9)	6.0 (*range* 5-7, *n* = 10)
Writing notes in Oiva	3.0 (*range* 2-7, *n* = 6)	3.5 (*range* 1-6, *n* = 6)
Favorites	4.0 (*range* 3-7, *n* = 9)	5.0 (*range* 2-6, *n* = 8)
Reminders	5.0 (*range* 2-5, *n* = 8)	4.0 (*range* 1-6, *n* = 6)
Showing progress	6.0 (*range* 4-6, *n* = 9)	6.0 (*range* 4-7, *n* = 10)
Guidance	6.0 (*range* 3-7, *n* = 9)	5.0 (*range* 4-7, *n* = 10)

Perceived benefits

Participants (12/19, 63,2%; men 5/9, 55,5%; women 7/10, 70%) reported in general that Oiva had helped them learn new things, or that they had even had a-ha moments while using Oiva (13/19, 68,4%; men 6/9, 66,6%; women 7/10, 70%). The participants (15/18, 83,3%; men 7/8, 87,5%; women 8/10, 80%) also rated Oiva's content useful.

The participants were asked to rate the four different intervention modules (i.e. "paths") according to how beneficial they considered them to be. All the median ratings of the different paths were above the midpoint of 4.0 among men and women. The highest median rating among men was 6.0 (*Mindful Mind* (*range* 2-7), *Wise Mind* (*range* 2-6)) and lowest 5.0 (*Values* (*range* 2-6), *Healthy Body* (*range* 3-7)). The median rating among women was 6.0 for each path (*Mindful Mind, Wise Mind* and *Values* (*range* 1-7)*, Healthy Body* (*range* 2-7)). The participants were also asked to rate the different skills they felt they had learned using Oiva. The median ratings for men and women regarding the skills learned with the help of Oiva are presented in Table 2.

Table 2. Median ratings for the skills men and women felt they had learned while using Oiva

Skills learned	Median	
	Men	Women
Contact with the present moment	5.0 (*range* 2-7, *n* = 9)	6.0 (*range* 1-7, *n* = 10)
Observing one's inner experiences	5.0 (*range* 2-7, *n* = 9)	5.5 (*range* 1-7, *n* = 10)
Not getting caught up in thoughts	5.0 (*range* 2-7, *n* = 9)	5.0 (*range* 1-7, *n* = 10)
Accepting thoughts and feelings	5.0 (*range* 2-7, *n* = 9)	5.0 (*range* 1-7, *n* = 10)
Clarifying one's own values	4.0 (*range* 2-6, *n* = 9)	5.0 (*range* 2-6, *n* = 10)
Acting in accordance with one's own values	5.0 (*range* 2-7, *n* = 9)	5.0 (*range* 2-7, *n* = 10)

User acceptance

The participants were asked to rate Oiva in general (*"What grade would you give to Oiva?")*. The median rating was 5.0 among both men (*range* 2-7, *n* = 9) and women (*range* 1-6, *n* = 10). The median ratings for how interesting the participants considered Oiva were above the midpoint of 4.0 among both men (*n* = 9, *Md* = 5.0, *range* 3-7); and women (*n* =10, *Md* = 6.0, *range* 1-7). The median ratings for the statement *"I would like to continue using Oiva"* were also above the midpoint, 5.0 for men (*range* 1-7, *n* = 9) and 4.5 for women (*range* 1-7, *n* = 10). In addition, the median ratings for the statement *"I would recommend Oiva to others"* were above the midpoint of 4.0 among male (*n* = 8, *Md* = 6.0, *range* 3-7) and female (*n* = 10, *Md* = 5.5, *range* 1-7) participants.

The content of Oiva was reported to be generally understandable, 88,8% (8/9) of men and 70% (7/10) of women rated the statement "*Oiva's content is understandable*" above the midpoint of 4.0. When participants (men *n* = 9, women *n* = 6) were asked to rate the statement *"Oiva should give more feedback*", 77,7% (7/9) of men and 83,4% (5/6) of women reported they would have preferred more feedback, i.e. their ratings were above the midpoint of 4.0. Regarding the graphic design of Oiva, 66,6% (6/9) of men and 60% (6/10) women rated Oiva as attractive and 88,9% (8/9) of male and 70% (7/10) of female participants rated Oiva's design to be pleasant.

Trustworthiness and reliability of Oiva App

The male and female participants' median ratings of the statements: "*Oiva has helped me to sustain and improve my personal well-being*", "*Oiva has helped me to achieve my goals related to well-*

being", "*Oiva works reliably*", "*I trust the information and instructions of Oiva*" and "*Oiva feels like personal companion"* are presented in detail below in Table 3.

Table 3. Median ratings regarding trustworthiness and reliability of Oiva App for male and female participants

	Median	
	Men	Women
Sustaining and improving well-being	3.0 (*range* 1-6, *n* = 8)	5.0 (*range* 1-7, *n* = 10)
Achieving goals related to well-being	2.0 (*range* 1-5, *n* = 8)	4.0 (*range* 1-7, *n* = 10)
Oiva works reliably	6.0 (*range* 5-7, *n* = 9)	6.0 (*range* 3-7, *n* = 9)
Trust in information and instructions	6.0 (*range* 4-7, *n* = 9)	6.0 (*range* 2-7, *n* = 10)
Oiva as personal companion	4.0 (*range* 2-6, *n* = 9)	3.5 (*range* 2-6, *n* = 10)

Gender differences in Oiva's effect on the participants' mental well-being

Table 4 presents the mean scores of male and female participants on the Perceived stress scale (PSS), the emotional well-being scale of RAND-36, the Acceptance and Action Questionnaire (AAQ-II) and the Five Facet Mindfulness Questionnaire (FFMQ) presented in the methods section. While analyzing pre-, post- and follow-up measurements of men and women, repeated-measures ANOVA was used (detailed information below) and the level of statistical significance was set at $p < 0.05$. The change from pre to post while using Oiva App during the mobile intervention was statistically significant for the whole group ($N = 20$) in PSS and RAND-36 (emotional well-being) and (according to additional analysis) between post and follow-up measurements in AAQ-II.

Table 4. Mean scores for men (*n* = 10) and women (*n* = 10) in PSS, AAQ-II, FFMQ, RAND-36 questionnaires before and after mobile intervention

	Mean			
	Before		After	
	Men	Women	Men	Women
PSS	27.40	25.90	23.80	22.80
AAQ-II	22.10	20.40	20.50	20.20
FFMQ	127.10	132.90	126.10	137.40
RAND (emotional well-being)	51.60	54.40	59.60	64.00

Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated (PSS $\chi^2(2)=13.7$, $p = .001$; RAND-36 emotional well-being $\chi^2(2)=10.7$, $p = .005$), and the degrees of freedom were therefore corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = 0.64$) for PSS and Huynh-Feldt estimates of sphericity ($\varepsilon = 0.759$) for RAND-36. Tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk) also indicated that the assumption of normality had slightly been violated. The results of the repeated measures ANOVA indicated that there was a statistically significant main effect of time on PSS scores ($F(1.288, 23.177) = 4.255$, $p = .042$; $\eta_p^2 = .191$) and of time on RAND-36 emotional well-being scores ($F(1.518, 27.330) = 5.984$, $p = .012$; $\eta_p^2 = .249$). This means that there was a significant change in the participants' (N=20) ratings of stress and mental well-being. Pairwise contrasts indicated that the change was statistically significant between *pre and post intervention* measurements (PSS $F(1,18) = 5.171$, $p = .035$, $\eta_p^2 = .223$; RAND-36 emotional well-being $F(1, 18) = 9.659$, $p = .006$; $\eta_p^2 = .349$) but not between post- and follow-up measurements.

The interaction between gender and change in the participants' mental well-being was not statistically significant, nor was there a statistically significant change or gender difference in the change regarding mindfulness skills (FFMQ total score) or psychological flexibility (AAQ-II).

The Mann-Whitney U-test performed on the pre to post change scores of psychological measures of well-being indicated that there was no statistically significant gender difference in these scores.

Since there were four outliers in the follow-up psychological measurement scores, additional analysis was also conducted. After imputing a reasonable value for the detected outliers the results of the repeated measures ANOVA were as follows: Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated (PSS $\chi^2(2)=4.85$, $p = .088$; RAND-36 emotional well-being $\chi^2(2)=6.11$, $p = .047$), therefore the degrees of freedom were corrected using Huynh-Feldt estimates of sphericity for PSS ($\varepsilon = 0.916$) and RAND-36 ($\varepsilon = 0.872$). Tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk) also indicated that the assumption of normality had slightly been violated. The results of the repeated measures ANOVA indicated that there was a statistically significant main effect of time on PSS scores ($F(1.832, 32.979) = 8.221$, $p = .002$; $\eta_p^2 = .314$), on RAND-36 emotional well-being scores ($F(1.745, 31.409) = 8.839$, $p = .001$; $\eta_p^2 = .329$) and on AAQ-II scores ($F(2, 36) = 5.090$, $p = .011$; $\eta_p^2 = .220$). This means that there was a significant change in the participants' ($N = 20$) ratings of stress, mental well-being and psychological flexibility. Pairwise contrasts indicated that the change was statistically significant between *pre and post intervention* measurements in PSS ($F(1,18) = 5.171$, $p = .035$, $\eta_p^2 = .223$) and RAND-36 emotional well-being ($F(1, 18) = 9.659$, $p = .006$; $\eta_p^2 = .349$), and between *post and follow-up* measurements in AAQ-II ($F(1,18) = 7.107$, $p = .016$, $\eta_p^2 = .283$). The interaction between

gender and change in the participants' mental well-being was not statistically significant, nor was there a statistically significant change or gender difference in the change regarding mindfulness skills (FFMQ total score).

DISCUSSION

Principal results and comparison with prior work

The current study examined gender differences in usage and user experience of a mobile wellness app called Oiva. The detailed study objectives were: 1) to study gender differences in the use of Oiva App, 2) to explore gender differences in the user experience of Oiva App and its functionalities, 3) to investigate gender differences in the effect of Oiva App on the participants' mental well-being.

The results indicated that men and women used and experienced the Oiva App and it's functionalities in a similar way. There was no statistically significant gender difference in the usage data from the log files or in the online questionnaire answers regarding usage and user experience of the Oiva App. The results also suggested that the intervention had a positive effect on the participants' mental well-being and that the effect was similar among men and women. There was a statistically significant change from *pre to post* intervention in PSS (psychological distress) and RAND-36 (emotional well-being) and between *post and follow-up* measurements in AAQ-II. The change in mental well-being did not differ statistically significantly across gender. No statistically significant change or gender difference was found in FFMQ (mindfulness skills).

Ahtinen et al. (2013) found no change in psychological flexibility in a preliminary study regarding the feasibility of Oiva App, and interpreted this to be possibly due to a short study period (one month) which does not allow sufficient time for such fundamental psychological processes to change. Although in study of Ly et al. (2012) changes in psychological flexibility were statistically significant after a one month mobile wellness intervention concentrating specifically on values and valued actions, which indicates, as Ahtinen et al. (2013) also mentioned, that a more specific intervention could work better in short time period. The fact, that there was no change in life satisfaction in the study of Ly et al. (2012) also indicates that interventions should be longer to induce change in many areas of mental well-being simultaneously, as seen in the current two month study. Although 50% of male and 70% of female participants of the current study commented that the intervention should have been longer than two months and that they (60% of male and 50% of female participants) would have preferred to continue using the Oiva App after the intervention, indicating that their practicing process with the Oiva App was not altogether finished. In the current study the mobile intervention delivered via Oiva lasted two months, which seems to have induced more change in mental well-being than the one month mobile intervention in a preliminary study regarding the feasibility and design implications of the Oiva App reported by Ahtinen et al. (2013).

Nevertheless, this need for a longer study period and the participants' willingness to continue ACT-based exercising with Oiva may be related to the results regarding mindfulness skills (FFMQ).

There is a need to improve people's psychological well-being to combat the non-fatal burden of disease related to mental health and substance abuse problems (Whiteford et al., 2013) as well as stress-related more fatal conditions, such as obesity, metabolic syndrome and cardiovascular disease (Eckel et al., 2005; Lundberg, 2005; Spatola et al., 2014). The results of the current study are in line with previous research (Lappalainen et al., 2013; Ly, Asplund, & Andersson, 2014; Ly, Dahl, Carlbring, & Andersson, 2012; Morris et al., 2010), suggesting that it is possible to positively affect psychological well-being by using mobile wellness interventions. Previous research has also indicated that gender is an important demographic to consider when designing effective, tailored technology interventions (Adibi, 2015; Oinas-Kukkonen & Harjumaa, 2009; Orji et al., 2013; Orji, 2014) but, despite this need, gender differences is still an understudied topic in the field of technology interventions (Perle et al., 2011; Zhang et al., 2014). To the best of my knowledge, this is the first study to investigate gender differences in usage and user experience of a mobile mental wellness app. The results of the current study indicate that the design of the Oiva App is gender-sensitive enough, since there was no gender difference in usage and user experience of the app, and the effect on mental well-being was similar across gender.

Previous studies have indicated that men are less likely than women to seek help for their health problems, especially emotional or mental health problems (Clarke et al., 2007; Galdas, Cheater, & Marshall, 2005b; Möller-Leimkühler, 2002; O'Brien et al., 2005; Oliver, Pearson, Coe, & Gunnell, 2005). Interestingly, the initial study population (N = 298), i.e. the volunteer participants who took part in the interventions of the randomized controlled trial (Lappalainen et al., 2014) also consisted of only 48 men versus 250 women. This could be interpreted to represent a typical gender difference in seeking help for health and mental health problems, in this case problems related to mental wellness (i.e. psychological distress) or metabolic syndrome risk factors. Despite the male/ female ratio of the initial study population, there was, however, no statistically significant gender difference found in the results of the current study (n = 20). Men and women were, for example, equally willing to use Oiva, and they also considered Oiva's content to be equally beneficial to them. Regarding the graphic design of Oiva both men and women considered Oiva attractive and Oiva's design pleasant. Male and female participants also reported that they would like to continue using Oiva App after the intervention and that they would recommend Oiva to others. Could this be seen as equal willingness to seek and receive help in the mobile intervention context? Proudfoot et al. (2010) did not, for example, find any gender difference among those interested in using the mobile phone for mental health monitoring and self-management. Does this also imply, that mobile

technology could indeed act as a change agent in altering the health consequences arising from the distinct gender roles, norms, values and behaviors of men and women (Adibi, 2015; Bates et al., 2009; Courtenay, 2000; O'Brien et al., 2005; Pinkhasov et al., 2010) by making help-seeking attractive for men as well. According to a review article by Clarke et al. (2007) men seem to consider anonymous Internet groups and cellphone text messaging to be more acceptable for seeking help for problems such as, for example, substance abuse or depression. Previous research also indicates that men have higher mHealth adoption intention than women (Zhang et al., 2014), and that mHealth app users also skew male (Malvey & Slovensky, 2014). This could indicate that men are indeed motivated to seek and receive help anonymously via mobile technology and that the gender differences in help-seeking behavior become visible only in situations where contacting a live person and revealing one's identity is required, as in the recruitment phase of the randomized controlled trial (Lappalainen et al., 2014). By default, smartphone applications provide greater anonymity and reduce stigma related to mental health problems (Aggarwal, 2012; Morris, 2010; Oliver et al., 2005), which may, as such, lead to higher rates of treatment-seeking behavior (Aggarwal, 2012). The results of the current study are generalizable only to the Oiva App, but this is nevertheless an important preliminary study on this topic, because gender, and especially different health behavior patterns of men and women, are important variables in determining longevity and healthy life expectancy (Courtenay, 2000; Mahalik & Burns, 2011; Salomon et al., 2012; Salzman & Wender, 2006; Wang et al., 2012), and thus also important factors to consider when designing effective mobile applications for health and wellness (Adibi, 2015; Oinas-Kukkonen & Harjumaa, 2009; Orji et al., 2013; Orji, 2014).

Limitations of the current study and future work

This study has several limitations. First of all, the number of participants (n = 20) was small, affecting the ability to generalize the results of the study, which are, therefore, only generalizable to the Oiva App. Additionally, the male/ female ratio (n = 48/ 250) of the initial study population of the RCT by Lappalainen et al. (2014) affected the small sample size of this study, as only 12 men were randomized to the mobile intervention group and, as a result of one male participant dropping out of the study and another being dismissed due to the omission of most of the questions in the online usage and user experience questionnaire, only 10 male participants were left. In future studies, samples should be gender-balanced to avoid such bias leading to small sample sizes. Due to the small sample size of the current study and the correction of the outliers in follow-up scores, the results regarding the effect of the mobile intervention on the participants' mental well-being should also be interpreted with caution. In addition, the results regarding mindfulness skills (FFMQ) may

also be related to the participants' need for a longer study period in order to continue ACT-based exercises with Oiva, as discussed above. It seems that in future studies the study periods should be even longer to allow investigation of change in many areas of mental well-being simultaneously.

Second, the study participants were recruited on a volunteer basis (they responded to an advertisement in local newspaper), so the participants of this study may have been especially well motivated to take care of their mental well-being and this must be taken into account when interpreting the results. Approximately half of the participants (10/19, 52,6%; men 5/10, 50%; women 5/9, 55,5%) were also familiar to some extent with the content of Oiva (i.e. topics covered by the Oiva App). It is thus possible that, for example, the male participants did not fully represent the average attitudes of men towards mobile mental wellness apps and this, in addition to the small sample size, may have affected the fact that gender differences in usage and user experience of Oiva App or in the effect of the intervention on mental well-being did not come up in this study. On the other hand, in spite of their small number, the participants represented a wide range of educational backgrounds from high school to Master's degree level and the age range was also quite wide, 33-55 for men and 34-54 for women, which makes the sample of participants quite representative, even on a small scale.

Finally, the participants were given android smartphones with a pre-installed Oiva App and most of the participants were not using Oiva on their own phones or did not insert their own SIM card into the phone on which Oiva was installed. In other words, the participants had an additional phone with the Oiva App installed and almost all were thus required to carry two phones in order to engage in mobile use of Oiva, and this may have affected the usage patterns observed in the current study. It has also been pointed out that carrying two phones may also attract unwanted attention and affect the therapeutic potential of mobile interventions in a negative way (Seko et al., 2014). Future studies should test wellness applications on mobile phones already owned by study participants in order to avoid this limitation.

Conclusion

To the best of my knowledge, this is the first study to investigate gender differences in usage and user experience of a mobile mental wellness app. Although there are several limitations in this study and the results are generalizable only to the Oiva App, this is, nevertheless, an important preliminary study on this topic, because gender, and especially different health behavior patterns of men and women, are important variables in determining longevity and healthy life expectancy (Courtenay, 2000; Mahalik & Burns, 2011; Salomon et al., 2012; Salzman & Wender, 2006; Wang et al., 2012), and thus, also important factors to consider when designing effective mobile

applications for health and wellness (Oinas-Kukkonen & Harjumaa, 2009; Orji et al., 2013; Orji, 2014; Perle et al., 2011). The results of the current study indicate that the design of the Oiva App is sufficiently gender-sensitive, as there was no gender difference in usage and user experience of the app, and the effect on mental well-being was similar across gender.

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