EVALUATION OF AN mHEALTH APP: A PILOT TRIAL OF 'DESTRESSIFY' ON UNIVERSITY STUDENT MENTAL HEALTH

by

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BSc (Hons), Queen's University, 2014

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

THE COLLEGE OF GRADUATE STUDIES

(Interdisciplinary Studies)

THE UNIVERSITY OF BRITISH COLUMBIA

(Okanagan)

September 2017

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EVALUATION OF AN mHEALTH APP: A PILOT TRIAL OF 'DESTRESSIFY' ON UNIVERSITY STUDENT MENTAL HEALTH

submitted by Rebecca Lee in partial fulfillment of the requirements of

the degree of Master of Science in Interdisciplinary Studies.

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Abstract

Background: One in five Canadians experience mental health issues with university students showing significantly higher rates of mental health problems than the general public. Current university support services are limited by factors such as available staff and finances, and social stigma has frequently been identified as an additional barrier that prevents students from accessing these resources. Mobile health (mHealth) apps are one form of alternative health support that is discrete and accessible to students, and while they are recognized as a promising alternative, there is limited research demonstrating their efficacy.

Objective: To evaluate a mindfulness-based app's ("DeStressify") efficacy on stress, anxiety, depressive symptomology, sleep behaviour, work/class absenteeism, work/school productivity, and quality of life among university students.

Methods: Full-time undergraduate students at a Canadian university with smartphones and internet access were recruited through in-class announcements and on-campus posters. Participants randomized into an experimental condition were given and instructed to use the Destressify app five days a week for four weeks. Control condition participants were wait-listed. All participants completed pre- and post-intervention online surveys to self-assess stress, anxiety, depressive symptomatology, sleep quality, and health-related quality of life.

Results: 206 responses were collected at baseline with 163 participants completing the study (86 control, 77 experimental). Using Destressify was shown to reduce trait anxiety ($P = .005$) and improve general health ($P = .001$), energy ($P = .005$), and emotional wellbeing ($P = .005$) in university students, and more participants than expected by chance in the experimental condition believed their productivity improved between baseline and post-intervention measurements ($P =$

.01). The app did not significantly improve stress, state anxiety, physical and social functioning, role limitations due to physical or emotional health problems, or pain ($P > .05$).

Conclusions: Mindfulness-based apps may provide an effective alternative support for university student mental health. Universities and other institutions may benefit from promoting the use of Destressify or other mindfulness-based mHealth apps among students who are interested in methods of anxiety management or mindfulness-based self-driven health support. Future steps include examining Destressify and similar mHealth apps over a longer time period and in university staff and faculty.

Preface

This manuscript is the collaborative work of Ms. Rebecca Lee and Dr. Mary Jung. Ms. Lee was responsible for recruitment, data collection, data analysis, and drafting the manuscript. Dr. Jung provided supervision, methodological guidance, and manuscript revisions. All procedures identified within this manuscript have been approved by the University of British Columbia Office of Research Services Behavioural Research Ethics Board (#H15-02581-A001).

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List of Abbreviations

Abbreviation	Term
ADD	Attention Deficit Disorder
ADHD	Attention Deficit Hyperactivity Disorder
ANOVA	Analysis of variance
ANCOVA	Analysis of Covariance
App(s)	Mobile phone application(s)
ArtSci	Arts and Sciences
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
GPA	Grade point average
G*Power	G*Power statistical power analysis software
IBM SPSS Statistics v23	IBM Statistical Package for the Social Sciences version 23
MANCOVA	Multivariate analysis of covariance
MBSR	Mindfulness-based stress reduction
mHealth	Mobile health
OCD	Obsessive Compulsive Disorder
PSQI	Pittsburg Sleep Quality Index
PSS	Cohen Perceived Stress Scale
PTSD	Post-Traumatic Stress Disorder
QIDS-SR	Quick Inventory of Depressive Symptomatology Self-Report
RAND 36-Item Health Survey	
Physfunct	Physical functioning
Physlim	Role limitations due to physical health
Emolim	Role limitations due to emotional health
Fatigue	Energy/fatigue
Emowell	Emotional well-being
Socialfunct	Social functioning
Pain	Pain
Genhealth	General health
STAI	State-Trait Anxiety Inventory for Adults
STAI state	State-Trait Anxiety Inventory for Adults – state anxiety
STAI trait	State-Trait Anxiety Inventory for Adults – trait anxiety
UBC	University of British Columbia
WHO	World Health Organization
WPAI	Work Productivity and Activity Impairment Questionnaire: General Health v2.0
WPAI activimpair	Percent activity impairment due to health
WPAI impairedtime	Percent impairment while working due to health
WPAI missedtime	Percent work missed due to health
WPAI overallworkimpair	Percent overall work impairment due to health

Acknowledgements

Thank you to my supervisor and the fierce leader of HEPL, Dr. Mary Jung. I would not be where I am today if not for your guidance and leadership. You have made this an unforgettable journey and I have learnt so much – both academically and personally – by working with you.

To everyone who I have met through Residence Life: it has been the most humbling experience to work with such enthusiastic, energetic, and compassionate people. You have all taught me so much about the power of listening and the importance of putting the needs of others first.

Thank you to my lab-mates and the graduate students at UBCO. I valued every conversation and interaction I've had with you all. Those small interactions are what make a campus a community.

Lastly to my parents, Jennifer and Kin Lee. You have taught me resilience, love, patience, and persistence. I am thankful every day to have grown up under your love and support and to be given the opportunity to pursue my passion. Without you, there is no me (literally and figuratively).

Chapter 1: Introduction

In the fourth year of my undergraduate degree, I was working as a staff member in a university residence building. One night during the winter exam period, I was walking through the halls and could hear heavy sobbing coming from one resident's room. After some time of talking through the door and trying to determine why she was so upset, the resident eventually let me in to her room. We talked into the early hours of the morning, and I learnt in that conversation that she lived with depression and anxiety and the stress of school often made it difficult for her to manage these mental health issues. However, she was adamant about keeping her diagnoses and struggles a secret from her classmates, fellow residents, and family members, out of fear of how it may affect her relationships and cause her family to interfere with her recently-gained independence. She had a prescription for medication but did not want to be dependent on drugs or pay the associated fees, and her fear of having others know about her mental health issues prevented her from seeking counselling and other resources. She was also concerned about the time commitment of certain support programs, since she didn't want to spend the majority of her free time away from friends and miss the "classic university experience." I quickly worked my way through the list of resources that the university offered to students with mental health issues, and our conversation eventually came to a point where I was simply providing a shoulder on which to cry and an ear to listen. I so badly wanted to find a solution that was of interest to the resident and effective at addressing her issues, but there were none that addressed all of her concerns. When she moved out of residence at the end of the year, she was still searching for ways to manage her mental health issues.

The importance of mental health

The term "health" can be difficult to describe as it relates to so many aspects of our lives. According to the World Health Organization (WHO), health can be defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 2005). However, there have been arguments made that this definition is outdated and that a more appropriate definition be adopted. Recently, views on health have taken on a more dynamic perspective and it is suggested that health now be described as "the ability to adapt and to self-manage in the face of social, physical, and emotional challenges" (Huber et al., 2011). Both definitions suggest that health is divided into three different components, which could be described as physical, mental, and social. However, the new definition focuses on a person's abilities to manage these components rather than a person's state of these components. This change in focus from evaluating a person's state to a person's abilities suggests that the healthiest people are in fact the ones who are equipped and have the skills to manage their health and the challenges that may arise. Despite this change in definition, physical fitness is often what comes to mind when people think of the term "health", but it is not the only thing that contributes to a healthy life. Mental health is another important component of health that should be attended to as carefully as physical health, and interest in the matter has been increasing in recent years (Sturgis, 2013). The WHO has proposed that financial support and human resources be invested towards improving the protection and promotion of mental health, and everyone from researchers to businesses to governments are now starting to direct their attention towards this matter (World Health Organization, 2003).

Physical, mental, and social health are arguably intertwined, and poor mental health can negatively impact a person's physical and social well-being. For example, nearly 17% of young

Canadians aged 14 to 24 years identified as having previously self-harmed, where participants who reported many depression symptoms, attention regulation issues, impulsivity, and activity were more likely to report self-harming themselves than other participants (Nixon, Cloutier, & Jansson, 2008). Similar results were found in a study examining self-harm in college students, where students who engaged in non-suicidal self-injury also reported greater difficulties in emotional regulation than a control group (Heath, Toste, Nedecheva, & Charlebois, 2008). Mental health also impacts the workplace; a recent survey by Morneau Shepell (2015) indicates that 90% of working Canadians believe that managing their mental wellness is important to their workplace productivity. A mentally healthy workplace is also believed to be important for employee attraction, retention, loyalty, and meeting business needs (Morneau Shepell, 2015). Productivity measures from a study by Hilton and colleagues (2009) show that employees with untreated high psychological distress were the least productive employees compared to those with either moderate or low psychological distress or high psychological distress but had received treatment. What's more, the productivity levels of highly distressed employees who had received treatment were similar to the productivity level of employees with low psychological distress (Hilton et al., 2009), demonstrating that it is possible for people to manage or mitigate the negative impact that their distress can have on their lives. These studies highlight only a few of the ways in which a person's mental health can impact other areas of their lives. Learning to manage mental health challenges through methods such as counselling or therapy has been shown to yield improvements in measurements of anxiety, depression, stress, and self-esteem (Cooper & Cartwright, 1994; Cooper, Murray, Wilson, & Romaniuk, 2003; Sharif & Armitage, 2004; Sheard & Maguire, 1999). These examples also demonstrate how the ability to adapt to mental health challenges can lead a person to be healthier, thus supporting the definition of

health by Huber and colleagues (2011). With physical and social health being so clearly impacted by mental health, we should focus on supporting the improvement and maintenance of a person's mental well-being.

As demonstrated above, being healthy plays an important role in the daily functioning of a person's life, and mental health is a crucial component of this overall health. It is therefore important for people to have the skills and resources available to them to help them in achieving a healthy mental state. Young adults are at a particularly influential age and it is during these years that a person could introduce and develop new habits that will help them to maintain and manage their mental health. As young adults transition into more independent lives, many head to university, college, or other post-secondary institutions. These institutions can be great places to provide them with useful resources that can help them in developing healthy behaviours. Knowing that one in five Canadians will experience a mental health disorder (Smetanin et al., 2011), it is understandable that further attention and research towards improving mental health resources would be highly valued - particularly at colleges or universities. Canadians aged 15 to 24 years are most at risk for a mood disorder (Statistics Canada, 2013) and university students have shown significantly higher rates of mental health problems than the general public (Stallman, 2010). There is also a large amount of evidence that supports the notion that mental health and academic success are correlated (Brackney & Karabenick, 1995; Dix, Slee, Lawson, & Keeves, 2012; Kessler, Foster, Saunders, & Stang, 1995; Stallman, 2010; Weitzman, 2004). Many Canadian post-secondary institutions have incorporated mental health into their strategic plans with varying degrees of specificity regarding how they will support student mental health (Brescia University College, n.d.; University of Alberta Institutional Strategic Planning Advisory Committee, 2016; University of Regina, n.d.; University of Waterloo, n.d.). It is becoming a

more frequently discussed topic among universities, and people - whether students, staff, faculty, or community members - are in need and looking to find ways in which they can further support the mental health needs of themselves and their communities.

General purpose of research

The study presented in this thesis evaluates an alternative method of providing mental health support to university students. Specifically, the study contributes information regarding the effectiveness of a mindfulness-based mental health mobile phone application (app) at helping university students manage stress, anxiety, and related struggles. The study will be among the first to provide empirical evidence regarding the effectiveness for this alternative resource, with implications for counselling center directors, university students, and individuals seeking alternative mental health support resources.

Overview of contents

A review of the literature concerning mental health, mindfulness, and mobile health apps is first presented in chapter 2. This is then followed by chapter 3, a manuscript-styled presentation of the study's methods, measurements, and general discussion in the format specific to the peer-reviewed journal to which it was submitted. Chapter 4 then discusses how the findings relate to the present literature, study limitations, suggestions for future research, and implications for universities and how the findings may be used to promote evidence-based supports within these communities. A copy of the baseline and post-intervention surveys are available in the Appendices.

Guiding note

The burden of stress, depression, anxiety, and other related disorders can be heavy and it is not guaranteed that a person who is struggling will be willing to let other people know about their struggles. Some people will confide in friends or family and look to them for support, while others will remain quiet and choose to find resources on their own. Some people will choose to do nothing at all. This research is conducted with the hope that it will contribute to the development of resources that will help people who are experiencing mental health concerns but not engaging with any support. For me, I immediately think about the resident whom I supported years ago, and I personally hope that this research will help her and other students who are struggling on their own.

Chapter 2: Literature Review

Prevalence of mental health issues in Canada and university campuses

One in five Canadians experience a mental health issue, with those aged 14 to 24 years most at risk of experiencing a mood disorder (Mental Health Commission of Canada, n.d.; Smetanin et al., 2011; Statistics Canada, 2013). Approximately 4.9 million Canadians aged 15 years or older perceive a need for mental health care, yet a third of these individuals do not believe that their needs are met (Statistics Canada, 2013). When seeking help, individuals turn to both formal and informal support, with Canadians being more than twice as likely to use informal supports as they are to use formal supports (Findlay & Sunderland, 2014). However, the majority of young Canadians (ages 15 to 24 years) do not seek any help at all for managing mental health issues (Findlay & Sunderland, 2014). Reasons for not seeking help have been widely discussed in the literature and are reviewed below. With so many individuals at risk, Canadian universities are an ideal area to target for treating mental health issues, as there are over two million students enrolled at Canadian post-secondary institutions (Statistics Canada, 2016) with many of these students between the ages of 15 to 24 years.

University students have higher rates of mental health concerns than the general public (Robinson, Jubenville, Renny, & Cairns, 2016; Stallman, 2010), and current services are not meeting student needs. Wait-list issues and funding concerns are listed among necessary improvements for Canadian post-secondary counselling services, with people having to wait up to 6 months for individual treatment at some institutions (Crozier & Willihnganz, 2005; Ryerson University Center for Student Development & Counselling, n.d.). In addition to the increase in demand for counselling services, post-secondary institutions have also seen student needs shifting from "benign developmental and informational needs" to psychological issues (Kitzrow,

2003, p. 168). An Australian-based survey examining student psychological distress found that more than four in five of today's university students experience elevated distress levels, with the majority of these students reporting symptoms suggesting moderate mental illness (Stallman, 2010). However, the focus of student needs is not the only thing that has changed. A cross-temporal meta-analysis of attitudes towards seeking mental health support revealed that from 1968 to 2008, attitudes among university students "have become increasingly negative over time" (Mackenzie, Erickson, Deane, & Wright, 2014, p. 99). The researchers who conducted the meta-analysis suggest that this negativity towards seeking help may be a result of an increase in the level of stress that is considered acceptable in a standard or normal life (Mackenzie et al., 2014). Although these elevated stress levels at university may seem normal to students, there is burgeoning research suggesting that such levels of stress are of concern to the well-being in university students.

Stress, depression, and anxiety within universities

Studying at university can understandably be stressful for students. Sutherland and Cooper (1990) define stress as being an "imbalance between perceived demand and perceived ability to meet that demand" (p. 19). Stress can then be divided into two different groups: acute or chronic. While the research related to acute and chronic stress fail to provide consistent definitions of the two domains, the two can generally be distinguished from one another in that acute stress is associated with specific life events such as writing certification exams or losing a job while chronic stress results from ongoing difficulties such as relationship conflicts or "social disadvantages" (e.g. racial discrimination) (Hammen, Kim, Eberhart, & Brennan, 2009, p. 719; McGonagle & Kessler, 1990). McGonagle and Kessler (1990) differentiate the two by

identifying acute stress as having existed for less than a year and chronic stress as having existed for longer than a year. Depending on the situations that students may find themselves in, they may experience acute or chronic stress. Although stress is unavoidable, neither acute nor chronic stress are inherently bad; they can be used for motivation and personal development. However, unmanageable stress can be harmful to a person, and students are not necessarily capable or prepared to manage the unique stressors of university – particularly when they have not experienced these stressors previously.

For many people, transitioning in to university is accompanied by significant life changes. Indeed, Brougham, Zail, Mendoza, and Miller (2009) found student stressors to include academics, familial relationships, finances, and social relationships. For example, samples of stressors reported by respondents to a college-based survey included choosing a major, having to pay bills, and difficulties with roommates (Brougham et al., 2009). These stressors are experienced for the first time by many people when they move away from home and high school and into university and shared housing. Additionally, students experience heightened stress during midterms and finals, with positive affect being lowest in the final week of term (Wang et al., 2014). Even when considering the complete term, students experience a concerning level of stress. The majority of students at a Canadian university (57%) reported feeling higher than average or tremendous levels of stress (University of Alberta Wellness Services, 2011), and 15.6% of undergraduates and 13% of graduates at a large mid-western university screened positive for a depressive or anxiety disorder (Eisenberg, Gollust, Golberstein, & Hefner, 2007b).

Numerous studies have found various determinants of experiencing and coping with stress within student populations. Gender and degree status are two factors consistently shown to influence stress levels in students; with college women experiencing more stress than college

men (Dixon & Robinson Kurpius, 2008; Pierceall & Keim, 2007), and first- and second-year students experiencing more stress than students in other years of study (Bayram & Bilgel, 2008; Brougham et al., 2009). Students, particularly women, are more likely to cope with stress by using emotion-focused strategies such as "expressing emotion or adjusting expectations" rather than problem-focused strategies which involve behavioural actions and planning (Brougham et al., 2009, p. 86). However, college men were found to use both adaptive and maladaptive strategies while college women were found to use maladaptive strategies (Brougham et al., 2009). It is suggested that opportunities be available for students to build more adaptive emotion-focused coping skills (Brougham et al., 2009). It has also been suggested that a greater sense of self-worth may be a protective factor for student vulnerability to stressful events and that maintaining positive self-esteem may help students cope with perceived stress (Dixon & Robinson Kurpius, 2008). The impacts of stress are far-reaching: life stress is a strong predictor of risky health behaviours including increased drug and alcohol use, sexual activity, and sleep problems, and lack of vigorous exercise and strength training (Doom & Haeffel, 2013).

College stress is also related to other mental health concerns such as depression (Dixon & Robinson Kurpius, 2008), which in and of itself is associated with maladaptive health behaviours (Allgöwer, Wardle, & Steptoe, 2001). The defining characteristics of depression depend on the specific type of depressive disorder; many studies that evaluate depression measure Major Depressive Disorder, which "is characterized by one or more Major Depressive Episodes without a history of Manic, Mixed, or Hypomanic Episodes" (American Psychiatric Association, 2000, p. 369). In a report based off the Canadian Community Health Survey, the most common type of mood disorder experienced by Canadians ages 15 years and older was a major depressive episode (Statistics Canada, 2013). Similar findings were observed by Robinson and colleagues

(2016), who found depression to be the second most prevalent mental health concern identified by Canadian university students. According to a survey completed by college students ages 18 to 23 years, gender, self-esteem and mattering were predictive of depression with self-esteem and mattering being negatively correlated with depression and women experiencing higher levels of depression than men (Dixon & Robinson Kurpius, 2008). Mattering, as defined by Rosenberg and McCollough (1981), is the feeling that others are interested in and care about oneself. Additionally, students with financial struggles were more likely to screen positive for depressive or anxiety disorders than students without financial struggles (Eisenberg et al., 2007b). Higher scores of depression were also associated with being in first- and second-year and coming from poor families or rural backgrounds (Bayram & Bilgel, 2008). Students with depression missed more classes, assignments, exams, and social activities and dropped more courses than students who were not depressed (Hysenbegasi, Hass, & Rowland, 2005). This behaviour may be part of the reason as to why diagnosed depression was associated with a decrease of 0.49 points in student grade-point average while treatment was associated with a protection of 0.44 points (Hysenbegasi et al., 2005). In addition to its association with poorer academic performance, Doom and Haeffel (2013) suggest that depression may increase an individual's risk of experiencing a range of health problems or engaging in poor health behaviours. Examples of the health problems that were assessed are diabetes, back pain, hypertension, and migraine headaches. Depression rates among university students seems to be climbing, with recent reports finding depression scores to be higher than data from earlier studies (Bayram & Bilgel, 2008). Severity has shifted from normal to mild, with nearly half of all students experiencing between mild to extremely severe depression (Bayram & Bilgel, 2008). Providing support to students during their years at university may help to address the prevalence of depression among

university students and result in campuses with noticeably improved student academics and physical health.

In addition to stress and depression, anxiety is another concern for university students. Anxiety disorders include generalized anxiety disorder, which is "characterized by at least 6 months of persistent and excessive anxiety and worry", agoraphobia, defined as anxiety about "places or situations from which escape might be difficult (or embarrassing) or in which help may not be available in the event of having a Panic Attack or panic-like symptoms", and obsessive-compulsive disorders, which is "characterized by obsessions (which cause marked anxiety of distress) and/or by compulsions (which serve to neutralize anxiety)" (American Psychiatric Association, 2000, p. 429). In Canada, 4 million people live with a mood or anxiety disorder, with the highest rates being among those between the ages of 20 to 30 years (Mental Health Commission of Canada, n.d.). Anxiety was the top mental health concern reported by Canadian university students, with 36.1% identifying it as a concern (Robinson et al., 2016). At the University of Alberta, over 50% of students reported feeling overwhelmed with anxiety (University of Alberta Wellness Services, 2011). Trends in anxiety also parallel trends in stress and depression in that females are more likely to experience a mood disorder and general anxiety than males at university (Bayram & Bilgel, 2008; Eisenberg et al., 2007b; Statistics Canada, 2013). Anxiety was also similar to depression in that first- and second-year students had greater anxiety than students in other years (Bayram & Bilgel, 2008) and that students with financial struggles were more likely to report symptoms of anxiety than students without such struggles (Eisenberg et al., 2007b). Screening positive for anxiety and depression were strongly associated, with approximately half of university students who screened positive for a general anxiety disorder also screening positive for major depression (Eisenberg et al., 2007b). Through a survey

completed by 2785 students from a Midwestern university, it was found that those who screened positive for anxiety or depression disorders and had used support services were more likely to report having friends or family who had also used those services and to believe that therapy, counselling, or medication were helpful than those who did not use services (Eisenberg, Golberstein, & Gollust, 2007a). The individuals who were encouraged to use support services are lucky to have such friends and family, but the challenge remains to make mental health care accessible to all individuals, including those who do not have people in their lives who can make personal recommendations for these services.

Impact of mental health issues on academic performance and well-being

Managing mental health concerns can be difficult, and this struggle can have negative impacts on student academic performance. Stress, anxiety, and sleep difficulties are the top three factors impacting academic performance as reported by Canadian university students (University of Alberta Wellness Services, 2011). Depression was among the top ten factors impacting academic performance, with 13.8% of students reporting depression negatively impacting their academic success (University of Alberta Wellness Services, 2011). Academic stressors such as perceived required knowledge and perceived inadequate time to develop this knowledge are negatively correlated with student time management behaviours such as setting goals, managing priorities, and scheduling (Misra & McKean, 2000). Diagnosed depression is associated with decreased academic performance (Hysenbegasi et al., 2005), and anxiety is negatively correlated with emotional reactions to academic stressors (Misra & McKean, 2000). Overall, poorer mental health has been associated with lower GPA scores (Stallman, 2010) and decreased retention and graduation rates (Kitzrow, 2003). Elementary schools that delivered high-quality implementation

of a mental health promotion initiative demonstrated academic performance that was equivalent to students completing an additional 6 months of schooling compared to schools that delivered low-quality implementation (Dix et al., 2012). If this is an indication of the benefits of mental health support within the education system, then institutions looking to support student academic success should take interest in developing programs or resources that support student mental health.

Mental health also plays a significant role in a person's general well-being. Psychological distress affects a person's cognitive and interpersonal functioning, with evidence showing it to be associated with greater test anxiety, less academic self-efficacy, and poor time management and use of resources (Brackney & Karabenick, 1995). Life stress is associated with a number of concerning behaviours such as drug and alcohol use, increased sexual partners, and lack of vigorous exercise, and highly stressed students are prone to engage in poor health habits and have lower self-esteem than those who are less stressed (Hudd et al., 2000). Depression is associated with similar concerning behaviours such as lack of exercise, skipping breakfast, and poor sleep patterns (Allgöwer et al., 2001), as well as negative outcomes such as diabetes, back pain, and migraine headaches (Doom & Haeffel, 2013). Students experiencing these behaviours and outcomes may choose to reach out for help in hopes that addressing their mental health struggles will also help improve their academics or personal well-being.

Available resources for university students

Many post-secondary institutions offer support services for students with mental health issues. On-campus counselling is one of the more widely known resources available to students in distress. Out of 400 students surveyed at Canadian universities, 74% were aware of

counselling services that were available to them, often because they were informed of these services through student orientation, the university webpage, or friends (Robinson et al., 2016). However only 8% of these students reported using the counselling services and 9% reported being likely or very likely to access such services (Robinson et al., 2016). Results from the Canadian Counselling Survey tell a slightly different story, with an average of 28% of students at post-secondary institutions reportedly accessing their counselling center (Crozier & Willihnganz, 2005). Specifically, personal, career, and academic counselling were the most commonly reported forms of counselling offered (Crozier & Willihnganz, 2005). Group sessions or workshops are another form of counselling that universities are offering students, as they allow for a greater number of students to be supported per session. More than half of the counselling center directors surveyed in the Canadian Counselling Centre Survey reported offering psycho-educational workshops/groups (Crozier & Willihnganz, 2005). These workshops focused on topics such as stress, relationship issues, anxiety, and self-esteem. Kitzrow (2003) suggests group therapy to be an effective and alternative resource for students, noting that 16% of counselling center directors send students to group counselling after their initial session. Although counselling services may be sending students to group-based sessions in order to meet the increasing need for support, this solution may not be a viable option for students who do not want others to know about their mental health concerns.

Some students may not be comfortable with or capable of accessing face-to-face counselling services. For these students, online or telephone counselling may be an option for mental health support. Twenty-eight percent of Canadian counselling centers offer online counselling to students, although the description of these online services vary between centers and institutions often prefer in-person counselling if possible (Crozier & Willihnganz, 2005).

Students prefer face-to-face counselling over online counselling (Klein & Cook, 2010) and are more likely to communicate feelings and thoughts to a counsellor when in person (Rogers, Griffin, Wykle, & Fitzpatrick, 2009), however only 10% of students seek therapy or counselling services (Eisenberg et al., 2007a) while over 90% would be willing to use mental health services that are delivered through electronic technology (Klein & Cook, 2010). A meta-analysis of web- and computer-based interventions for depression, anxiety, psychological distress, and stress by Davies, Morriss, & Glazebrook (2014) showed that use of such supports improve anxiety, depression, and stress when compared to wait-list or no-treatment controls. In 2012, 2.4% of respondents to the Canadian Community Health Survey on Mental Health aged 15 to 24 years consulted the internet for online discussion, therapy, or other similar support for mental health problems. Telephone help lines were reportedly used by an even smaller percentage (Findlay & Sunderland, 2014). This is compared to the 5.1% who accessed professional help through counsellors, social workers, or psychotherapists (Findlay & Sunderland, 2014). While these percentages may seem small, the internet remains one of the most frequently cited informal sources of support (Findlay & Sunderland, 2014). The Kids Help Line is one example of a service that provides 24-hour telephone and online support to youth aged 5 to 18. Youth who accessed the Australian-based service often turned to text-based support over telephone counselling because it provided an "emotionally safe" environment (King et al., 2006, p. 171). For example, users could access the service without worry of being heard talking – such as when using phone-based counselling – by people in the nearby environment. It was also said to be less intimidating and confrontational than speaking to someone over the telephone. However, disadvantages for the online text messaging counselling included long wait times and difficulties conveying proper context or emotion (King et al., 2006).

Recently, universities have embraced less formal manners of supporting student mental health. One common stress-coping mechanism was talking to friends and family. Three in four students reported using this method of managing stress, making it the most common way to cope (Pierceall & Keim, 2007). Findlay and Sunderland (2014) also found that talking to family and friends was the most frequently reported informal support by Canadians aged 15 to 24 years. Formal supports were less popular, with 5% of students choosing to speak to a professional about their stress (Findlay & Sunderland, 2014; Pierceall & Keim, 2007). It is important to note that talking to a professional came after unhealthy coping mechanisms such as drinking, smoking, and using illegal drugs (Pierceall & Keim, 2007). Another popular initiative that has been recently adopted by Canadian colleges and universities is pet therapy. Sessions are generally structured to offer students the opportunity to interact with therapy dogs or cats in an enclosed environment with one or more handlers present. These programs are of interest to students and early studies have shown them to be well received (Adamle, Riley, & Carlson, 2009). The positive responses to new and less formal supports are encouraging, as many barriers can prevent students from accessing current traditional supports. It is not known if these supports are sought out by students because of the barriers related to more formal supports, but they are certainly of interest to university students and more research needs to be conducted to evaluate the efficacy of such informal treatments.

Barriers to accessing resources

There are both formal and informal services available to university students in need of mental health support, although they vary in popularity. From traditional services that are more well known such as counselling to the informal support offered by reaching out to family and

friends, there appears to be a number of resources that students can turn to when seeking help to address their mental health concerns. Yet despite these available resources, many individuals refrain for accessing them. Among young Canadians with mental health disorders, only a quarter engaged with support services (Bergeron, Poirier, Fournier, & Roberge, 2005). Similarly, over half of the population surveyed by Robinson and colleagues (2016) who were identified as being in distress said they were either unlikely or very unlikely to access services, and nearly a third said they were neutral. The disproportion of students needing or seeking mental health support to those who use mental health support services is seen globally: in Australia, only 34.3% of students with elevated distress levels consulted a health professional (Stallman, 2010), and about half of students at a Japanese university were reluctant to speak with a mental health professional (Sasaki, 2014). Many barriers can prevent a person from accessing these resources. Some services may have limited resources, associated costs, or require too much of a time commitment. Students may also refuse to seek help because they fear stigmatization, perceive services to lack sufficient privacy, or have normalized their struggles.

Counselling services are recommended to many students, and approximately three in four Canadian university students know about these available services (Robinson et al., 2016). Individuals seeking treatment for mental health problems often received medication and "non-specific" counselling, sometimes regardless of if they met the criteria for diagnosis (Andrews, Issakidis, & Carter, 2001, p. 418). Andrews and colleagues (2001) refer to this combination of treatments as "the stock in trade" that doctors provide to patients with mental health problems (p. 418). While one-on-one counselling certainly helps to serve the needs of university students, centers are restricted by the number of available sessions or bookings they have. A large majority of counselling center directors reported an average wait time for the initial or intake appointment

to be 3.7 days. The wait time for ongoing counselling sessions, which typically follow an assessment session, averaged more than a week for the majority of counselling centers (Crozier & Willihnganz, 2005). Universities are unable to provide adequate staffing to meet the increase in demand for counselling services (Kitzrow, 2003) and many on-campus counsellors are advised to only accept patients short-term or have policies limiting the number of sessions they are allowed to offer each patient (Crozier & Willihnganz, 2005). While these policies may allow for a greater number of students to access counsellors, it does not necessarily ensure that clients are receiving the long-term support that they are seeking or need. When asked about the current concerns of counselling centers, 13% of directors reported wait list issues, 78% worried about finding adequate referrals for those in need of long-term care, and 78% were concerned about matching the increase in demand with an increase in resources (Crozier & Willihnganz, 2005).

Among the students who consider reaching out to counselling services for their mental health concerns, some may determine that they are unable to use such services because of associated costs. Nearly all students at a Midwestern university who responded to a survey on help-seeking and mental health care access had health insurance, whether offered through their parents or the university's student health plan. However, among those who reported inadequate health insurance coverage, the exclusion or limit of certain services or providers and expensive copay were the most frequent explanations for why their insurance did not meet their mental health needs (Eisenberg et al., 2007a). In Canada, psychologist visits range from $50 to $220 per visit, with most being over $100 per visit (Nunes et al., 2014). Many health insurance plans only cover a certain percentage of the total cost and have limits to their maximum coverage, meaning that students would be responsible for paying a large part of the bill (Nunes et al., 2014). This financial burden can be too much for students to manage on their own, resulting in them forgoing

the service. However, Nunes and colleagues (2014) note that some post-secondary institutions – more often universities than colleges – have extended health insurance plans available to students that cover the costs of psychotherapy or counselling. Furthermore, while off-campus counselling can be expensive, on-campus services are often more affordable or free for students. Yet affordable counselling doesn't eliminate the perceived barrier of cost that ultimately prevents students from accessing the service. At a university in western Canada, 12.5% of students reported cost as a barrier to accessing counselling services despite there being no direct costs at their particular university (Robinson et al., 2016).

Counselling, online support services, and workshops for mental health often require commitment in order for people to benefit from them or see noticeable improvements. However, academic demands can be high at university and students may have limited amounts of time to spend on activities that are not academically-related. In fact, approximately one third of university students identified a lack of time as a reason for not utilizing counselling or health clinic services (Yorgason, Linville, & Zitzman, 2008), even if they screened positive for anxiety and depression disorders (Eisenberg et al., 2007a). A Canadian study found an even greater proportion of students identifying time as a barrier, with over half of respondents claiming to not have enough time to access mental health services. Indeed, lack of time was the most frequently reported barrier for students in psychological distress within the study (Robinson et al., 2016). Similar difficulties were experienced by potential users of a web-based intervention trial, who claimed that finding time was the major barrier to engaging with online mental health interventions (Crisp & Griffiths, 2014). In addition to the lack of time within a student's schedule to seek help, there is also a limit to the amount of time that counselling services are able to offer students. As alluded to previously, certain counselling centers have limits or guidelines

that determine the number of sessions accessible to a student seeking counselling (Crozier & Willihnganz, 2005). These concerns relate back to the barrier of limited resources which further highlights how additional supports are necessary if we wish to improve the mental health of Canadian campuses. Many participants from the 2007 British Columbia Ministry of Health Conversation on Health forums commented on wait times for medical centers, counselling and other mental health services being unacceptably long (British Columbia Ministry of Health, 2007). If students already have limited hours in their days to devote to non-academic activities, long wait times and limited numbers of sessions may be enough to deter those who need it most from accessing support.

Another notable barrier to seeking mental health aid is stigma (Gulliver, Griffiths, & Christensen, 2010; Jorm, Wright, & Morgan, 2007; Talebi, Matheson, & Anisman, 2013). Results from a study on help-seeking behaviours and access to health care within a university population showed that 20% of students who did not use support services despite reporting symptoms of anxiety and depressive disorders did so because they were worried about what people would think. Another 20% said that they did not seek help because they thought that others wouldn't understand their problems (Eisenberg et al., 2007a). Feeling ashamed or worrying about other people's opinions were listed as barriers to visiting mental health professionals among Japanese university students (Sasaki, 2014). These thoughts and feelings arguably relate to the stigma associated with mental health disorders and struggles. Many people involved in a study regarding an online intervention for depression were embarrassed to be associated with depression and its stigma, and preferred to remain silent and deal with their issues on their own (Crisp & Griffiths, 2014). In an Australian survey, perceived and self stigma were reported as significant predictors of the likelihood that an individual would seek help from

medical and mental health professionals (Barney, Griffiths, Jorm, & Christensen, 2006). Respondents claimed to feel embarrassed for seeking help for depression from mental health professionals, particularly psychiatrists. They were also concerned that mental health professionals – especially general practitioners – would be condescending and view a person as being "unbalanced or neurotic" if they were to seek help for depression (Barney et al., 2006). Interestingly, evidence from one study seems to contradict these identified effects of perceived stigma. Survey responses from Canadian university students regarding mental health needs indicated that worrying about what other people think was the least common reason to avoid mental health services (Robinson et al., 2016). However, it should be noted that despite its seeming infrequency, students were more likely to see this as a barrier if they were distressed than if not (Robinson et al., 2016). Perhaps this is because there is an upward trend in "mental health literacy" with an emphasis on the biological factors that can influence mental health (Schomerus et al., 2012, p. 442), and students – particularly those *not* in distress – recognize a need to receive support for mental health concerns because of these biological factors. Today, professional help for mental health problems is also more widely accepted, but attitudes towards people with mental illnesses remain the same and are perhaps even worse than in previous years (Schomerus et al., 2012). This discrepancy helps us to understand why students may be interested in seeking mental health support but worry that other people will know of their struggles.

A person's physical and mental health information is private, and concern for maintaining privacy may prevent people from getting help to deal with their mental health problems. Indeed, privacy concerns were among the top ten barriers for university students to services such as on-campus counselling, professional help, and medication (Eisenberg et al.,

2007a). Counselling center directors believe their centers need improved space, in part to improve confidentiality through components such as file storage and layouts to protect student identity from individuals passing by (Crozier & Willihnganz, 2005). Concerns can also be particularly heightened when technology is involved. The internet is easily accessible and many digital health programs are run on computers or hardware that have online access. It is suggested that the perceived vulnerabilities of these systems and concerns regarding the use and storage of data may discourage people from using online programs (Crisp & Griffiths, 2014; Dennison, Morrison, Conway, & Yardley, 2013). Respondents to a study assessing the likelihood of participation in an online intervention for depression reported "concerns relating to maintaining privacy and confidentiality within the study context" among reasons for declining participation (Crisp & Griffiths, 2014, p. 6). If a digital tool can be used in public locations, users may also be concerned that people can see what they are doing and believe it to be socially undesirable, leading to embarrassment (Dennison et al., 2013). Whether mental health supports are provided in person or through digital means, people need to feel that their service use is private and that their information is confidential if they are to access the support. Otherwise, a person's concern for privacy may prevent them from accessing the help they need.

People's attitudes towards the severity of mental health problems also play a role in the likelihood of them accessing services. People want to manage their problems on their own (Crisp & Griffiths, 2014; Mackenzie et al., 2014), and this desire to self-manage can be a barrier to seeking mental health support. Within the university setting, it is understandable for students to believe that they can manage their own mental health issues if they also believe that most students experience these issues without having to seek help. Evidence from previous studies support this suggestion: the most common reason reported by university students for not

accessing services was the belief that "stress is normal in college/graduate school" followed by "not perceiving a need" (Eisenberg et al., 2007a, p. 600). Students from universities in North America and Japan are reportedly not seeking help for mental health concerns because they felt that it was not necessary, even though many of them screened positive for mental health disorders such as anxiety, depression, or psychological distress. The common argument made by these students is that stress is a normal part of university (Eisenberg et al., 2007a; Robinson et al., 2016; Sasaki, 2014). Normalizing stress or other mental health struggles can prevent students from seeking out necessary or beneficial services, acting as another barrier that must be addressed if we wish to improve mental health at universities.

There is a need for alternative mental health resources that can address the current barriers identified in the literature. Students have expressed an interest in receiving information on stress reduction (Pierceall & Keim, 2007) and there is a call for mental health professionals to provide courses or workshops that teach students healthy coping techniques for stress management (Doom & Haeffel, 2013). One study found that among students who screened positive for depression, nearly two thirds did not receive medication or therapy within the past year (Eisenberg et al., 2007a). Another study showed similar findings, with only a third of people who met the criteria for a mental health disorder consulting for their problems (Andrews et al., 2001). Providing unique and alternative resources beyond the typical medication, therapy, and counselling recommendations may help to reach students who have yet to receive support. Through the British Columbia Government's 2007 report from the Conversation on Health initiative, Canadians recommended providing alternative health care services with greater mobility, availability, and method of access (British Columbia Ministry of Health, 2007). It is suggested that universities teach more adaptive coping strategies to students to break past

barriers that prevent many of them from helping themselves overcome mental health struggles (Talebi, Matheson, & Anisman., 2016).

Mindfulness and mHealth apps as alternative resources

The idea of mindfulness has become popular in recent years. Mindfulness is described as the focusing of attention on the present moment, including an awareness of the body and thoughts that is accomplished without judgment (Van Gordon, Shonin, & Griffiths, 2015). A person does not need to be seated and in a meditative pose to practice mindfulness, although it may be helpful for some people. It can be practiced in a number of locations while engaging in different activities such as walking or taking the transit, making it more accessible. The manner in which people interpret stress can exacerbate the negative impact that it can have on them (Doom & Haeffel, 2013) and mindfulness could be a tool that helps people control this interpretation. Mindfulness is positively correlated with well-being (Carmody & Baer, 2009; Ramler, Tennison, & Lynch, 2016), and so it is unsurprising that people are interested in evaluating how mindfulness may be used by students to help them achieve and maintain good mental health. Recently, researchers have shown particular interest in exploring the effects of traditional mindfulness training on stress, with many studies involving university students and other young adults. Jang and Jeon (2015) found that university students with a stronger degree of mindfulness were able to better maintain their mental health. Among first year students, mindfulness has been found to enhance adjustment to university and reduce physiological stress (Ramler et al., 2016). Older university students show similar responses to mindfulness training, according to a study by Chang and colleagues (2004) that involved students enrolled in a continuing education course with a mean age of 46.52 years. Those in the study who completed a

mindfulness-based stress reduction program consisting of 8 weeks of 150-minute group sessions and 45 minutes a day of at-home practice 6 days a week showed a reduction in perceived stress scores and positive "states of mind scores" despite no change in pain and suffering (Chang et al., 2004, p. 143). Practicing mindfulness can bring students mental health benefits; specifically, increasing mindfulness reduces the severity of stress-related problems and improves well-being (Carmody & Baer, 2009). These effects make it an appealing resource for people who are struggling with mental health issues.

Smartphone apps are a platform that can be used for health-related services and are gaining interest for their potential use to help people manage physical and mental health. Mobile health (mHealth) apps that induce relaxation to help users cope with stress are popular and many different types are available to download (Simmons, Garcia, Howell, & Leong, 2016). There is an abundance of mHealth apps that target mental health, but not many have been empirically evaluated for efficacy (Donker et al., 2013; Payne, Lister, West, & Bernhardt, 2015). From what little evidence there is, it is suggested that apps targeting depression may help to reduce symptoms of depression and anxiety (Payne et al., 2015; Donker et al., 2013). One stress management app based on acceptance and commitment therapy was found to improve stress and life satisfaction scores in a small group of 15 university staff after one month of use (Ahtinen et al., 2013), while another app has been shown to help reduce anxiety and improve coping skills in studies involving female university students and nurses (Donker et al., 2013). Aside from efficacy, participants in mHealth studies regarding weight loss, diet, and physical activity apps often gave the apps high ratings of usability, helpfulness, and satisfaction, and found the apps to be convenient, easy, and comfortable to use in public (Payne et al., 2015). Many apps also had a high user retention rate, with a mean rate of 79.6% (Payne et al., 2015). Additionally, mobile

services allow for greater accessibility, immediate and personalized use, portability, and potentially greater adherence (Donker et al., 2013). However, it is important to note that the studies from which these findings are drawn were often pilot or feasibility studies with small sample sizes or low quality, and there remains a lack of larger studies that evaluate the efficacy of mHealth apps (Donker et al., 2013; Payne et al., 2015). In consideration of the current barriers to accessing mental health services, successful engagement and participant retention for mental health supports may be achieved by providing students with services that are inconspicuous and easily accessible. mHealth apps may be able to provide this sort of service.

The current lack of research in mindfulness-based mHealth apps

Many post-secondary institutions such as universities and colleges work hard to address the mental health concerns of their students, but there has yet to be adequate support that addresses the barriers that many students experience when looking to access support. It is important to ensure that students have access to, or knowledge of, healthy coping techniques that are available, enticing, and of practical use. Mindfulness techniques and mHealth apps may be means to achieving or supporting the development of good mental health. These two domains have recently come together with mindfulness-based apps available for download from popular online app stores. Mindfulness-based courses and workshops help to improve psychological distress and related concerns, although many of the studies that support this notion are focused on interventions that deliver long in-person sessions. However, shortened versions do not appear to be less effective (Carmody & Baer, 2009) and would be more accessible, especially if available through a mobile device. Ramler and colleagues (2016) have demonstrated the benefits of in-person mindfulness-based training, and suggest that electronic methods of delivery be

explored as this would allow for students to practice mindfulness without needing to commit to an instructed course. Within a systematic review of studies regarding health-related apps, very few apps were found to be tested in intervention settings, with the majority of peer-reviewed published studies being small pilot or feasibility studies. Among these studies, only four involved interventions for improving mental health (Payne et al., 2015). There is a clear lack of research addressing the quality and efficacy of mHealth apps for improving mental health (Luxton, McCann, Bush, Mishkind, & Reger, 2011; Simmons et al., 2016), particularly those designed as randomized control trials (Payne et al., 2015).

Universities are calling for the development of more accessible and useful resources (University of Alberta Wellness Services, 2011), and people have shown an interest in apps that are evidence-based and from reputable sources (Dennison et al., 2013). Further research on the efficacy of mHealth apps to help students manage their stress, anxiety, and related traits would help universities to support students who may not wish to access more traditional resources for mental health concerns. Mindfulness-based mHealth apps are of particular interest because of their potential to overcome the aforementioned barriers to accessing mental health services and the suggested benefits of practicing mindfulness. They can be used privately, at times that are of convenience to the student, and for as long as a student feels it is necessary. They are also low in cost and universities could even choose to subsidize or cover any associated costs so that the service is free to students. Additionally, there is no limit to the number of students who can be using the app at any given time, thus eliminating concerns of insufficient resources. Finally, students experiencing any level of concern for their mental well-being can choose to engage with mindfulness-based mHealth apps. If students were to use this resource as a preemptive means to address mental health struggles, then perhaps universities and other post-secondary institutions

would begin to see an improvement in the mental well-being of the student population and, in turn, a reduction in the number of students who require more intensive and demanding support such as individual counselling.

Specific research objective

Recent studies have shown app-based supports and mindfulness-based techniques to be promising ways of addressing mental health concerns, yet there is a lack of research regarding the efficacy of apps that deliver such techniques. This finding is surprising considering the exhaustive number of mindfulness-based mHealth apps available for purchase. The present thesis addresses this gap by evaluating the efficacy of a commercially available mindfulness-based app called DeStressify by Stress Refuge Inc. (hereafter "DeStressify") on stress, anxiety and depressive symptomology within a university population. This thesis specifically addresses the question: can a mindfulness-based app reduce the levels of stress, anxiety, and depressive symptomatology, and improve sleep quality, work productivity, and quality of life within a sample of Canadian university students after one month of app use?

Hypotheses

It was hypothesized that students who use DeStressify would report significantly lower stress, anxiety, and depressive symptomatology as compared to a wait-list control sample post-intervention. Secondary outcomes relevant for this specific study population included sleep behaviour, work/class absenteeism, work/school productivity, and quality of life. It was hypothesized that compared to matched wait-list control participants, the participants using

DeStressify would report significantly greater sleep quality, school/work productivity and quality of life, and significantly less class/work absenteeism at post-intervention.

Chapter 3: Manuscript

Overview

One in five Canadians will experience a mental health issue (Smetanin et al., n.d.), with those aged 15 to 24 being the most at risk of mood disorders (Statistics Canada, 2013). University students are of particular concern as they have shown significantly higher rates of mental health problems than the general public (Stallman, 2010). In recent years, mental health support services on university campuses have experienced high volumes of appointment requests, but are limited in the amount of support they are able to provide. Wait-list issues and funding concerns are listed among necessary improvements for Canadian post-secondary counselling services (Crozier & Willihnganz, 2005), with people having to wait up to 6 months for individual treatment at some institutions (Ryerson University Centre for Student Development & Counselling, n.d.). Seventy-eight percent of Counselling Centre Directors from post-secondary Canadian institutions reported a growing demand for services that cannot be met with what is currently available (Crozier & Willihnganz, 2005), meaning many students are left without support.

Mental health issues have been shown to negatively impact student wellbeing (Kitzrow, 2003), with stress, anxiety, and sleep difficulties found to be the top three most reported factors affecting student academic performance (University of Alberta Wellness Services, 2011). Additionally, diagnosed depression was associated with decreased academic performance (Hysenbegasi et al., 2005) and health problems such as back pain, diabetes, irritable bowel syndrome, and migraine headaches (Doom & Haeffel, 2013). Unfortunately, when students attempt to manage their mental health issues, they do not always engage in healthy coping mechanisms. A survey of 212 American college students found that only 5% reach out to a

professional for stress-related management (Pierceall & Keim, 2007). Disparagingly, avoidance of seeking professional help for assistance with mental health on university campuses is a worldwide problem (Statistics Canada, 2013; Mackenzie et al., 2014; Sasaki, 2014; Eisenberg et al., 2007a). Reasons for not engaging in these forms of support included perceiving stress as normal for university or graduate school, fear of judgment, shame, and uncertainty of effectiveness (Sasaki, 2014; Eisenberg et al., 2007a). Furthermore, stigma associated with mental illness precludes many people from seeking face-to-face counselling (Andrews et al., 2001; Talebi et al., 2013), particularly for those experiencing depressive symptoms, stress and anxiety (Barney et al., 2006; Griffiths, Crisp, Jorm, & Christensen, 2011). In extension of the barrier that stigma creates to accessing face-to-face counselling, analysis of a large Canadian mental health survey has shown that young men, individuals living with other people, and people with anxiety disorders are less likely than their counterparts to use services such as support groups, consultations with specialists, and help lines (Bergeron et al., 2005).

Canadian universities currently provide services and programs to support student mental health, but these services and programs have shortcomings. First, the rise in serious mental health concerns has been associated with an increase in demand for on-campus counselling, yet university counselling centers have not been able to meet these demands with adequate staffing (Kitzrow, 2003). Furthermore, on-campus counsellors are often advised to only take on patients short-term, with policies often limiting the number of sessions allowed per patient (Crozier & Willihnganz, 2005). While these policies may allow for a greater number of students to access counsellors, it does not necessarily ensure that clients are receiving the long-term support that they are seeking or need. Some institutions have attempted to address this concern by providing group counselling sessions. However, as many students have reported concerns of stigma as a

barrier to seeking mental health support (Mackenzie et al., 2014; Bigam, 2014), they may avoid group sessions for fear of being recognized by group members. Additionally, lack of time is a notable barrier to mental health service use (Yorgason, Linville, & Zitzman, 2008; Robinson et al., 2016) and group therapy sessions may be too time consuming for students to commit to.

Taking into account the barriers to current university mental health support services, an appeal can be made for an alternative, more accessible, service. Mobile health (mHealth) phone applications (apps) may be a service that addresses these barriers. Smart phones are integrated into the daily lives of nearly all university community members, and can be discreetly used by students to participate in app-based mental health support programs. Individuals seeking help can receive online assistance in a nonthreatening manner that is also feasible and capable of reaching a wide number of people (Crisp & Griffiths, 2014). mHealth apps have high acceptability among users (Payne et al., 2015; Donker et al., 2013) and are reportedly more comfortable to use in public compared to other intervention formats (Payne et al., 2015). mHealth apps also hold promise for engaging with people when they need it most and appealing to people who are not clinically diagnosed with a mental illness but nonetheless have concerns. An app is publicly accessible and can be used at a person's discretion. Many people at risk of mental illness may feel uncomfortable seeing a counsellor because they perceive their mental health concerns as neither urgent nor in need of professional assistance; the accessibility of apps helps to overcome this barrier. Additionally, mHealth apps are user friendly: they are easy to use, have minimal time commitment (Payne et al., 2015), and can be used at anytime that is convenient or necessary. These features can help ensure user anonymity and accessibility, making mHealth apps an appealing mental health support alternative.

Apps provide an inconspicuous and convenient mode of delivery for health interventions, and may assist in improving accessibility of "evidence-based monitoring and self-help" (Donker et al., 2013). A systematic review of 24 studies concerning the behavioural functionality of mHealth apps found that apps may provide a feasible delivery method for health interventions and have shown potential to bring about behavioural changes (Payneet al., 2015). However, a systematic review of studies concerning mHealth app efficacy conducted by Donker et al (2013) found that of over 3000 mental health apps available at time of study, only eight studies within the systematic review were identified as evidence-based and only one study utilized a university sample. Reviewers also found measurements regarding sleep disturbances and anxiety disorders to be particularly lacking in the literature (Donker et al., 2013). Similarly, Grist, Porter, and Stallard (2017) argue that there is an insufficient amount of evidence to support the effectiveness of mHealth apps supporting the mental health of adolescents and youth. Both Payne et al (2015) and Donker et al (2013) identified small sample sizes as a limitation in the current literature on mHealth apps in their systematic reviews.

Preliminary studies of non-app-based interventions have shown mindfulness-based techniques to be promising tools for helping university students manage their stress and anxiety. For example, one study involving first-year undergraduate students found that adapted mindfulness-based stress reduction (MBSR) interventions may improve the students' physiological and psychological well-being (Ramler et al., 2016). The adapted MBSR techniques for the study included reading assignments, discussion, meditation, and yoga, and were performed 2 hours a week for 8 weeks. The original MBSR program includes eight weekly classes delivering 31 hours of instruction in addition to daily home assignments of approximately 45-60 minutes each (Kabat-Zinn, 1990). Students demonstrated enhanced personal-emotional

adjustment and reduced physiological stress. Similarly, researchers at the University of Northampton found that students who participated in an 8-week mindfulness-based program demonstrated significant decreases in perceived stress, anxiety, and depression as compared to a wait-list control group (Lynch, Gander, Kohls, Kudielka, & Walach, 2011). These findings support a previous study in 2014 involving 458 university students that found mindfulness to be associated with improved mental health (e.g. reduction in symptoms of depression, anxiety, hostility, and paranoia) (Jang & Jeon, 2015). Mindfulness-based interventions are increasing in public interest, and these preliminary findings suggest it may be a promising way of helping university students improve their mental health.

Recent studies have shown app-based supports and mindfulness-based techniques to be promising ways of addressing mental health concerns, yet there is a lack of research regarding mindfulness-based techniques delivered through apps. This finding is surprising considering the exhaustive number of mindfulness-based mHealth apps available for purchase. In a recent study evaluating the feasibility of an internet-based mindfulness training program among university students in Sweden, researchers found that users generally enjoyed the program and its flexibility regarding time and location of use, yet found no significant intervention effect when compared to an internet-based "expressive writing" program (Kvillemo, Brandberg, & Bränström, 2016). However, the mindfulness training was extensive - with participants encouraged to practice 30 to 45 minutes a day for 6 or 7 days a week. Evaluation of mindfulness-based apps that are less time-intensive than the typical length of in-person MBSR practices is needed. The present study addressed this gap by evaluating the efficacy of a commercially available mindfulness-based app, called DeStressify by Stress Refuge Inc. (hereafter "DeStressify"), on stress, anxiety and depressive symptomology within a university population. It was hypothesized that students who

use DeStressify would report significantly lower stress, anxiety, and depressive symptomatology as compared to a wait-list control sample post-intervention. Secondary outcomes relevant for this specific study population included sleep behaviour, work/class absenteeism, work/school productivity, and quality of life. It was hypothesized that compared to matched wait-list control participants, the participants using DeStressify would report significantly greater sleep quality, school/work productivity and quality of life, and significantly less class/work absenteeism at post-intervention.

Methods

In the systematic review of mHealth app studies by Donker et al (2013), recruitment within each study ranged from 8 to 117 participants. For this pilot, exploratory study, sample size was calculated through a power analysis using G*Power. Effect size estimate calculations were made with the Cohen Perceived Stress Scale (PSS) values from a study by Chang et al (2004) in which university students participated in an 8-week MBSR intervention that included group meditation sessions and home practice. Alpha was set at 0.05, power at 0.80, and effect size at 0.37. A power analysis indicated a sample size of 61 would be required to test the hypotheses. It is important to note that the intervention used by Chang et al (2004) included 20 hours of in-class mindfulness practice and 36 hours of assigned home practice. In consideration of the power analysis, the intervention design differences between the present study and that of Chang et al (2004), the sample size range in studies reviewed by Donker et al (2013), and an anticipated drop-out of some participants from pre- to post-intervention, a recruitment goal of 200 participants was used.

Participants were recruited through poster advertisements, in-class announcements and e-mails to administrative assistants of various faculties across The University of British Columbia Okanagan campus. Individuals interested in participating in the study e-mailed the researcher assistant and received a link to the online eligibility survey, consent form and baseline survey. Eligibility criteria included i) enrollment in full course load during the Winter term at The University of British Columbia Okanagan campus in an undergraduate program, ii) ownership of a smartphone, iii) regular access to the internet, and iv) fluent comprehension of the English language. Participants indicated consent by clicking an "I consent" button after reading an information page regarding the study. Following the completion of the baseline survey, participants were randomized into either an experimental or wait-list control condition using a computer-generated random numbers table. Random numbers were generated in batches of 50 with equal counts for both treatment conditions (i.e. 25 total for each).

Individuals in the experimental condition were provided the Pro version of Destressify and instructed to use the app's Core Plan five days a week for four weeks. The Destressify Core Plan delivers mindfulness-based exercises through audio, video, or text files that require between 3 to 23 minutes to complete. Example titles of these exercises include Grounding Visualization, Gratitude, Imagining the Life You Want, and Finding Meaning. Participants were asked to not engage with the "My Friends", "Nutrition", or "Shop" features of the app during the course of the study. The Core Plan is available on both the free and Pro version of Destressify. Individuals in the control condition were given no treatment and no intervention material until after the post-intervention survey was completed, at which time they were provided the app and similar guidelines for use as the experimental condition. The follow-up period was four weeks post-baseline, at which point all participants were sent a second online questionnaire. All participants

who completed both surveys received an electronic $25 Amazon gift card. Data were collected and stored on secure systems and accessed through computers with password protection and encryption. This study was approved by the institutional review board.

Measures

All participants completed a baseline survey composed of questions regarding demographic characteristics and six validated self-reported measures of stress, anxiety, depressive symptomatology, sleep quality, quality of life, and work productivity. Each measure was presented on a separate page in the survey, and participants were able to use a "back" button to review and change their answers prior to submitting their completed surveys. Participant responses were identified by their e-mail addresses.

Demographic measurements of sex, age, income, ethnic origin, educational background, and university program of enrollment were included at the baseline assessment. Participants were also asked to identify any mental health disorder diagnoses they had, whether they were using mental health services and if so for how long.

Perceived stress was measured using the Perceived Stress Scale (PSS), which contains 10 items requiring respondents to indicate how often they felt or thought a certain way over the past month (Cohen, Kamarck, & Mermelstein, 1983).

Anxiety was measured using the State-Trait Anxiety Inventory for Adults (STAI), which contains 40 items in two subscales: state anxiety and trait anxiety (Spielberger, Gorsuch, Lushene, & Vagg, 2015). Each subscale includes twenty statements that people may use to describe how they feel. Participants were asked to indicate how accurately each statement

described them presently for state anxiety and in general for trait anxiety. Responses were scored to yield a collective score for each subscale.

Symptoms of depression were measured using The Quick Inventory of Depressive Symptomatology Self-Report (QIDS-SR), with ratings made in consideration of the past seven days (Rush et al., 2003). It contains 16 items that divide into the nine symptom criterion domains associated with the DSM-IV for Major Depressive Disorder: low mood, concentration, self-criticism, suicidal ideation, loss of interest in activities, energy/fatigue, sleep disturbance, changes in appetite/weight, and psychomotor agitation/retardation.

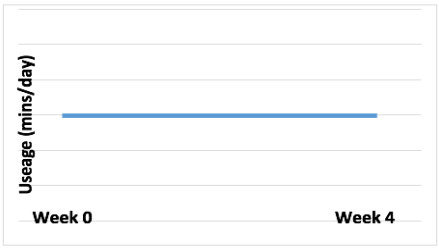
Sleep quality was measured using the Pittsburg Sleep Quality Index (PSQI) which asks participants to complete the measure in consideration of their usual sleep habits over the past month (Buysse, Reynold, Monk, Berman, & Kupfer, 1989). The measure contains 19 questions for respondents that are scored and combined to form seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. These component scores are added to form a global PSQI score. If respondents have bed partners or roommates, an additional five questions that are not included in the scoring are completed.

Health-related qualify of life was measured using the RAND 36-Item Health Survey, which includes 36 items to address eight health concepts: physical functioning (e.g. ability to perform any physical activity such as bathing and eating), bodily pain, physical health problems that limit ability to perform a specific role (e.g. work, daily activities), personal or emotional problems that limit ability to perform a specific role, emotional well-being, social functioning, energy/fatigue, and general health perceptions (i.e. beliefs regarding overall health) (Ware & Sherbourne, 1993; Hays, Sherbourne, & Mazel, 1993). Responses to all items are scored out of

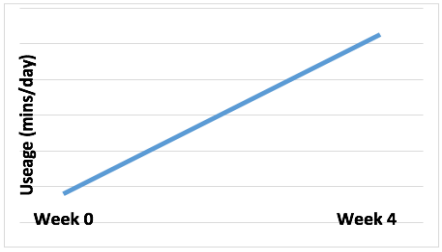
100, and a score for each of the eight health concepts is calculated by averaging a collection of item scores. These scores represent percentages, where "a high score defines a more favorable health state" (RAND Health, n.d.).

Work productivity was measured using the Work Productivity and Activity Impairment Questionnaire: General Health v2.0 (WPAI) (Reilly, Zbrozek, & Dukes, 1993). Respondents complete two to six items in consideration of "the effect of (their) health problems on (their) ability to work and perform regular activities" where health problems were defined as "any physical or emotional problem or symptom" (Reilly Associates, n.d.). Responses are scored and final scores are calculated for four subscales: absenteeism, "presenteeism", work productivity loss, and activity impairment (Reilly Associates, n.d.). Higher scores indicated greater impairment and productivity loss.

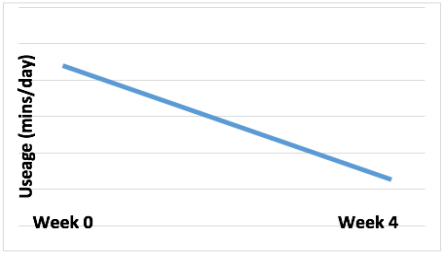
Additional questions in the follow-up surveys for both the experimental and control conditions included two questions asking participants to identify whether their sleeping and work or school productivity improved, worsened, or stayed the same since baseline measurements were taken. The follow-up survey for the experimental condition also asked participants how often they used the app and their pattern of app use over the 4 weeks. Response options were increased, increased then decreased, consistent, decreased then increased, and decreased, and included graphic representations (see Figure 1).



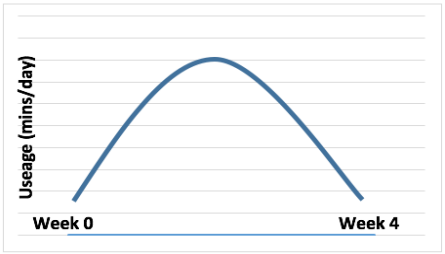
Consistent



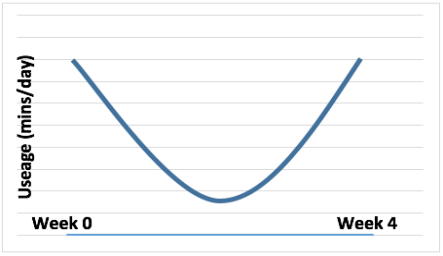
Increase in use



Decrease in use



Increase then decrease in use



Decrease then increase in use

Figure 1: Graphic representations of app use trends provided in experimental condition post-intervention survey.

Analytic plan

Data were analyzed using IBM SPSS Statistics v23. Age distribution of treatment conditions were compared using the Mann Whitney U Test. Distribution of sex, mental health disorder diagnoses, and mental health service use within treatment conditions were compared using Chi square tests. Distribution of program enrollment within treatment conditions was

compared using Fisher's exact test. Ethnicity distributions were compared using either Chi Squared test or Fisher's exact test, depending on whether or not the assumptions of the Chi Squared test were met within each ethnicity category. Changes in pre- and post-intervention scores between treatment conditions for measurements of stress, depression, state and trait anxiety, sleep quality, quality of life sub-scales, and work productivity sub-scales were assessed using ANCOVA. For all ANCOVA, post scores were treated as the dependent variable and pre scores the covariate. A MANCOVA was also conducted in which the baseline scores for both state and trait anxiety were assigned as covariates and the dependent variables were the post-intervention state and trait anxiety scores. Chi Square test was conducted to identify differences in perceived work productivity. An alpha level of .05 was used in all statistical tests of significance and effect size was determined using partial eta squared values. In alignment with suggestions by Cohen, partial eta squared values of .0099, .0588, and .1379 were used to correspond to small, medium, and large effect sizes, respectively (Richardson, 2011). Normality was tested using the Kolmogorov-Smirnov test. Raw scores that were not normally distributed were transformed through square root calculations to produce normality (Tabachnick & Fidell, 2001). Univariate outliers were identified as having z-scores with magnitude greater than 3.29 ($P < .001$). Mutivariate outliers were identified as having Mahalanobis distance values greater than $\chi^2(2) = 13.82$ when analyzing anxiety scores and $\chi^2(8) = 26.13$ when analyzing quality of life scores, $P < .001$ (Tabachnick & Fidell, 2001). When outliers were present, analyses were run with and without outliers.

Results

Responses from 206 students at The University of British Columbia Okanagan Campus were collected at baseline, with 104 randomized into the control condition and 102 into the experimental condition. Of the 206 participants, 43 were excluded from analysis due to failure to complete post surveys (n = 41), having a phone that did not support the app (n = 1), or a family emergency (n = 1). This resulted in 163 responses being used in analysis (86 control, 77 experimental). There were no differences in age, sex, ethnicity, program enrolment, mental health diagnosis percentage, and mental health service use between conditions, $P > .05$; see Table 1. The percent of participants in both conditions self-reporting mental health diagnoses is noteworthy, although a chi-square test confirmed that the number of people reporting such diagnoses was not statistically different between conditions, $P = .18$. There was also no difference in the percentage of participants in each condition who utilized health care services, $P = .80$. Human Kinetics, General Arts and Sciences, and Nursing were the three most common programs for enrolment in both treatment conditions.

Stress

Stress scores from individuals in the experimental condition did not reach statistically significant differences as compared to stress scores from those in the control condition four weeks after baseline measures were taken, $F(1,160) = 3.54$, $P = .06$, $\eta_p^2 = .02$. Changes in PSS scores for the experimental condition (pre = 18.58, post = 17.78) and control condition (pre = 19.60, post = 19.84) are, however, noteworthy (see Table 2).

Depression

One participant was excluded from analysis of the QIDS-SR questionnaire as baseline responses were not provided for this measure by the participant. Raw scores were transformed

Table 1: Demographics of treatment conditions

	Control (n=86)	**Experimental (n=77)**
Age	Range: 16 – 47 Average: 20.85 years	Range: 18 - 27 Average: 20.30 years
Sex	58 (67%) female	45 (58%) female
Ethnicity (3 most predominant listed)	61 White (71%) 9 Chinese (11%) 5 South Asian (6%)	50 White (65%) 12 Chinese (16%) 9 South Asian (12%)
Program enrolment	22 Human Kinetics (26%) 12 First Year ArtSci (14%) 11 Nursing (13%)	14 First Year ArtSci (18%) 12 Human Kinetics (16%) 11 Nursing (14%)
Mental health diagnosis	12 yes (14%) 1 Bipolar 4 Depression 4 Anxiety 3 Other (OCD & dermotilamania; depression, anxiety, & mania; ADHD)	17 yes (22%) 0 Bipolar 5 Depression 6 Anxiety 11 Other (adjustment disorder, anxiety, & depression; 3 ADHD; ADD; depression, anxiety, & ADHD; PTSD; binge eating; depression & anxiety; bipolar, depression, & anxiety; depression, anxiety, & PTSD).
Mental health service use	10 yes (12%)	10 yes (13%)

Table 2: Mean values of measures for control (n=86) and experimental (n=77) treatment conditions at baseline and four weeks post-intervention, excluding outliers[a]

	Pre		Post	
Dep. Var.	**Con.**	**Exp.**	**Con.**	**Exp.**
STAI state	44.67	42.96	43.35	40.09
STAI trait	47.64	47.39	47.53	44.52
QIDS-SR	8.08	8.36	7.37	6.36
Physfunct[b]	93.77	92.13	93.27	92.07
Physlim	78.20	79.22	77.03	83.77
Emolim	50.39	52.38	49.22	58.44
Energy	45.06	46.23	41.10	48.90
Emowell	60.88	61.14	58.74	65.97
Socialfunct	72.24	74.19	71.37	76.95
Pain[c]	78.26	83.49	77.97	84.34
Genhealth	64.65	63.31	61.74	67.47
PSS	19.60	18.58	19.84	17.78
WPAI[d] missedtime	4.21	2.05	0.11	0.06
WPAI[d] impairedtime	16.55	10.97	20.69	14.29
WPAI[d] overallworkimpair	18.05	11.57	28.11	16.62
WPAI activimpair	25.70	22.86	23.95	18.05
PSQI	7.00	6.86	7.00	6.19

[a] *STAI state = State-Trait Anxiety Inventory for Adults – state anxiety; STAI trait = State-Trait Anxiety Inventory for Adults – trait anxiety; QIDS-SR = Quick Inventory of Depressive Symptomatology Self-Report; Physfunct, Physlim Emolim, Fatigue, Emowell, Socialfunct, Pain, Genhealth = RAND 36-Item Health Survey – Physical functioning subscale, Role limitations due to physical health subscale, Role limitations due to emotional health subscale, Energy/fatigue subscale, Emotional well-being subscale, Social functioning subscale, Pain subscale, General health subscale; PSS = Cohen Perceived Stress Scale; WPAI missedtime, impairedtime, overallworkimpair, activimpair = Work Productivity and Activity Impairment Questionnaire: General Health v2.0 – Percent work missed due to health, Percent impairment while working due to health, Percent overall work impairment due to health, Percent activity impairment due to health; PSQI = Pittsburg Sleep Quality Index.*

[b] *Physfunct scores were based off of n=162 (n_{exp}=76, n_{con}=86).*

[c] *Pain scores were based off of n=156 (n_{exp}=75, n_{con}=81).*

[d] *WPAI scores were based off of n=50 (n_{exp}=21, n_{con}=29).*

for normality. Mean values for the QIDS-SR scores in Table 2 were calculated using raw data. Post-intervention transformed QIDS-SR scores for the experimental condition showed no significant difference from the control condition, $F(1,159) = 3.01$, $P = .09$, $\eta_p^2 = .02$, when controlling for baseline scores. Tests were re-conducted using non-transformed data, and results were similar, $F(1,159) = 3.54$, $P = .06$, $\eta_p^2 = .02$.

Anxiety

One multivariate outlier was identified in the control condition. No univariate outliers were observed in either trait or state anxiety scores. Overall omnibus F tests of the MANCOVA were significant when the outlier was included, $F(1,160) = 4.25$, $P = .02$, $\eta_p^2 = .05$, and excluded, $F(1,159) = 4.13$, $P = .02$, $\eta_p^2 = .05$. ANCOVA results demonstrate that individuals in the experimental condition reported less trait anxiety, $F(1,160) = 8.23$, $P = .005$, $\eta_p^2 = .049$, than

individuals in the control condition after four weeks of using the Destressify app. State anxiety scores did not significantly differ between conditions at post-intervention, $F(1,160) = 1.93$, $P = .17$, $\eta_p^2 = .01$.

Sleep quality

In regards to the baseline scores, there was one outlier from each treatment condition that was removed from analysis for sleep quality. Raw scores were transformed for normality. Transformed values were more normally distributed although both the raw and the transformed scores were significant when tested for normality. Nonetheless, ANOVAs were conducted as they are robust given the data's traits (Tabachnick & Fidell, 2001). There was no significant differences between treatment conditions in the post-intervention scores for both raw, $F(1,158) = 2.51$, $P = .12$, $\eta_p^2 = .02$, and transformed scores, $F(1,158) = 1.89$, $P = .17$, $\eta_p^2 = .01$, when outliers were excluded. Results were similar when outliers were included (raw = $F(1,160) = 2.58$, $P = .11$, $\eta_p^2 = .016$; transformed = $F(1,160) = 1.91$, $P = .17$, $\eta_p^2 = .01$).

Quality of life

Distributions of all sub-scores for the RAND 36-Item Health Survey were non-normally distributed with the exception of energy/fatigue at baseline for the experimental condition, energy/fatigue at follow-up for both treatment conditions, and general health at follow-up for the control condition. Additionally, the assumption of homogeneity of covariance matrices was not met. However, ANOVA is robust to violations of normality for this data when outliers are excluded (Tabachnick & Fidell, 2001) and MANOVAs are robust to heterogeneity of covariance matrices when sample sizes are equal (Tabachnick & Fidell, 2001 ; Field, 2009).

Researchers identified one univariate outlier from the pain sub-scale, seven univariate outliers from the physical functioning sub-scale, and six multivariate outliers. MANCOVA was

conducted with outliers and a significant interaction effect was found between condition assignment and time, $F(1,160) = 2.06$, $P = .04$, $\eta_p^2 = .10$, warranting examination of individual quality of life subscales, as discussed below. Eight outliers were removed from analysis for a second MANCOVA, resulting in the test being conducted on a sample size of 81 control condition participants and 74 experimental condition participants. Trends were similar in that mean subscale values decreased within the control condition from baseline to post-intervention and increased within the experimental condition (see Table 2), although these trends were not found to be significant, $F(1,152) = 1.86$, $P = .07$, $\eta_p^2 = .10$.

Vincent (1999) warns that significance of certain dependent variables may be masked by non-significant variables in MANOVAs, and therefore recommends ANOVA with the Bonferroni adjustment for assessing specific variables of interest. Thus, ANCOVAs were conducted on all subscales of the RAND 36-Item Health Survey. The general health subscale was shown to significantly differ in post-intervention scores between treatment conditions, $F(1,160) = 12.44$, $P = .001$, $\eta_p^2 = .07$, such that scores decreased in the control condition and increased in the experimental condition as illustrated in Table 2. A significant difference was also found between treatment conditions in regards to post-intervention energy/fatigue subscale scores, $F(1,160) = 8.19$, $P = .005$, $\eta_p^2 = .05$, with similar trends as the general health subscale. The results of the emotional wellbeing subscale did not meet the assumption of homogeneity of regression slopes for ANCOVA and were therefore analyzed using Repeated Measures ANOVA. There was no main effect of time, $F(1,161) = 1.21$, $P = .27$, $\eta_p^2 = .01$, or condition assignment $F(1,161) = 1.89$, $P = .17$, $\eta_p^2 = .01$, however there was an interaction effect, $F(1,161) = 8.13$, $P = .005$, $\eta_p^2 = .05$, such that scores decreased over time for the control condition and increased over time for the experimental condition (see Table 2). All other tests were insignificant.

Work productivity

Of the 163 participants who completed the follow-up survey, 29 people from the control condition and 21 from the experimental condition (n = 50) reported having work at both baseline and post-intervention, and therefore completed all components of the WPAI. A sub-score was calculated using these work-related data, labelled "percent overall work impairment due to health" (Reilly et al., 1993). No significant difference was found between treatment conditions, $F(1,47) = 1.10$, $P = .30$, $\eta_p^2 = .02$.

All 163 participants completed the question, "During the past seven days, how much did your health problems affect your ability to do your regular daily activities, other than work at a job?" (Reilly et al., 1993). This question was used to calculate percent activity impairment due to health. No significant difference was found between treatment conditions, $F(1,160) = 1.72$, $P = .19$, $\eta_p^2 = .01$.

When participants were asked to choose a description that best described how their work or school productivity has changed over the past four weeks, there was an association between treatment condition and responses, $P = .01$. More participants than expected by chance in the experimental condition reported an improvement in their productivity. Conversely, fewer participants than expected by chance in the control condition reported improved productivity. These results (Table 3) suggest that those in the experimental condition reported being more productive than those in the control condition.

Table 3: Participant count for responses regarding changes in perceived work or school productivity over four weeks between baseline and post-intervention measurements[a]

Treatment	***I think I was MORE productive***	***I think I was LESS productive***	***I think my productivity stayed about the same***
Control	14 (22.2)	32 (26.4)	40 (37.5)
Experimental	28 (19.8)	18 (23.6)	31 (33.5)

[a]*Expected count provided in parentheses.*

Patterns of app use

One participant did not report app use trends and was thus excluded from the data regarding response frequencies of participants in the experimental condition (n=76) for self-reported trends in app use. The most frequently reported patterns of app use were decrease in use (n=23) and consistent use (n=23). The most infrequently reported app use trend was increase in use (n=4). The remaining responses of increase then decrease in use and decrease then increase in use had 14 and 11 responses, respectively.

Comment

It was hypothesized that students who use DeStressify would report significantly lower stress, anxiety, depressive symptomatology, and class/work absenteeism and significantly greater sleep quality, school/work productivity and quality of life as compared to a wait-list control sample post-intervention. The results support predictions that short-term use of Destressify can reduce trait anxiety and improve general health, energy, emotional wellbeing and work or school

productivity in university students, but do not support the other predictions. These findings are somewhat consistent with related literature, which have shown that MBSR techniques that are delivered in person and through one- to two-hour-long sessions improve physiological and psychological well-being in university students (Ramler et al., 2016; Lynch et al., 2011; Jang & Jeon, 2015). Inconsistencies may be attributed to the difference in intervention delivery methods (i.e. through a mobile phone rather than in person), shorter sessions, and lack of experimental control over app use frequency. Considering the study's design, these findings are encouraging as universities are in need of accessible alternative mental health management tools and services for students, but should be considered cautiously given the small effect sizes.

The sample population of this study is representative of a large number of university students in Canada. Many universities are primarily composed of full-time undergraduate students, with a greater proportion of females attending in comparison to males. Specifically, 95% of first-year undergraduate students at Canadian universities are attending full-time, with 66% being female (Prairie Research Associates, n.d.); participants in the present study were of similar demographics (enrolled full-time, 63% female). Additionally, the University of British Columbia is a Western Canadian university with approximately 8000 students registered in undergraduate programs on the Okanagan campus (University of British Columbia Senate, n.d.). This size is comparative to small- to medium-sized Canadian universities.

Previous studies have found that students reportedly avoid mental health services such as counselling and medication because of fear of stigmatization, lack of time, and cost. Apps are an appealing platform for mental health support for university students that avoid many of the barriers associated with other forms of support including those aforementioned, and until recently have lacked evidence regarding effectiveness. App-based supports such as Destressify

can help university students avoid the stigma associated with mental health, as a large majority of students possess smart phones and frequently engage with them, making app use a more discrete form of mental health maintenance. Additionally, mHealth apps do not generally require a large amount of time to use; the practices provided in Destressify are approximately 10 minutes in length – much shorter than a standard counselling session. Participants in the experimental condition of this study were instructed to use the app five days a week, with no specifications regarding when it should be used. This allowed for greater flexibility in scheduling and thus greater convenience, while still resulting in changes to trait anxiety, certain quality of life components, and work or school productivity. In addition, apps are often inexpensive. The Destressify app that was provided to participants is publicly available for $8.49 (CDN) at the Apple iTunes store (iTunes Preview, n.d.) and $8.23 (CDN) at the Google Play store (Google Play, n.d.).

The changes in stress, anxiety, and related traits after short term use of Destressify are encouraging, yet the effects of long-term use remain unknown; however, app use patterns from this four-week study may provide an indication of long term adherence to a mindfulness-based mHealth app. The most frequently reported patterns of app use for participants in the experimental condition were “consistent” and “decrease in use”. Considering these adherence patterns in addition to the changes in measured traits among Destressify users, it would be interesting to determine whether the positive changes observed in the experimental group of this study would persist with prolonged use of Destressify.

This study is among the first to provide empirical evidence regarding the effectiveness of a mindfulness-based mHealth app on stress, anxiety, depression, and related symptomatology within university students. In recognizing the novelty of this study, areas for future development

should also be addressed. Although this study's objectives did not necessitate the use of a mindfulness measure, future studies should include one as it would provide a greater understanding in to the mechanism of action of Destressify and would be useful in the design of future mental health apps and support services. Obtaining data directly from the app regarding participant use would also be more accurate than obtaining data from self-reported measures, and should be considered in future studies. As some participants provided feedback regarding user satisfaction, future studies may also wish to include a measure of user satisfaction to enrich discussion regarding a mental health app's effectiveness and acceptance within a university population. Rickard, Arjmand, Bakker, and Seabrook (2016) recommend providing opportunities for feedback directly in the app, particularly using established measures to allow for comparison between apps. Additionally, participant recruitment was dependent on self-selection, and thus may not represent a random sample of the university population. However, individuals who would be inclined to use a mental health app may also be more likely to respond to this study's call for participants. Future directions may also include comparing the effectiveness of a mental health app on different sub-populations such as university staff or high school students, and gathering data beyond 4 weeks of app use to better understand long-term effectiveness of the app. Additional apps may also be considered, so as to provide a more generalized understanding of mindfulness-based mHealth apps.

Universities and other similar institutions may benefit from supporting the use of Destressify or other mindfulness-based mHealth apps. It is a resource that can be easily incorporated into support services and used in addition to other mental health support services. Mindfulness-based mHealth apps such as Destressify may be of interest to university students who are comfortable with apps and seek to manage their anxiety and mental health through an

accessible, inexpensive and discrete manner. Students interested in methods of anxiety management or mindfulness-based self-driven health support may be encouraged to try using the Destressify app. As app use is self-directed, institutions that provide students with Destressify may choose to conduct their own follow-up with students so as to track mental health progress. Regardless, an effective mHealth app would provide another means of addressing stress, anxiety, and related mental health concerns, allowing more students to receive the help they are seeking. This study has demonstrated how Destressify can assist in improving some of these mental health traits in a short time frame, and therefore may be of interest to universities aiming to diversify their student mental health supports.

Chapter 4: Discussion

The study presented in this thesis evaluated the effectiveness of the mindfulness-based mobile health application (mHealth app), Destressify, on improving stress, anxiety, depressive symptomatology, sleep quality, work productivity, and quality of life in university students. It was hypothesized that students who used DeStressify would report significantly lower stress, anxiety, depressive symptomatology, and class/work absenteeism as well as significantly greater sleep quality, school and work productivity and quality of life as compared to students in a wait-list control after four weeks. The results partially supported these hypotheses, demonstrating that short-term use of the Destressify app can reduce trait anxiety and improve certain aspects of quality of life and work or school productivity in university students. Other predictions did not reach statistical significance, however trends in scores are noteworthy. The details specific to these trends are discussed below.

Perceived stress scale (PSS) scores within the experimental condition decreased in value from 18.58 at pre-intervention to 17.78 at post-intervention, while control condition scores slightly increased in value from 19.60 at pre-intervention to 19.84 at post-intervention. All of these mean scores are notably higher than the mean score previously reported for people of similar ages in a normative table for PSS scores (Cohen, 1994). Specifically, the normative table provides a mean score of 14.2 with a standard deviation of 6.2 for people ages 18 to 29 years (Cohen, 1994). The one unit change in PSS scores observed in the experimental condition in this study is also noteworthy; in female university students, an approximately half unit increase in PSS scores was found to be significantly associated with a one unit increase in a five-point scale measuring “sweets” and “snacks” consumption frequency that ranges from “never” to “several times a day” (Mikolajczyk, Ansari, & Maxwell, 2009). Given the passive and brief nature of the

current experiment (i.e. delivery of an app and suggestion to use it for 4 weeks with no monitoring of app use), witnessing an approximate one unit reduction in stress scores is seen as a promising finding supporting further examination of mhealth apps. Larger reductions in mental stress by means of more intensive mindfulness training have been associated with improved personal-emotional adjustment to college and university, reductions in physiological stress, and increased self-compassion (Ramler et al., 2016; Shapiro, Astin, Bishop, & Cordova, 2005). While speculative, if the trend in PSS scores observed in the present study were to continue with prolonged app use, more noticeable differences in scores may have been observed. As this study only covered 30 days of non-monitored use with the app, and more intensive mindfulness-based interventions appear to have more potent changes to stress outcomes, it seems plausible that greater use and/or more intensive use of the app (e.g., encouraging daily use) may lead to even greater reductions in stress.

A greater decrease in the Quick Inventory of Depressive Symptomatology Self-Report (QIDS-SR) scores from pre- to post-intervention was also observed within the experimental condition (8.36 to 6.36) compared to the control condition (8.08 to 7.37). While the control condition also reported reduced scores for depressive symptomatology, the absolute value of the decrease in scores for the experimental condition was greater. These scores all fall within the classification of mild severity of depression, which is associated with QIDS-SR scores between six and ten (University of Pittsburg Epidemiology Data Center, n.d.). The scale, which ranges from zero to 27, is divided into five classifications of depression severity: none, mild, moderate, severe, and very severe, with a five-point change in score associated with a change in classification (University of Pittsburg Epidemiology Data Center, n.d.). Interestingly, nearly one third of participants in the present study reported decreasing their app use over the course of the

study with another one third reporting consistent app use. Extending app use may have resulted in even greater changes in PSS and QIDS-SR scores in those who showed consistent or increased app use. It would therefore be of interest to study the long-term efficacy of Destressify on stress and depressive symptomatology and further research with longer follow-up times is warranted.

Since levels of state anxiety fluctuate over time, a student's state anxiety scores from the State-Trait Anxiety Inventory for Adults (STAI) instrument would likely differ depending on the time at which they completed the survey. If a student is in a heightened emotional state due to a recent stimulus (e.g. having to present to a large class), then their scores may be higher than if they had completed the survey when in the absence of such a stimulus. Indeed, Spielberger, Gorsuch, Lushene, Vagg, and Jacobs (2015) warn that state anxiety scores will be higher when respondents are in stressful conditions in comparison to neutral or relaxed conditions. It is therefore unsurprising then that there was no significant difference in pre- and post-intervention scores for state anxiety between the experimental and control conditions, since students participated in this study during the months of February and March and would have been approaching the end of their term and completing cumulative projects and assignments. Comparatively, trait anxiety speaks to a person's tendencies to responding a certain way to stimuli and is more stable over time than state anxiety. It is this stability that arguably makes the measure of trait anxiety a better representation of the Destressify app's efficacy at helping students manage anxiety. Anxiety, and particularly test anxiety, has been identified as a major factor that affects academic success among university students (Richardson, Abraham, & Bond, 2012; University of Alberta Wellness Services, 2011) and this study has shown that app use is associated with a decrease in trait anxiety. Thus, students wishing to support their academic success may benefit from using a mindfulness-based app such as Destressify. Trait anxiety

scores decreased from 47.39 at pre-intervention to 44.52 at post-intervention for the experimental condition and remained nearly consistent in the control condition (47.64 to 47.53 from pre- to post-intervention). A decrease in three points in the trait subscale of the STAI – such as the observed difference in mean scores for the experimental condition between pre- and post-intervention – can have a meaningful impact on a student's life; for college students with STAI scores of 47, decreasing their trait scores by 3 points would bring males from the 82nd to 76th percentile and females from the 79th to 69th percentile for stress level for normative means (Spielberger et al., 2015). Since a person's change in percentile depends on their initial score, people with scores representing high anxiety levels may require more intensive treatment as compared to a non-invasive self-guided app. Conversely, such individuals have the most to "gain" from a reduction in anxiety scores, so reducing a highly anxious individual's score by a few points may result in meaningful changes for that individual. Students interested in addressing their trait or chronic anxiety levels, may find Destressify to be a valuable tool.

In addition to trait anxiety, scores for general health, energy, and emotional well-being statistically improved with app use. General health scores within the experimental condition improved from 63.31 to 67.47, whereas scores decreased in the control condition from 64.65 to 61.74. Regarding the connection between mindfulness and general health, Sen (2002) argues that a person's assessment of their health is dependent on their own perceptions which may be shaped and limited by their experiences. Mindfulness can influence how a person evaluates their surroundings and thoughts, therefore potentially influencing a person's perception of their health. To illustrate, Kabat-Zinn (1982) found that after patients with chronic pain (back, shoulder, cervical, and head) attended a ten-week mindfulness meditation program with two hours of practice per week, 65% of participants reported a decrease in pain ratings equal to or greater than

30%, and 50% reported a decrease in pain ratings equal to or greater than 50%. Similarly, pain was improved among participants of another study after completing an eight-week MBSR course using techniques such as body scanning and yoga to teach mindfulness (Smith et al., 2008).

In the present study, use of the mindfulness-based app was also associated with improved energy scores. The experimental condition increased from 46.23 to 48.90, with higher scores implying greater levels of energy and vitality (Ware & Sherbourne, 1992). This is compared to the control condition, which decreased from 45.06 to 41.10. These findings support previous research, in which mindfulness has also been shown to improve people's energy levels. Participants of an eight-week MBSR course using meditation, yoga, and body scanning reported increased energy levels after eight weeks of three-hour weekly classes, with an additional three hours in the sixth week (Smith et al., 2008). Eight-weeks of a mindfulness-based cognitive therapy course for individuals with brain injury also increased energy levels among participants, with 90-minute sessions delivered once a week (Bédard et al., 2012). Improved levels of energy are important as they are correlated with greater well-being and confidence. Results from university student responses to a one-time mail-in survey that included measures of vitality (energy), self-actualization, and self-esteem showed that vitality was associated with certain indexes of well-being, such that greater energy levels were correlated with greater well-being (Ryan & Frederick, 1997). Measures of energy were also associated with "body functioning self-esteem" and body image confidence (Ryan & Frederick, 1997, p. 542).

Emotional well-being was another sub-section of the RAND 36-Item Health Survey that significantly improved with associated app use. Many arguments have been made for the beneficial effects that mindfulness has on people's abilities to assess and manage their emotions. Higher scores of mindfulness were correlated with lower levels of neuroticism (Brown & Ryan,

2003), one of the 'Big Five" personality traits that is often associated with poorer psychological health. Brown and Ryan (2003) found that people who scored higher on the Mindful Attention Awareness Scale (MAAS) were more aware and in control of their emotional states and reported higher levels of optimism, life satisfaction, and pleasant affect, and lower levels of depression, anxiety, and unpleasant affect. Later research using the MAAS to evaluate mindfulness in relation to sleep and well-being supports these findings, noting a positive relationship between mindfulness and well-being (Howell, Digdon, & Buro, 2010). In a study by Carmody and Baer (2008), middle-aged adults with stress-related physical and mental issues participated in eight weekly sessions of a mindfulness program for two and a half hours per week in addition to at-home practices, using meditation, yoga, and body scanning exercises. Program participation and additional out-of-class practices of formal mindfulness exercises were associated with improvements in four of the five facets of mindfulness as described in the Five Facet Mindfulness Questionnaire (observing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience; describing was not a facet that was found to be significantly related) and greater psychological well-being. Overall, it is impressive that a brief, low cost mental health intervention such as a mindfulness-based mHealth app can improve trait anxiety, general health, energy, and emotional well-being. It is particularly exciting to observe significant changes in these measures given that participants in the present study were only asked to use the app for approximately 10 minutes per day, whereas the popular MBSR program designed by Kabat-Zinn (1990) requires people to attend in-class sessions multiple hours per week for several weeks.

While scores were significantly different between the experimental and control conditions for the RAND 36-Item Health Survey sub-sections of general health, energy, and

emotional well-being sub-scores, scores were not significant for the pain, role limitations due to emotional and physical health, and social and physical functioning sub-sections. Although Kabat-Zinn (1982) found improved mindfulness to be positively correlated with reduced pain, the training that participants received in their study was delivered over a longer period of time and in more formal and lengthier sessions than what Destressify users were provided and instructed to do. It is possible that with increased app use and more time spent engaging in mindfulness exercises, users may experience similar benefits. Additionally, mindfulness can improve emotional health and perceptions in physical health, but this may not necessarily lead to reduced role limitations. Although mechanisms of actions were not examined in this study, Destressify aims to reduce stress through mindfulness-based exercises, and an increase in mindfulness has been shown to be associated with improved emotional health (Brown & Ryan, 2003). While it was hypothesized that app users would experience general improvements in quality of life, changes in role limitations were not anticipated. Similarly, app use was not specifically hypothesized to lead to significant changes in social or physical functioning. Use of the Destressify app may – at best – indirectly improve these two aspects. It is noteworthy, though, that mean scores for role limitations due to emotional health increased among the experimental condition but did not among the control condition. Mean scores for participants in the experimental condition increased from 52.38 to 58.44 for pre- to post-intervention, respectively, whereas participants in the control condition had mean scores change from 50.39 to 49.22. In recalling that a higher score represents less limitation, this considerable difference in pre-and post-intervention scores is encouraging, albeit somewhat surprising.

In addition to certain RAND 36-Item Health Survey sub-sections, differences in scores between the experimental and control conditions for the Pittsburg Sleep Quality Index (PSQI)

were not found to be statistically significant. Some previous research has shown higher levels of mindfulness to be associated with higher levels of sleep quality and less effort required to sleep (Howell et al., 2010). However, these findings come from a cross-sectional study and do not elaborate on how changes in mindfulness may impact sleep-related concerns. It is possible that the exercises provided in Destressify do not provide a type of mindfulness training that addresses the issues associated with sleep concerns, and future researchers are encouraged to evaluate the relationship between mindfulness and sleep-related concerns in prospective, experimental designs in order to provide a better understanding of how mindfulness may impact sleep quality.

Mental health has been identified as a factor that impacts a person's productivity at work and in school (Hysenbegasi et al., 2005; Hilton et al., 2009; Morneau Shepell, 2015; Mental Health Commission of Canada, n.d.). Overall work impairment scores (a sub-score of the Mean Work Productivity and Activity Impairment Questionnaire: General Health v2.0; WPAI) for participants who were provided and instructed to use Destressify for four weeks had a smaller increase in absolute value from pre- to post-intervention than participants in the control condition. The difference between pre- and post-intervention scores for the control condition was approximately twice as large as the difference for the experimental condition. Additionally, mean WPAI activity impairment sub-scores remained consistent in the experimental condition and increased from 26.07 to 30.00 in the control condition. Large standard deviations may contribute to the non-significance reported in the statistical tests for these two sub-sections of the WPAI. Other sub-sections of the WPAI did not have any notable trends in scores. It is important to note, however, that many of the participants in this study were students who did not identify as working individuals. Specifically, only 50 out of 163 participants responded to the WPAI survey

questions. As a result, findings pertaining to this measure are limited to small sample size and future studies should be conducted with working student populations.

In addition to efficacy of improving outcome variables, app use trends are another important factor to consider when assessing Destressify as a potential mental health intervention. The two most frequently reported patterns of app use were decrease in use over the 4-week period (*n*=23) and consistent app use over the 4-week period (*n*=23). Despite those reporting a decrease in use being one of the most frequently reported patterns of app use, participants still reported a significant reduction in trait anxiety and improved general health, energy, emotional well-being, and work or school productivity after 4 weeks of app use. Changes in these scores from pre- to post-intervention were similar among the experimental group regardless of app use pattern. In consideration of the trends in app use reported by participants, it is possible that mHealth apps may be used as a short-term support for mental health concerns, at times when the user is motivated enough to adhere to the app.

This study was conducted during the second and third month of a new semester, a time that many students are completing midterm evaluations and preparing for final examinations. Of course, students likely vary in their opinions of when they are most stressed during a semester, however reports have shown exam periods and the weeks leading up to these periods to be some of the most stressful times for university and college students (Crandall, Preisler, & Aussprung, 1992). It is possible that results would vary depending on the time of year that the study was conducted, and future research may look to evaluate the efficacy of Destressify or other mindfulness-based mHealth apps at addressing stress and related traits during other periods of the academic year. For all variables measured in this study, using Destressify was associated with either a significant improvement or no significant change in scores, compared to the wait-

list control condition. The conditions and results of this study suggest that using Destressify can help students maintain and improve certain aspects of their mental health during the exam period. Specifically, results support the argument that Destressify can help improve levels of trait anxiety, emotional well-being, energy, and general health in university students when used for four weeks.

The present study displays both internal and external validity. Internal validity was established through the randomization of participants into two conditions, the use of a control condition, and the use of validated tools to measure outcome variables. Randomization minimizes selection bias (Turlik, 2009) and the use of a control condition allowed for the comparison of changes in outcomes between those who did and did not use Destressify. The use of validated tools to measure outcome variables contributed towards the results' criterion and content validity. External validity was established by recruiting participants through self-selection, maintaining participant anonymity, and using a "hands off" approach. With all participants having self-selected to participate in the study, it can be argued that this sample population is a good representation of the students who are likely to use Destressify if it were to be used outside of a research context. Additionally, participants were not required to provide any identifying information to researchers and those in the experimental condition were provided Destressify and instructions on how to use the app without being tracked by researchers to ensure that they were using the app as requested. These components of the study's design allowed the study to more closely parallel a "real-world" setting in which students could privately download the app with instructions and use it as they wish without another person's knowledge.

Previous studies have found that students reportedly avoid mental health services such as counselling and medication because of lack of time, cost, preference to manage with their issues

on their own, and fear of stigmatization (Sasaki, 2014; Eisenberg et al., 2007a; Andrews et al., 2001; Crisp & Griffiths, 2014; Barney et al., 2006; Robinson et al., 2016). A mindfulness-based mHealth app such as Destressify is a mental health support tool that does not require a large time commitment from the user or demand from professional resources. The practices provided in Destressify are approximately 10 minutes in length and users are encouraged to use one each day – thus demanding a lot less time than a standard counselling session. Participants in the experimental condition of this study were instructed to use the app five days a week, with no specifications regarding when it should be used. These aspects of the app allow for greater flexibility in scheduling and thus greater convenience. The app also required no input or monitoring from mental health professionals. Rather, the user maintains control over when, where, how often they use the service, catering to the desire to manage their mental health concerns on their own. In addition, apps are often inexpensive. The Destressify app that was provided to participants is publicly available for $8.49 (CDN) at the Apple iTunes store (iTunes Preview, n.d.) and $8.23 (CDN) at the Google Play store (Google Play, n.d.). Low costs help to ensure that mental health supports are accessible to all students.

In addition to requiring only a small investment of time and money, Destressify can be easily accessed and used in whatever environment a person finds to be most comfortable. Many students possess smart phones and frequently engage with them, making app use a more discrete form of mental health maintenance. These aspects of Destressify allow users to avoid being associated with mental health's stigma and thus overcome this large barrier that prevents many from seeking support. Attitudes towards seeking mental health services have become increasingly negative over time (Mackenzie et al., 2014) and many individuals do not seek support for their mental health concerns because they fear these negative opinions (Barney et al.,

2006; Eisenberg et al., 2007a). Crisp and Griffiths (2014) found that individuals with higher levels of perceived stigma were less likely to be interested in participating in a mental health support program. However, when comparing preferences for internet- and non-internet-based services, individuals preferring internet-based services had higher levels of stigma (Klein & Cook, 2010). Internet-based services such as mHealth apps might address stigma concerns, making them an appealing platform for mental health support for university students that, until recently, have lacked evidence regarding effectiveness.

Chapter 5: Conclusion

To provide students with an inexpensive mindfulness-based mHealth app that can be used anywhere is to provide them with a mental health support that addresses many of their identified concerns. Using Destressify would be a small change to a person's daily routine that has potential to improve their trait anxiety, certain quality of life components, and perceived work or school productivity. What's more, app use was not associated with the worsening of any traits measured in the study's surveys. At worst, students may not enjoy the app and choose to abandon it without experiencing negative consequences; at best, the app provides support that improves student mental health. Counselling center directors and other university mental health groups may therefore choose to encourage students with certain mental health concerns to try Destressify as the students can dismiss it if they do not enjoy the app or if it is not helping them to manage their concerns.

Limitations

Given the novelty of this study, areas for future development should be addressed. Self-reported trends in app use provide a general idea of whether the app will be used over longer periods of time, but future studies would benefit from recording user analytics data directly from the app. Obtaining information directly from the app regarding participant use would provide more accurate data from which additional trends or patterns may be observed. This data could also better inform industries to develop programs so that certain mindfulness-based exercises are delivered at times when app use is greatest. Industries could use the data to inform marketing and promote engagement when users begin to decline in app use, thus potentially prolonging app use over time. Adding notifications can help improve frequency of app engagement; for example,

Bentley and Tollmar (2013) found that adding notifications to a food-logging app increased logging frequency five-fold. In a study evaluating the effectiveness of a mindfulness-based app at improving mindfulness, app use activity peaked the day after participants were sent a reminder to complete a second survey, suggesting that prompts such as reminders and notifications can increase app use (Chittaro & Vianello, 2016).

Another study limitation is the methods in which participants were recruited. Recruitment was dependent on self-selection, and thus may not represent a random sample of the university population. However, if a mindfulness-based app were to be offered to students as a mental health support, it would be at the students' discretion to choose the app as their support of choice. In other words, students would have to self-select or opt-in to using the app, similar to how students had to opt-in to participate in the present study. Arguably, individuals who would be inclined to use a mental health app may also be more likely to respond to this study's call for participants.

While this study's objectives did not necessitate the use of a mindfulness measure, future studies may wish to include such a measure as it would provide a greater understanding in to the mechanism of action of Destressify and would be useful in the design of future mental health apps and support services. Group-based MBSR courses have been found to improve mindfulness as well as psychological and general health outcomes (Smith et al., 2008), yet the Destressify app differs from traditional styled MBSR courses in that users are only engaging with the app for minutes rather than hours per week and are able to use it in private rather than attend group sessions. Despite the differences between these methods of delivery, use of the Destressify app was nonetheless associated with improvements in certain outcomes measured in the present study such as trait anxiety and emotional well-being. Measuring mindfulness would allow one to

better understand if Destressify improved these outcomes through improved mindfulness or if alternative mechanisms ought to be considered.

A final limitation addressed here is the possibility of a placebo effect, particularly a subject-expectancy effect. Participants were aware that the study was related to stress and anxiety management by using a mobile phone app, and therefore likely had an idea of what the app was aiming to improve. Participants in the experimental condition would have learnt through app use that the app specifically used mindfulness-based techniques and may have responded to the surveys with a bias for certain responses. However, it is unlikely that participants would be able to recall their baseline responses after the four-week intervention period and consider these responses when completing the post-intervention survey. To address possible subject-expectancy effects, an attention placebo control condition could be used, where participants in this control condition would be requested to use a non-mindfulness-based app with similar time commitments (e.g. ten minute sessions of app use, five times per week). Although it is speculative to suggest that there may be a placebo effect, use of an attention placebo condition would mean that all students would be provided an app and would be aware that the study was related to stress and anxiety management, thus addressing concerns regarding a potential placebo effect.

Future directions

As discussed above, future studies should collect user diagnostics data direct from the app, as this would allow for researchers and industries to better understand when app use is most popular, when prompts or reminders may be required, and how stress, anxiety, and related measures may change over time. Additionally, the inclusion of a mindfulness measure would

provide additional information that researchers and industries may find beneficial, as it would provide further information regarding the impact that a mindfulness-based app has on mindfulness and may provide insight into the app's mechanisms of action. This information would enable developers to revise apps accordingly and consequently lead to more effective apps and more evidence-based supports for student mental health.

Other suggested aspects to be included in future studies include a method of recording user satisfaction. Collecting participant feedback regarding their satisfaction of using Destressify would enrich discussion regarding a mental health app's effectiveness and acceptance within a university population. Additionally, this study focused on the effectiveness of one app within a Canadian university's student population. Researchers may wish to consider evaluating other similar apps so as to provide a more generalized understanding of mindfulness-based mHealth apps in this population. Finally, in recognizing the difficulties associated with studying and working on university campuses, it would also be of interest to examine the effectiveness of a mindfulness-based mHealth app on addressing mental health concerns of university staff and faculty.

This study is among the first to formally evaluate the efficacy of a mindfulness-based mHealth app at addressing mental health concerns in a university student population. The study's findings are encouraging as universities need more accessible alternative mental health management tools and services for students, but they should be considered cautiously given the small effect sizes.

Although additional information is required, findings from this study may be used to support policy changes or university-wide campaigns and initiatives. Policy changes may include editing the list of supports that university staff are to promote to students with mental health

concerns so that these lists include evidence-based mHealth apps. Universities may also wish to provide access to download the Destressify app or a similar mHealth app through their counselling services websites. Doing so would provide greater awareness and access to the app, as many people turn to the internet for information on mental health supports.

Promoting mHealth apps for addressing student mental health concerns may also help institutions who signed the Okanagan Charter achieve mental health goals outlined in the Charter. The Okanagan Charter is a document resulting from the 2015 International Conference on Health Promoting Universities and Colleges that, in part, aims to "create or re-orient campus services" by encouraging campuses to provide health and well-being services that are accessible to all and "optimize human and ecosystem potential and promote a supportive organizational culture" (International Conference on Health Promoting Universities & Colleges, 2015, pg. 7). Destressify is an mHealth app that can help universities to meet these aims, and universities may therefore wish to incorporate Destressify or other similar mHealth apps into campus life.

Closing remarks

There is a high prevalence of mental health issues in Canada - particularly in young adults (Smetanin et al., 2011; Statistics Canada, 2013), and these issues have a negative impact on student well-being and academic performance (Kitzrow, 2003; University of Alberta Wellness Services, 2011). Current services are not meeting the needs of university students, and people have expressed an interest in alternative mental health supports (British Columbia Ministry of Health, 2007). An effective mHealth app would provide another means of addressing stress, anxiety, and related mental health concerns, allowing more students to receive the help they are seeking. mHealth apps have recently gained researchers' attention as a new and possibly

efficacious support, and this study has demonstrated that students can gain certain benefits such as improved trait anxiety, general health, emotional well-being, and energy from using a mindfulness-based mHealth app. Universities and other similar institutions may benefit from promoting the use of Destressify or other mindfulness-based mHealth apps among students who are interested in methods of anxiety management or mindfulness-based self-driven health support. As mHealth apps continue to gain popularity, it is important that their effectiveness at addressing user needs is evaluated. This study helps to accomplish this task.

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Appendices

Appendix A: Online Consent Form

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Health and Social Development
School of Health and Exercise Sciences
Reichwald Health Sciences Centre
3333 University Way
Okanagan Campus
Kelowna, B. C., Canada, V1V 1V7

Participant Information and Consent Form

Evaluation of an mHealth App: A Randomized Controlled Trial of Destressify on Campus Staff and Student Mental Health

Principal Investigator: Dr. Mary Jung Ph.D.
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Candidate for Masters of Science
Health and Exercise Psychology Lab
The University of British Columbia, Okanagan Campus
Phone: (250) 807-8419

INVITATION
You are being invited to take part in this research study because you are a member of the University of British Columbia Okanagan campus population.

YOUR PARTICIPATION IS VOLUNTARY
Your participation in this study is entirely voluntary and it is your decision whether or not to take part in this study. Before you decide, it is important for you to understand what this research will involve. This document will explain the study, why the research is being done, what you will be asked to do and what will happen to you, and the possible benefits, risks and discomforts associated with the study.

If you would like to participate and consent to the conditions of this study, please select the "I consent" box at the end of this form. If you decide to participate in this study you are free to withdraw at any time and without giving any reasons for your decision.

If you do not wish to participate, you do not have to provide any reason for your decision, nor will you face any repercussions. Please take time to read the following information carefully before you decide.

WHO IS CONDUCTING THE STUDY?

This study will be conducted by Dr. Mary Jung and assisted by Masters of Science candidate Rebecca Lee at UBC Okanagan.

WHO IS FUNDING THIS STUDY?

This study is funded through the Mitacs Accelerate program. by Mitacs Inc.

BACKGROUND

Destressify Pro is a smartphone application ("app") made by Stress Refuge, Inc. that is designed to assist individuals in developing skills for managing stress and anxiety using mindfulness techniques. The app utilizes tools such as schedules, progress trackers, and positive reinforcement to support the user. Visualizations, guided breathing, informative videos and nutrition and exercise guides are used to promote change in cognitive behaviour. The proposed study as follows has been developed by Dr. Mary Jung at the University of British Columbia: Okanagan.

WHAT IS THE PURPOSE OF THE STUDY?

The primary purpose of this study is to evaluate the effectiveness of the Destressify Pro mental health app at reducing depressive symptomatology and sleep disturbances and maintaining health-focused lifestyles in university-affiliated individuals. This study is also designed to assess whether mobile mental health applications are practical for use by university-affiliated individuals.

WHO CAN PARTICIPATE IN THIS STUDY?

You may be able to participate in this study if you are a student, staff or faculty member at the University of British Columbia Okanagan campus, own a smartphone with regular access to the Internet and have fluent comprehension of the English language. Students must be enrolled in a full-time undergraduate program. Staff and faculty must have full-time employment throughout January – April 2016.

WHO SHOULD NOT PARTICIPATE IN THE STUDY?

There are no exclusion criteria to participation in this study, other than not meeting the inclusion criteria above.

WHAT DOES THE STUDY INVOLVE?

The study will be conducted through online collection of data by means of surveys. You are receiving this consent form as you expressed interest in participating in this research study and are believed to meet the inclusion criteria. If you agree to participate in the study you will also be asked to complete two short online surveys (4 weeks apart) in which you will report information about your perceived mental health and psychological wellbeing.

Following initial survey completion, you will be placed randomly into one of two possible groups. Everyone who participates in the study will receive the app free of charge for a total of 4 weeks. One group will be immediately provided the Destressify Pro app following initial survey completion, and the other group will be provided the app 4 weeks after the initial survey. Participants will be asked to not use similar alternative apps during their participation in the

study. The time commitment for completion of the two surveys is expected to be approximately 1 hour. Participants provided the app at the beginning of the 4-week period can anticipate approximately 4 minutes of app use per day. All information will be accessible to the primary investigator and research assistant of the study at the conclusion of the study for research purposes.

WHAT ARE THE POSSIBLE HARMS AND DISCOMFORTS?

Risks include potential stress or anxiety triggered by answering survey questions. There are no physical or health risks associated with the use of the app. In the case of triggered emotional responses, participants are encouraged to seek support or counseling if desired. Counseling services are provide on campus at no cost and can be contacted at healthwellness.okanagan@ubc.ca or 250.807.9270. Alternatively, participants may visit in person at the following address:
UNC337 - 3272 University Way
Kelowna, BC Canada V1V 1V7

WHAT ARE THE POTENTIAL BENEFITS OF PARTICIPATING?

The benefits to participants that could arise from participation in this research are a reduction in stress, anxiety and depressive symptoms, reduced sleep disturbances, and the maintenance of a health related quality of life. By extension of these benefits, participants may experience improved efficiency and productivity in university-related work and personal life.

WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time without any explanation.
If you withdraw from the study your data collected up to the point of withdrawal from the study must be kept for data analysis purposes under strict provisions of confidentiality.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your confidentiality will be respected. No information that discloses your identity will be released or published without your specific consent to the disclosure. No records which identify you by name or initials will be allowed to leave the Investigators' offices. Data will be encrypted and password protected. In accordance with Policy 85 (Scholarly Integrity) of the UBC Board of Governors, all records will be retained for a minimum of 5 years on UBC's SurveyTool secure system after publication. E-mails will be used to provide participants with the app download code, survey links, and gift card code. The results of the study will also be communicated through e-mail, if participants desire to receive them. The data collected will be used as part of a master's thesis. Results from the study will be made publically available on UBC's cIRcle.

WHAT HAPPENS IF SOMETHING GOES WRONG?

If you experience psychological trauma as a consequence of participation in the study due to the administration of the app or study procedures, you can be referred to appropriate resources for treatment. Signing this consent form in no way limits your legal rights against the sponsor, investigators, or anyone else.

REMUNERATION

There is no monetary cost associated with participating in the study as the Destressify Pro app will be provided free of charge. Additionally, participants will receive an Amazon.ca gift card, redeemable online for a value of $25.00 CDN.

WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

If you have any questions or desire further information with respect to this study, you may contact Dr. Mary Jung (250) 807-9670.

WHO DO I CONTACT IF I HAVE ANY QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A SUBJECT?

If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Services at 1-877-822-8598 or the UBC Okanagan Research Services Office at 250-807-8832. It is also possible to contact the Research Participant Complaint Line by email (RSIL@ors.ubc.ca)

If you are interested in learning about the results of this research, or if you'd like to be informed of future research opportunities, please provide a mailing address or email address to which we may send you the study findings:

☐ Yes, I'd like to learn about the results of my research. You can contact me at:

☐ Yes, I'd like to be informed about future research opportunities. You can contact me at:

By clicking on the "I consent" button below, you consent to the following:

Participant Consent:

- **I have read and understood the subject information and consent form.**
- **I have had sufficient time to consider the information provided and to ask for advice if necessary.**
- **I have had the opportunity to ask questions and have had satisfactory responses to my questions.**
- **I understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives.**
- **I understand that my participation in this study is voluntary and that I am completely free to refuse to participate or to withdraw from this study at any time without jeopardy to my status at the university [for example, employment, class standing, access to campus services, etc.].**
- **I understand that I am not waiving any of my legal rights as a result of signing this consent form.**
- **I understand that there is no guarantee that this study will provide any benefits to me.**
- **I have read this form and I freely consent to participate in this study.**
- **I have been told that I will receive a dated and signed copy of this form.**

I CONSENT

Appendix B: Baseline Questionnaire

Evaluation of an mHealth App

STUDY SUMMARY

Stress Refuge, Inc. has designed a smartphone application ("app") to assist individuals in developing skills for managing stress and anxiety using mindfulness techniques. The app utilizes tools such as schedules, progress trackers, and positive reinforcement to support the user. Visualizations, guided breathing, informative videos and nutrition and exercise guides are used to promote change in cognitive behaviour. The proposed study as follows has been developed by Dr. Mary Jung at the University of British Columbia: Okanagan.

The primary purpose of this study is to evaluate the effectiveness of the mental health app at reducing depressive symptomatology and sleep disturbances and maintaining health-focused lifestyles in university-affiliated individuals. This study is also designed to assess whether mobile mental health applications are practical for use by university-affiliated individuals.

Recruitment will occur through poster advertisements, in-class announcements and e-mails to all students, staff and faculty of UBC Okanagan campus. Individuals interested in participating in the study will receive a letter of information with detailed information of the study and asked to read a consent form and click an "I consent" button. By clicking "I consent", participants are stating that they meet the inclusion and exclusion criteria, understand the study's purpose and design, and are aware of the potential risks and benefits. Consent can be revoked at any time throughout the study.

The study will be conducted through online collection of data by means of surveys. After the investigators receive consent, participants will be asked to complete an initial online survey in which they will report information about their perceived mental health and psychological wellbeing. Following initial survey completion, participants will be placed randomly into one of two possible groups.

Everyone who participates in the study will receive the app free of charge for a total of 4 weeks. One group will be immediately provided the app following initial survey completion, and the other group will be provided the app 4 weeks after the initial survey. Participants will be asked to not use similar alternative apps during their participation in the study. The time commitment for completion of the two surveys is expected to be approximately 1 hour. All information will be accessible to the primary investigator and research assistant of the study at the conclusion of the study for research purposes.

Risks include potential stress or anxiety triggered by answering survey questions. There are no physical or health risks associated with the use of the app. In the case of triggered emotional responses, participants are encouraged to seek support or counseling if desired. Research participants may experience benefits including a reduction in stress, anxiety and depressive symptoms, reduced sleep disturbances, and the maintenance of a health related quality of life. By extension of these benefits, participants may experience improved efficiency and productivity in university-related work and personal life.

THANK YOU FOR YOUR PARTICIPATION!

It is people like you that make research possible. With your help, we hope to shed some light on the use and effect of mental health apps on university-affiliated individuals. If you have any questions, please ask. We are here to help!

INSTRUCTIONS: Please answer EVERY question as honestly as possible. Your intuition is the best answer – there is no right or wrong answer. If you have any questions, please let the researcher know (Dr. Mary Jung, 250-807-9670, mary.jung@ubc.ca).

PLEASE CHECK THE ONE RESPONSE TO EACH ITEM THAT IS MOST APPROPRIATE TO HOW YOU HAVE BEEN FEELING OVER THE PAST 7 DAYS.

Falling asleep:

- ○ I never took longer than 30 minutes to fall asleep.
- ○ I took at least 30 minutes to fall asleep, less than half the time (3 days or less out of the past 7 days).
- ○ I took at least 30 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).
- ○ I took more than 60 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).

Sleep during the night:

- ○ I didn't wake up at night.
- ○ I had a restless, light sleep, briefly waking up a few times each night.
- ○ I woke up at least once a night, but I got back to sleep easily.
- ○ I woke up more than once a night and stayed awake for 20 minutes or more, more than half the time (4 days or more out of the past 7 days).

Waking up too early:

- ○ Most of the time, I woke up no more than 30 minutes before my scheduled time.
- ○ More than half the time (4 days or more out of the past 7 days), I woke up more than 30 minutes before my scheduled time.
- ○ I almost always woke up at least one hour or so before my scheduled time, but I got back to sleep eventually.
- ○ I woke up at least one hour before my scheduled time, and couldn't get back to sleep.

Sleeping too much:

- ○ I slept no longer than 7-8 hours/night, without napping during the day.
- ○ I slept no longer than 10 hours in a 24-hour period including naps.
- ○ I slept no longer than 12 hours in a 24-hour period including naps.
- ○ I slept longer than 12 hours in a 24-hour period including naps.

Feeling sad:

- ○ I didn't feel sad.
- ○ I felt sad less than half the time (3 days or less out of the past 7 days).

- ○ I felt sad more than half the time (4 days or more out of the past 7 days).
- ○ I felt sad nearly all of the time.

Appetite:

- ○ There was no change in my usual appetite.
- ○ I ate somewhat less often or smaller amounts of food than usual.
- ○ I ate much less than usual and only by forcing myself to eat.
- ○ I rarely ate within a 24-hour period, and only by really forcing myself to eat or when others persuaded me to eat.
- ○ I felt a need to eat more frequently than usual.
- ○ I regularly ate more often and/or greater amounts of food than usual.
- ○ I felt driven to overeat both at mealtime and between meals.

Decreased weight (within the last 14 days):

- ○ My weight has not changed.
- ○ I feel as if I've had a slight weight loss.
- ○ I've lost 2 pounds (about 1 kilo) or more.
- ○ I've lost 5 pounds (about 2 kilos) or more.
- ○ I feel as if I've had a slight weight gain.
- ○ I've gained 2 pounds (about 1 kilo) or more.
- ○ I've gained 5 pounds (about 2 kilos) or more.

Concentration/decision-making:

- ○ There was no change in my usual ability to concentrate or make decisions.
- ○ I occasionally felt indecisive or found that my attention wandered.
- ○ Most of the time, I found it hard to focus or to make decisions.
- ○ I couldn't concentrate well enough to read or I couldn't make even minor decisions.

Perception of myself:

- ○ I saw myself as equally worthwhile and deserving as other people.
- ○ I put the blame on myself more than usual.
- ○ For the most part, I believed that I caused problems for others.
- ○ I thought almost constantly about major and minor defects in myself.

Thoughts of my own death or suicide:

- ○ I didn't think of suicide or death.
- ○ I felt that life was empty or wondered if it was worth living.
- ○ I thought of suicide or death several times for several minutes over the past 7 days.
- ○ I thought of suicide or death several times a day in some detail, or I made specific plans for suicide or actually tried to take my life.

General interest:

- ○ There was no change from usual in how interested I was in other people or activities.
- ○ I noticed that I was less interested in other people or activities.
- ○ I found I had interest in only one or two of the activities I used to do.
- ○ I had virtually no interest in the activities I used to do.

Energy level:

- ○ There was no change in my usual level of energy.
- ○ I got tired more easily than usual.
- ○ I had to make a big effort to start or finish my usual daily activities (for example: shopping, homework, cooking or going to work).
- ○ I really couldn't carry out most of my usual daily activities because I just didn't have the energy.

Feeling more sluggish than usual:

- ○ I thought, spoke, and moved at my usual pace.
- ○ I found that my thinking was more sluggish than usual or my voice sounded dull or flat.
- ○ It took me several seconds to respond to most questions and I was sure my thinking was more sluggish than usual.
- ○ I was often unable to respond to questions without forcing myself.

Feeling restless (agitated, not relaxed, fidgety):

- ○ I didn't feel restless.
- ○ I was often fidgety, wringing my hands, or needed to change my sitting position.
- ○ I had sudden urges to move about and was quite restless.
- ○ At times, I was unable to stay seated and needed to pace around.

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month, what time have you usually gone to bed at night?
__:__:__ (HH/MM/SS)

During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

During the past month, what time have you usually gotten up in the morning?
__:__:__ (HH/MM/SS)

During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

For each of the remaining questions, check the one best response. Please answer all questions.

During the past month, how often have you had trouble sleeping because you . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Cannot get to sleep within 30 minutes	○	○	○	○
Wake up in the middle of the night or early morning	○	○	○	○
Have to get up to use the bathroom	○	○	○	○
Cannot breathe comfortably	○	○	○	○
Cough or snore loudly	○	○	○	○
Feel too cold	○	○	○	○
Feel too hot	○	○	○	○
Had bad dreams	○	○	○	○
Have pain	○	○	○	○

Other reason(s), please describe:

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
How often during the past month have you had trouble sleeping because of this ("other" reason)?	○	○	○	○

During the past month, how would you rate your sleep quality overall?

- ○ Very good
- ○ Fairly good
- ○ Fairly bad
- ○ Very bad

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- ○ No problem at all
- ○ Only a very slight problem
- ○ Somewhat of a problem
- ○ A very big problem

Do you have a bed partner or room mate?

- ○ No bed partner or room mate
- ○ Partner/room mate in other room
- ○ Partner in same room, but not same bed
- ○ Partner in same bed

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Loud snoring	○	○	○	○
Long pauses between breaths while asleep	○	○	○	○
Legs twitching or jerking while you sleep	○	○	○	○
Episodes of disorientation or confusion during sleep	○	○	○	○
Other restlessness while you sleep*	○	○	○	○

*please describe

This section asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. For each of the following questions, please tick the answer that best describes your answer.

In general, would you say your health is:

- ○ Excellent
- ○ Very Good
- ○ Good
- ○ Fair
- ○ Poor

Compared to one year ago, how would you rate your health in general now?

- ○ Much better now than one year ago
- ○ Somewhat better now than one year ago
- ○ About the same as one year ago
- ○ Somewhat worse now than one year ago
- ○ Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
Vigorous activities, such as running, lifting heave objects, participating in strenuous sports	○	○	○
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
Lifting or carrying groceries	○	○	○
Climbing several flights of stairs	○	○	○
Climbing one flight of stairs	○	○	○
Bending, kneeling, or stooping	○	○	○
Walking more than a mile	○	○	○
Walking several blocks	○	○	○
Walking one block	○	○	○
Bathing or dressing yourself	○	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Were limited in the kind of work or other activities	○	○
Had difficulty performing the work or other activities (for example, it took extra effort)	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Did work or other activities less carefully than usual	○	○

During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours or groups?

- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

How much bodily pain have you had during the past 4 weeks?

- ○ None
- ○ Very mild
- ○ Mild
- ○ Moderate
- ○ Severe
- ○ Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- ○ Not at all

- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

These questions are about how you feel and how things have been with you during the <u>past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks….

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
Did you feel full of pep?	○	○	○	○	○	○
Have you been a very nervous person?	○	○	○	○	○	○
Have you felt so down in the dumps that nothing could cheer you up?	○	○	○	○	○	○
Have you felt calm and peaceful	○	○	○	○	○	○
Did you have a lot of energy?	○	○	○	○	○	○
Have you felt downhearted and blue?	○	○	○	○	○	○
Did you feel worn out?	○	○	○	○	○	○
Have you been a happy person?	○	○	○	○	○	○
Did you feel tired?	○	○	○	○	○	○

During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?

- ○ All of the time
- ○ Most of the time
- ○ Some of the time
- ○ A little of the time
- ○ None of the time

How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I seem to get sick a little easier than other people	○	○	○	○	○
I am as healthy as anybody I know	○	○	○	○	○
I expect my health to get worse	○	○	○	○	○
My health is excellent	○	○	○	○	○

Good Job! You're more than halfway complete! As a reminder, you will receive a $25.00 Amazon gift card at the end of the study in recognition of your participation.

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel RIGHT NOW, THAT IS, AT THIS MOMENT. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately So	Very Much So
I feel calm	○	○	○	○
I feel secure	○	○	○	○
I feel tense	○	○	○	○
I feel strained	○	○	○	○
I feel at ease	○	○	○	○
I feel upset	○	○	○	○
I am presently worrying over possible misfortunes	○	○	○	○
I feel satisfied	○	○	○	○
I feel frightened	○	○	○	○
I feel comfortable	○	○	○	○
I feel self-confident	○	○	○	○
I feel nervous	○	○	○	○
I am jittery	○	○	○	○
I feel indecisive	○	○	○	○
I am relaxed	○	○	○	○
I feel content	○	○	○	○
I am worried	○	○	○	○
I feel confused	○	○	○	○
I feel steady	○	○	○	○
I feel pleasant	○	○	○	○

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you GENERALLY FEEL. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you feel generally.

	Almost never	Sometimes	Often	Almost always
I feel unpleasant	○	○	○	○
I feel nervous and restless	○	○	○	○
I am satisfied with myself	○	○	○	○
I wish I could be as happy as others seem to be	○	○	○	○
I feel like a failure	○	○	○	○
I feel rested	○	○	○	○
I am 'calm, cool, and collected'	○	○	○	○
I feel that difficulties are piling up so that I cannot overcome them	○	○	○	○
I worry too much over something that really doesn't matter	○	○	○	○
I am happy	○	○	○	○
I have disturbing thoughts	○	○	○	○
I lack self-confidence	○	○	○	○
I feel secure	○	○	○	○
I make decisions easily	○	○	○	○
I feel inadequate	○	○	○	○
I am content	○	○	○	○
Some unimportant thought runs through my mind and bothers me	○	○	○	○
I take disappointments so keenly that I can't put them out of my mind	○	○	○	○
I am a steady person	○	○	○	○
I get in a state of tension or turmoil as I think over my recent concerns and interests	○	○	○	○

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate HOW OFTEN you felt or thought a certain way.

	Never	Almost never	Sometimes	Often	Fairly often
In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
In the last month, how often have you felt nervous and “stressed”?	○	○	○	○	○
In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
In the last month, how often have you been angered because of things that were outside your control?	○	○	○	○	○
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

The following questions ask about the effect of your health problems on your ability to work and perform regular activities. By health problems we mean any physical or emotional problem or symptom.

Question 1. Are you currently employed (working for pay)? If NO, check "NO" and skip to question 6.

- ○ No
- ○ Yes

The next questions are about the past seven days, not including today.

Question 2. During the past seven days, how many hours did you miss from work <u>because of your health problems</u>? Include hours you missed on sick days, times you went in late, left early, etc., because of your health problems. Do not include time you missed to participate in this study.
HOURS:

[ ]

Question 3. During the past seven days, how many hours did you miss from work because of any other reason, such as vacation, holidays, time off to participate in this study?
HOURS:

[ ]

Question 4. During the past seven days, how many hours did you actually work?
(If "0", skip to question 6.) HOURS :

[ ]

Question 5. During the past seven days, how much did your health problems affect your productivity while you were working?
Think about days you were limited in the amount or kind of work you could do, days you accomplished less than you would like, or days you could not do your work as carefully as usual. If health problems affected your work only a little, choose a low number. Choose a high number if health problems affected your work a great deal.

Consider only how much <u>health problems</u> affected productivity <u>while you were working</u>.

Health problems had no effect on my work (0)	[ ]	Health problems completely prevented me from working (10)

Question 6. During the past seven days, how much did your health problems affect your ability to do your regular daily activities, other than work at a job?

By regular activities, we mean the usual activities you do, such as work around the house, shopping, childcare, exercising, studying, etc. Think about times you were limited in the amount or kind of activities you could do and times you accomplished less than you would like. If health problems affected your activities only a little, choose a low number. Choose a high number if health problems affected your activities a great deal.

Consider only how much health problems affected your ability to do your regular daily activities, other than work at a job.

Health problems had no effect on my daily activities (0)

Health problems completely prevented me from doing my daily activities (10)

What is the highest degree in education that you have achieved?

- ○ I never finished school or training programme
- ○ Primary school or elementary school
- ○ Junior vocational education
- ○ Lower general secondary school
- ○ Intermediate vocational education
- ○ Higher general secondary education
- ○ School for higher vocational education
- ○ University
- ○ I achieved another degree, namely _____

Do you have a paying job?

- ○ Yes
- ○ No

The following questions refer to your work. That is work that you get paid for. ***You do not have a paying job? Skip to question 10. Please first read the explanation above the question.***

Question 1. What is your occupation?

Question 2. How many hours a week do you work?

Count only the hours that you get paid.

HOURS:

Question 3. How many days a week do you work?

DAYS:

Question 4. Have you missed work in the last 4 weeks as a result of being sick?

(Only count the missed work days in the last 4 weeks)

Did you check "Yes"? Go to question 5. Otherwise skip to question 7.

- ○ No

○ Yes, I have missed ___ days: _____

Question 5. Did you miss work earlier than the period of 4 weeks due to being sick?
This is referring to one whole uninterrupted period of missed work as a result of being sick.

Did you check "Yes"? Go to question 6. Otherwise skip to question 7.

○ No

○ Yes

Question 6. When did you call in sick?
Skip to question 10. Please first read the explanation above question 10.

____/__/__ (YYYY/MM/DD)

Question 7. During the last 4 weeks have there been days in which you worked but during this time were bothered by physical or psychological problems?
Did you check "Yes"? Go to question 8 and 9. Otherwise skip to question 10. *First read the explanation above question 10.*

○ No

○ Yes

Question 8. How many days at work were you bothered by physical or psychological problems?
(Only count the days at work in the last 4 weeks)

WORK DAYS:

Question 9. On the days that you were bothered by these problems, was it perhaps difficult to get as much work finished as you normally do? On these days how much work could you do on average?
A 10 means that you were able to do as much work as you normally do. A 5 means you were able to do half as much as you normally do. A 0 means that you were unable to do any work on these days.

On these days I could not do anything (0)

I was able to do just as much as I normally do (10)

Explanation
Even for unpaid work, you can be bothered by physical or psychological problems. Sometimes as a result you (might) do less. For example you have trouble caring for your children or doing voluntary work. Or

you are unable to run errands and pick up groceries, or to work in the garden. The following questions refer to this.

Question 10. Were there days in which you were forced to do less unpaid work because of physical or psychological problems?
Only days in the last four weeks.

Did you check "Yes"? Go to question 11 and 12. Otherwise skip to the end of the questionnaire.

- ○ No
- ○ Yes

Question 11. How many days did this happen?
Only count the days in the last 4 weeks.

DAYS:

Question 12. Imagine that somebody, for example your partner, family member or friend helped you on these days, and he or she did all the unpaid work that you were unable to do for you. How many hours on average did that person spend doing this on these days?
On average …….. hours on these days

Select the option that best describes your position at UBC:

- ○ Student
- ○ Staff
- ○ Faculty
- ○ Other, please specify... _____

Program/Faculty:

If you are a student, please also give year of study:

[ ]

Sex:

[ ]

Age:

[ ]

Income:

[ ]

Have you ever been diagnosed with a mental health disorder?

- ○ Yes
- ○ No
- ○ Prefer not to disclose

If you answered "yes" to the question above, what diagnosis have you received:

- ○ Schizophrenia
- ○ Bipolar disorder
- ○ Depression
- ○ Anxiety disorder
- ○ Schizoaffective disorder
- ○ Dually diagnosed (substance use and mental illness)
- ○ Other, please specify... _____

Are you currently receiving mental health services?

- ○ Yes
- ○ No

If you answered "yes" to the question above, for how long have you received these services:

- ○ Less than 1 year
- ○ 1-2 years
- ○ 3-5 years
- ○ More than 5 years

Select all levels of educational background that you have completed:

- ☐ High school (but did not graduate)
- ☐ High school
- ☐ CEGEP
- ☐ College
- ☐ Non-college-based apprenticeship, trades certificate or diploma program
- ☐ University undergraduate program
- ☐ University graduate program
- ☐ Other, please specify... _____

Comments:

How do you describe yourself in terms of your ethnic origin? Please mark the one or two groups that you feel most closely describe(s) your ethnic origin.

- ☐ White
- ☐ Native/Aboriginal
- ☐ Chinese
- ☐ American
- ☐ Southeast Asian (e.g. Vietnamese, Cambodian, Malaysian, Laotian etc.)
- ☐ South Asian (e.g. East Indian, Pakistani, Sri Lankan etc.)
- ☐ Filipino
- ☐ Latin American

- ☐ Black
- ☐ Arab
- ☐ Korean
- ☐ Japanese
- ☐ West Asian (e.g. Iranian, Afghani etc.)
- ☐ Other, please specify... _____

Please provide a VALID e-mail that we can use to provide you with the mHealth app. This e-mail address must be provided for you to fully participate in the study.
We will contact you shortly with a code for a free download.

[ ]

Re-type e-mail to confirm:

[ ]

Do you have an Android or Apple product?

- ○ Android
- ○ Apple

Thank you for completing this survey! You will be contacted shortly. Your participation is appreciated and will provide valuable data to this research project. You will receive a $25.00 Amazon gift card at the end of the study in recognition of your participation. If you have any questions concerning the study, please contact the lead researcher.

If you have any questions or comments, please respond below:

Appendix C: Post-Intervention Questionnaire

Appendix C1: Post-Intervention Questionnaire – Experimental Condition

Evaluation of an mHealth App

THANK YOU FOR YOUR PARTICIPATION!

After completing this survey, you will be e-mailed your $25 Amazon gift card.

INSTRUCTIONS: Please answer EVERY question as honestly as possible. Your intuition is the best answer – there is no right or wrong answer. If you have any questions, please let the researcher know (Dr. Mary Jung, 250-807-9670, mary.jung@ubc.ca).

PLEASE CHECK THE ONE RESPONSE TO EACH ITEM THAT IS MOST APPROPRIATE TO HOW YOU HAVE BEEN FEELING OVER THE PAST 7 DAYS.

Falling asleep:

- ○ I never took longer than 30 minutes to fall asleep.
- ○ I took at least 30 minutes to fall asleep, less than half the time (3 days or less out of the past 7 days).
- ○ I took at least 30 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).
- ○ I took more than 60 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).

Sleep during the night:

- ○ I didn't wake up at night.
- ○ I had a restless, light sleep, briefly waking up a few times each night.
- ○ I woke up at least once a night, but I got back to sleep easily.
- ○ I woke up more than once a night and stayed awake for 20 minutes or more, more than half the time (4 days or more out of the past 7 days).

Waking up too early:

- ○ Most of the time, I woke up no more than 30 minutes before my scheduled time.
- ○ More than half the time (4 days or more out of the past 7 days), I woke up more than 30 minutes before my scheduled time.
- ○ I almost always woke up at least one hour or so before my scheduled time, but I got back to sleep eventually.
- ○ I woke up at least one hour before my scheduled time, and couldn't get back to sleep.

Sleeping too much:

- ○ I slept no longer than 7-8 hours/night, without napping during the day.
- ○ I slept no longer than 10 hours in a 24-hour period including naps.
- ○ I slept no longer than 12 hours in a 24-hour period including naps.
- ○ I slept longer than 12 hours in a 24-hour period including naps.

Feeling sad:

- ○ I didn't feel sad.
- ○ I felt sad less than half the time (3 days or less out of the past 7 days).

- ○ I felt sad more than half the time (4 days or more out of the past 7 days).
- ○ I felt sad nearly all of the time.

Appetite:

- ○ There was no change in my usual appetite.
- ○ I ate somewhat less often or smaller amounts of food than usual.
- ○ I ate much less than usual and only by forcing myself to eat.
- ○ I rarely ate within a 24-hour period, and only by really forcing myself to eat or when others persuaded me to eat.
- ○ I felt a need to eat more frequently than usual.
- ○ I regularly ate more often and/or greater amounts of food than usual.
- ○ I felt driven to overeat both at mealtime and between meals.

Weight (within the last 14 days):

- ○ My weight has not changed.
- ○ I feel as if I've had a slight weight loss.
- ○ I've lost 2 pounds (about 1 kilo) or more.
- ○ I've lost 5 pounds (about 2 kilos) or more.
- ○ I feel as if I've had a slight weight gain.
- ○ I've gained 2 pounds (about 1 kilo) or more.
- ○ I've gained 5 pounds (about 2 kilos) or more.

Concentration/decision-making:

- ○ There was no change in my usual ability to concentrate or make decisions.
- ○ I occasionally felt indecisive or found that my attention wandered.
- ○ Most of the time, I found it hard to focus or to make decisions.
- ○ I couldn't concentrate well enough to read or I couldn't make even minor decisions.

Perception of myself:

- ○ I saw myself as equally worthwhile and deserving as other people.
- ○ I put the blame on myself more than usual.
- ○ For the most part, I believed that I caused problems for others.
- ○ I thought almost constantly about major and minor defects in myself.

Thoughts of my own death or suicide:

- ○ I didn't think of suicide or death.
- ○ I felt that life was empty or wondered if it was worth living.
- ○ I thought of suicide or death several times for several minutes over the past 7 days.
- ○ I thought of suicide or death several times a day in some detail, or I made specific plans for suicide or actually tried to take my life.

General interest:

- ○ There was no change from usual in how interested I was in other people or activities.
- ○ I noticed that I was less interested in other people or activities.
- ○ I found I had interest in only one or two of the activities I used to do.
- ○ I had virtually no interest in the activities I used to do.

Energy level:

- ○ There was no change in my usual level of energy.
- ○ I got tired more easily than usual.
- ○ I had to make a big effort to start or finish my usual daily activities (for example: shopping, homework, cooking or going to work).
- ○ I really couldn't carry out most of my usual daily activities because I just didn't have the energy.

Feeling more sluggish than usual:

- ○ I thought, spoke, and moved at my usual pace.
- ○ I found that my thinking was more sluggish than usual or my voice sounded dull or flat.
- ○ It took me several seconds to respond to most questions and I was sure my thinking was more sluggish than usual.
- ○ I was often unable to respond to questions without forcing myself.

Feeling restless (agitated, not relaxed, fidgety):

- ○ I didn't feel restless.
- ○ I was often fidgety, wringing my hands, or needed to change my sitting position.
- ○ I had sudden urges to move about and was quite restless.
- ○ At times, I was unable to stay seated and needed to pace around.

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month, what time have you usually gone to bed at night?
__:__:__ (HH/MM/SS)

During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

During the past month, what time have you usually gotten up in the morning?
__:__:__ (HH/MM/SS)

During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

(0)  (24)

For each of the remaining questions, check the one best response. Please answer all questions.

During the past month, how often have you had trouble sleeping because you . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Cannot get to sleep within 30 minutes	○	○	○	○
Wake up in the middle of the night or early morning	○	○	○	○
Have to get up to use the bathroom	○	○	○	○
Cannot breathe comfortably	○	○	○	○
Cough or snore loudly	○	○	○	○
Feel too cold	○	○	○	○
Feel too hot	○	○	○	○
Had bad dreams	○	○	○	○
Have pain	○	○	○	○

Other reason(s), please describe:

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
How often during the past month have you had trouble sleeping because of this ("other" reason)?	○	○	○	○

During the past month, how would you rate your sleep quality overall?

- ○ Very good
- ○ Fairly good
- ○ Fairly bad
- ○ Very bad

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- ○ No problem at all
- ○ Only a very slight problem
- ○ Somewhat of a problem
- ○ A very big problem

Do you have a bed partner or room mate?

- ○ No bed partner or room mate
- ○ Partner/room mate in other room
- ○ Partner in same room, but not same bed
- ○ Partner in same bed

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Loud snoring	○	○	○	○
Long pauses between breaths while asleep	○	○	○	○
Legs twitching or jerking while you sleep	○	○	○	○
Episodes of disorientation or confusion during sleep	○	○	○	○
Other restlessness while you sleep*	○	○	○	○

*please describe

In the past 4 weeks, has your sleeping improved or worsened?

- ○ Improved
- ○ Worsened
- ○ Stayed about the same

This section asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. For each of the following questions, please tick the answer that best describes your answer.

In general, would you say your health is:

- ○ Excellent
- ○ Very Good
- ○ Good
- ○ Fair
- ○ Poor

Compared to one year ago, how would you rate your health in general now?

- ○ Much better now than one year ago
- ○ Somewhat better now than one year ago
- ○ About the same as one year ago
- ○ Somewhat worse now than one year ago
- ○ Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
Vigorous activities, such as running, lifting heave objects, participating in strenuous sports	○	○	○
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
Lifting or carrying groceries	○	○	○
Climbing several flights of stairs	○	○	○
Climbing one flight of stairs	○	○	○
Bending, kneeling, or stooping	○	○	○
Walking more than a mile	○	○	○
Walking several blocks	○	○	○
Walking one block	○	○	○
Bathing or dressing yourself	○	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Were limited in the kind of work or other activities	○	○
Had difficulty performing the work or other activities (for example, it took extra effort)	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Did work or other activities less carefully than usual	○	○

During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours or groups?

- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

How much bodily pain have you had during the past 4 weeks?

- ○ None
- ○ Very mild
- ○ Mild
- ○ Moderate
- ○ Severe
- ○ Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- ○ Not at all

- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

These questions are about how you feel and how things have been with you during the <u>past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks….

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
Did you feel full of pep?	○	○	○	○	○	○
Have you been a very nervous person?	○	○	○	○	○	○
Have you felt so down in the dumps that nothing could cheer you up?	○	○	○	○	○	○
Have you felt calm and peaceful	○	○	○	○	○	○
Did you have a lot of energy?	○	○	○	○	○	○
Have you felt downhearted and blue?	○	○	○	○	○	○
Did you feel worn out?	○	○	○	○	○	○
Have you been a happy person?	○	○	○	○	○	○
Did you feel tired?	○	○	○	○	○	○

During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?

- ○ All of the time
- ○ Most of the time
- ○ Some of the time
- ○ A little of the time
- ○ None of the time

How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I seem to get sick a little easier than other people	○	○	○	○	○
I am as healthy as anybody I know	○	○	○	○	○
I expect my health to get worse	○	○	○	○	○
My health is excellent	○	○	○	○	○

Good Job! You're more than halfway complete! As a reminder, you will receive a $25.00 Amazon gift card at the end of the study in recognition of your participation.

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel RIGHT NOW, THAT IS, AT THIS MOMENT. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately So	Very Much So
I feel calm	○	○	○	○
I feel secure	○	○	○	○
I feel tense	○	○	○	○
I feel strained	○	○	○	○
I feel at ease	○	○	○	○
I feel upset	○	○	○	○
I am presently worrying over possible misfortunes	○	○	○	○
I feel satisfied	○	○	○	○
I feel frightened	○	○	○	○
I feel comfortable	○	○	○	○
I feel self-confident	○	○	○	○
I feel nervous	○	○	○	○
I am jittery	○	○	○	○
I feel indecisive	○	○	○	○
I am relaxed	○	○	○	○
I feel content	○	○	○	○
I am worried	○	○	○	○
I feel confused	○	○	○	○
I feel steady	○	○	○	○
I feel pleasant	○	○	○	○

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you <u>GENERALLY FEEL</u>. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you feel generally.

	Almost never	Sometimes	Often	Almost always
I feel unpleasant	○	○	○	○
I feel nervous and restless	○	○	○	○
I am satisfied with myself	○	○	○	○
I wish I could be as happy as others seem to be	○	○	○	○
I feel like a failure	○	○	○	○
I feel rested	○	○	○	○
I am 'calm, cool, and collected'	○	○	○	○
I feel that difficulties are piling up so that I cannot overcome them	○	○	○	○
I worry too much over something that really doesn't matter	○	○	○	○
I am happy	○	○	○	○
I have disturbing thoughts	○	○	○	○
I lack self-confidence	○	○	○	○
I feel secure	○	○	○	○
I make decisions easily	○	○	○	○
I feel inadequate	○	○	○	○
I am content	○	○	○	○
Some unimportant thought runs through my mind and bothers me	○	○	○	○
I take disappointments so keenly that I can't put them out of my mind	○	○	○	○
I am a steady person	○	○	○	○
I get in a state of tension or turmoil as I think over my recent concerns and interests	○	○	○	○

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate HOW OFTEN you felt or thought a certain way.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
In the last month, how often have you felt nervous and "stressed"?	○	○	○	○	○
In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
In the last month, how often have you been angered because of things that were outside your control?	○	○	○	○	○
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

The following questions ask about the effect of your health problems on your ability to work and perform regular activities. By health problems we mean any physical or emotional problem or symptom.

Question 1. Are you currently employed (working for pay)?

- ○ No
- ○ Yes

The next questions are about the past seven days, not including today.

Question 2. During the past seven days, how many hours did you miss from work <u>because of your health problems</u>? Include hours you missed on sick days, times you went in late, left early, etc., because of your health problems. Do not include time you missed to participate in this study.
HOURS:

Question 3. During the past seven days, how many hours did you miss from work because of any other reason, such as vacation, holidays, time off to participate in this study?
HOURS:

Question 4. During the past seven days, how many hours did you actually work?
HOURS:

Question 5. During the past seven days, how much did your health problems affect your productivity while you were working?
Think about days you were limited in the amount or kind of work you could do, days you accomplished less than you would like, or days you could not do your work as carefully as usual. If health problems affected your work only a little, choose a low number. Choose a high number if health problems affected your work a great deal.

Consider only how much <u>health problems</u> affected productivity <u>while you were working</u>.

Health problems had no effect on my health (0)		Health problems completely prevented me from working (10)

Question 6. During the past seven days, how much did your health problems affect your ability to do your regular daily activities, other than work at a job?

By regular activities, we mean the usual activities you do, such as work around the house, shopping, childcare, exercising, studying, etc. Think about times you were limited in the amount or kind of activities you could do and times you accomplished less than you would like. If health problems affected your activities only a little, choose a low number. Choose a high number if health problems affected your activities a great deal.

Consider only how much health problems affected your ability to do your regular daily activities, other than work at a job.

Health problems had no effect on my daily activities (0)		Health problems completely prevented me from doing my daily activities (10)

Do you have a paying job?

- ○ Yes
- ○ No

The following questions refer to your work. That is work that you get paid for. ***Please first read the explanation above the question.***

Question 1. What is your occupation?

Question 2. How many hours a week do you work?

Count only the hours that you get paid.

HOURS:

(0) (168)

Question 3. How many days a week do you work?

DAYS:

(0) (7)

Question 4. Have you missed work in the last 4 weeks as a result of being sick?

(Only count the missed work days in the last 4 weeks)

- ○ No
- ○ Yes, I have missed ___ days: _____

Question 5. Did you miss work earlier than the period of 4 weeks due to being sick?

This is referring to one whole uninterrupted period of missed work as a result of being sick.

- ○ No
- ○ Yes

Question 6. When did you call in sick?

____/__/__ (YYYY/MM/DD)

Question 7. During the last 4 weeks have there been days in which you worked but during this time were bothered by physical or psychological problems?

- ○ No
- ○ Yes

Question 8. How many days at work were you bothered by physical or psychological problems?
(Only count the days at work in the last 4 weeks)

WORK DAYS:

Question 9. On the days that you were bothered by these problems, was it perhaps difficult to get as much work finished as you normally do? On these days how much work could you do on average?
A 10 means that you were able to do as much work as you normally do. A 5 means you were able to do half as much as you normally do. A 0 means that you were unable to do any work on these days.

On these days I could not to anything (0) — I was able to do just as much as I normally do (10)

Explanation
Even for unpaid work, you can be bothered by physical or psychological problems. Sometimes as a result you (might) do less. For example you have trouble caring for your children or doing voluntary work. Or you are unable to run errands and pick up groceries, or to work in the garden. The following questions refer to this.

Question 10. Were there days in which you were forced to do less unpaid work because of physical or psychological problems?
Only days in the last four weeks.

- ○ No
- ○ Yes

Question 11. How many days did this happen?
Only count the days in the last 4 weeks.

DAYS:

(0)  (28)

Question 12. Imagine that somebody, for example your partner, family member or friend helped you on these days, and he or she did all the unpaid work that you were unable to do for you. How many hours on average did that person spend doing this on these days?

On average …….. hours on these days

(0)  (24)

In the past 4 weeks, do you feel that your work or school productivity has changed?

- ○ I think I was **MORE** productive.
- ○ I think I was **LESS** productive.
- ○ I think my productivity stayed about the same.

Select the option that best describes your position at UBC:

- ○ Student
- ○ Staff
- ○ Faculty
- ○ Other, please specify... _____

Please give year of study:

- ○ First year (1)
- ○ Second year (2)
- ○ Third year (3)
- ○ Fourth year (4)
- ○ Fifth year (5)
- ○ Other (please specify) _____

Program/Faculty:

- ○ Anthropology
- ○ Computer Science
- ○ Economics
- ○ French
- ○ Gender and Women's Studies
- ○ Geography
- ○ Indigenous Studies
- ○ Latin American Studies
- ○ Medieval and Renaissance Studies
- ○ Philosophy

... 31 additional choices hidden ...

- ○ Not associated with a faculty/program
- ○ Other

Please specify: [ ]

Have you ever been diagnosed with a mental health disorder?

- ○ Yes
- ○ No
- ○ Prefer not to disclose

If you answered "yes" to the question above, what diagnosis have you received:

- ☐ Schizophrenia
- ☐ Bipolar disorder
- ☐ Depression
- ☐ Anxiety disorder
- ☐ Schizoaffective disorder
- ☐ Dually diagnosed (substance use and mental illness)
- ☐ Other, please specify... _____

Are you currently receiving mental health services?

- ○ Yes
- ○ No

If you answered "yes" to the question above, for how long have you received these services:

- ○ Less than 1 year
- ○ 1-2 years
- ○ 3-5 years
- ○ More than 5 years

Select all levels of educational background that you have completed:

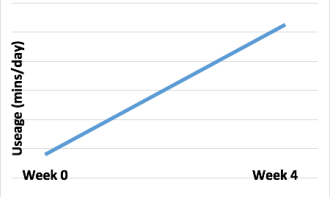
- ☐ High school (but did not graduate)
- ☐ High school
- ☐ CEGEP
- ☐ College
- ☐ Non-college-based apprenticeship, trades certificate or diploma program
- ☐ University undergraduate program
- ☐ University graduate program
- ☐ Other, please specify... _____

You were requested to use the Destressify CORE program 5 days a week. Please rate how often you used this app, in comparison to the frequency of use requested.

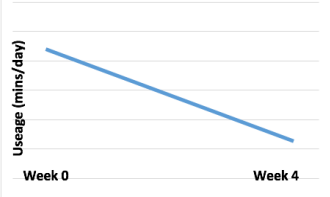
Did not use at all (0) — Used as often as requested (10)

Select the pattern that best describes your use of the app. Note that the vertical (x) axis marks app use while the horizontal (y) axis marks time (0 to 4 weeks).

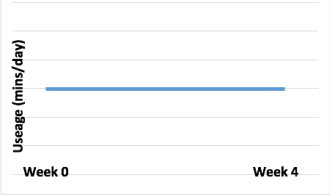
○ Increase in use



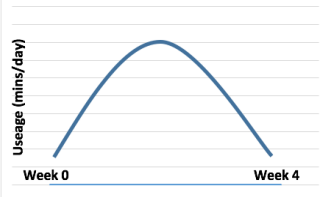
○ Decrease in use



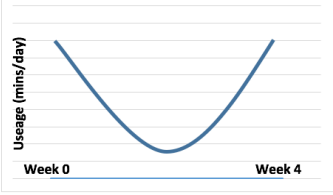
○ Consistent



○ Increase then decrease in use



○ Decrease then increase in use



Thank you for completing this survey!

This information will be used in Rebecca Lee's masters thesis. A copy of this thesis will be publicly available on UBC's cIRcle. If you have any questions, please contact the lead researcher (mary.jung@ubc.ca).

Your participation is appreciated and will provide valuable data for our research project. Please provide the SAME email that you initially used to participate in this study (i.e. to correspond and receive the app download code).

Please provide a valid e-mail address below to receive your $25.00 Amazon gift card. This can be the same e-mail as above, or a different e-mail.

The Destressify core program is a total of 58 days. You have completed approximately half of the program. Would you like to continue using the app and complete a second follow-up survey upon completion of the core program? Those who complete the additional survey will be entered into a draw to win one of ten $50 gift cards.

- ○ Yes, please!

  Great! Please continue to use the app as recommended. We will contact you once you have completed the entire core program.

- ○ No, thank you.

If you have any questions or comments, please respond below:

Appendix C2: Post-Intervention Questionnaire – Control Condition

Evaluation of an mHealth App

THANK YOU FOR YOUR PARTICIPATION!

After completing this survey, you will be e-mailed your $25 Amazon gift card.

INSTRUCTIONS: Please answer EVERY question as honestly as possible. Your intuition is the best answer – there is no right or wrong answer. If you have any questions, please let the researcher know (Dr. Mary Jung, 250-807-9670, mary.jung@ubc.ca).

PLEASE CHECK THE ONE RESPONSE TO EACH ITEM THAT IS MOST APPROPRIATE TO HOW YOU HAVE BEEN FEELING OVER THE PAST 7 DAYS.

Falling asleep:

- ○ I never took longer than 30 minutes to fall asleep.
- ○ I took at least 30 minutes to fall asleep, less than half the time (3 days or less out of the past 7 days).
- ○ I took at least 30 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).
- ○ I took more than 60 minutes to fall asleep, more than half the time (4 days or more out of the past 7 days).

Sleep during the night:

- ○ I didn't wake up at night.
- ○ I had a restless, light sleep, briefly waking up a few times each night.
- ○ I woke up at least once a night, but I got back to sleep easily.
- ○ I woke up more than once a night and stayed awake for 20 minutes or more, more than half the time (4 days or more out of the past 7 days).

Waking up too early:

- ○ Most of the time, I woke up no more than 30 minutes before my scheduled time.
- ○ More than half the time (4 days or more out of the past 7 days), I woke up more than 30 minutes before my scheduled time.
- ○ I almost always woke up at least one hour or so before my scheduled time, but I got back to sleep eventually.
- ○ I woke up at least one hour before my scheduled time, and couldn't get back to sleep.

Sleeping too much:

- ○ I slept no longer than 7-8 hours/night, without napping during the day.
- ○ I slept no longer than 10 hours in a 24-hour period including naps.
- ○ I slept no longer than 12 hours in a 24-hour period including naps.
- ○ I slept longer than 12 hours in a 24-hour period including naps.

Feeling sad:

- ○ I didn't feel sad.
- ○ I felt sad less than half the time (3 days or less out of the past 7 days).

- ○ I felt sad more than half the time (4 days or more out of the past 7 days).
- ○ I felt sad nearly all of the time.

Appetite:

- ○ There was no change in my usual appetite.
- ○ I ate somewhat less often or smaller amounts of food than usual.
- ○ I ate much less than usual and only by forcing myself to eat.
- ○ I rarely ate within a 24-hour period, and only by really forcing myself to eat or when others persuaded me to eat.
- ○ I felt a need to eat more frequently than usual.
- ○ I regularly ate more often and/or greater amounts of food than usual.
- ○ I felt driven to overeat both at mealtime and between meals.

Weight (within the last 14 days):

- ○ My weight has not changed.
- ○ I feel as if I've had a slight weight loss.
- ○ I've lost 2 pounds (about 1 kilo) or more.
- ○ I've lost 5 pounds (about 2 kilos) or more.
- ○ I feel as if I've had a slight weight gain.
- ○ I've gained 2 pounds (about 1 kilo) or more.
- ○ I've gained 5 pounds (about 2 kilos) or more.

Concentration/decision-making:

- ○ There was no change in my usual ability to concentrate or make decisions.
- ○ I occasionally felt indecisive or found that my attention wandered.
- ○ Most of the time, I found it hard to focus or to make decisions.
- ○ I couldn't concentrate well enough to read or I couldn't make even minor decisions.

Perception of myself:

- ○ I saw myself as equally worthwhile and deserving as other people.
- ○ I put the blame on myself more than usual.
- ○ For the most part, I believed that I caused problems for others.
- ○ I thought almost constantly about major and minor defects in myself.

Thoughts of my own death or suicide:

- ○ I didn't think of suicide or death.
- ○ I felt that life was empty or wondered if it was worth living.
- ○ I thought of suicide or death several times for several minutes over the past 7 days.
- ○ I thought of suicide or death several times a day in some detail, or I made specific plans for suicide or actually tried to take my life.

General interest:

- ○ There was no change from usual in how interested I was in other people or activities.
- ○ I noticed that I was less interested in other people or activities.
- ○ I found I had interest in only one or two of the activities I used to do.
- ○ I had virtually no interest in the activities I used to do.

Energy level:

- ○ There was no change in my usual level of energy.
- ○ I got tired more easily than usual.
- ○ I had to make a big effort to start or finish my usual daily activities (for example: shopping, homework, cooking or going to work).
- ○ I really couldn't carry out most of my usual daily activities because I just didn't have the energy.

Feeling more sluggish than usual:

- ○ I thought, spoke, and moved at my usual pace.
- ○ I found that my thinking was more sluggish than usual or my voice sounded dull or flat.
- ○ It took me several seconds to respond to most questions and I was sure my thinking was more sluggish than usual.
- ○ I was often unable to respond to questions without forcing myself.

Feeling restless (agitated, not relaxed, fidgety):

- ○ I didn't feel restless.
- ○ I was often fidgety, wringing my hands, or needed to change my sitting position.
- ○ I had sudden urges to move about and was quite restless.
- ○ At times, I was unable to stay seated and needed to pace around.

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month, what time have you usually gone to bed at night?
__:__:__ (HH/MM/SS)

During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

During the past month, what time have you usually gotten up in the morning?
__:__:__ (HH/MM/SS)

During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

(0)  (24)

For each of the remaining questions, check the one best response. Please answer all questions.

During the past month, how often have you had trouble sleeping because you . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Cannot get to sleep within 30 minutes	○	○	○	○
Wake up in the middle of the night or early morning	○	○	○	○
Have to get up to use the bathroom	○	○	○	○
Cannot breathe comfortably	○	○	○	○
Cough or snore loudly	○	○	○	○
Feel too cold	○	○	○	○
Feel too hot	○	○	○	○
Had bad dreams	○	○	○	○
Have pain	○	○	○	○

Other reason(s), please describe:

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
How often during the past month have you had trouble sleeping because of this ("other" reason)?	○	○	○	○

During the past month, how would you rate your sleep quality overall?

- ○ Very good
- ○ Fairly good
- ○ Fairly bad
- ○ Very bad

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- ○ No problem at all
- ○ Only a very slight problem
- ○ Somewhat of a problem
- ○ A very big problem

Do you have a bed partner or room mate?

- ○ No bed partner or room mate
- ○ Partner/room mate in other room
- ○ Partner in same room, but not same bed
- ○ Partner in same bed

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

	Not during the past month	Less than once a week	Once or twice a week	Three times or more a week
Loud snoring	○	○	○	○
Long pauses between breaths while asleep	○	○	○	○
Legs twitching or jerking while you sleep	○	○	○	○
Episodes of disorientation or confusion during sleep	○	○	○	○
Other restlessness while you sleep*	○	○	○	○

*please describe

In the past 4 weeks, has your sleeping improved or worsened?

- ○ Improved
- ○ Worsened
- ○ Stayed about the same

This section asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. For each of the following questions, please tick the answer that best describes your answer.

In general, would you say your health is:

- ○ Excellent
- ○ Very Good
- ○ Good
- ○ Fair
- ○ Poor

Compared to one year ago, how would you rate your health in general now?

- ○ Much better now than one year ago
- ○ Somewhat better now than one year ago
- ○ About the same as one year ago
- ○ Somewhat worse now than one year ago
- ○ Much worse now than one year ago

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
Vigorous activities, such as running, lifting heave objects, participating in strenuous sports	○	○	○
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
Lifting or carrying groceries	○	○	○
Climbing several flights of stairs	○	○	○
Climbing one flight of stairs	○	○	○
Bending, kneeling, or stooping	○	○	○
Walking more than a mile	○	○	○
Walking several blocks	○	○	○
Walking one block	○	○	○
Bathing or dressing yourself	○	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Were limited in the kind of work or other activities	○	○
Had difficulty performing the work or other activities (for example, it took extra effort)	○	○

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
Cut down on the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Did work or other activities less carefully than usual	○	○

During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours or groups?

- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

How much bodily pain have you had during the past 4 weeks?

- ○ None
- ○ Very mild
- ○ Mild
- ○ Moderate
- ○ Severe
- ○ Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- ○ Not at all

- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

These questions are about how you feel and how things have been with you during the <u>past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks….

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
Did you feel full of pep?	○	○	○	○	○	○
Have you been a very nervous person?	○	○	○	○	○	○
Have you felt so down in the dumps that nothing could cheer you up?	○	○	○	○	○	○
Have you felt calm and peaceful	○	○	○	○	○	○
Did you have a lot of energy?	○	○	○	○	○	○
Have you felt downhearted and blue?	○	○	○	○	○	○
Did you feel worn out?	○	○	○	○	○	○
Have you been a happy person?	○	○	○	○	○	○
Did you feel tired?	○	○	○	○	○	○

During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?

- ○ All of the time
- ○ Most of the time
- ○ Some of the time
- ○ A little of the time
- ○ None of the time

How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I seem to get sick a little easier than other people	○	○	○	○	○
I am as healthy as anybody I know	○	○	○	○	○
I expect my health to get worse	○	○	○	○	○
My health is excellent	○	○	○	○	○

Good Job! You're more than halfway complete! As a reminder, you will receive a $25.00 Amazon gift card at the end of the study in recognition of your participation.

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel RIGHT NOW, THAT IS, AT THIS MOMENT. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately So	Very Much So
I feel calm	○	○	○	○
I feel secure	○	○	○	○
I feel tense	○	○	○	○
I feel strained	○	○	○	○
I feel at ease	○	○	○	○
I feel upset	○	○	○	○
I am presently worrying over possible misfortunes	○	○	○	○
I feel satisfied	○	○	○	○
I feel frightened	○	○	○	○
I feel comfortable	○	○	○	○
I feel self-confident	○	○	○	○
I feel nervous	○	○	○	○
I am jittery	○	○	○	○
I feel indecisive	○	○	○	○
I am relaxed	○	○	○	○
I feel content	○	○	○	○
I am worried	○	○	○	○
I feel confused	○	○	○	○
I feel steady	○	○	○	○
I feel pleasant	○	○	○	○

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you <u>GENERALLY FEEL</u>. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you feel generally.

	Almost never	Sometimes	Often	Almost always
I feel unpleasant	○	○	○	○
I feel nervous and restless	○	○	○	○
I am satisfied with myself	○	○	○	○
I wish I could be as happy as others seem to be	○	○	○	○
I feel like a failure	○	○	○	○
I feel rested	○	○	○	○
I am 'calm, cool, and collected'	○	○	○	○
I feel that difficulties are piling up so that I cannot overcome them	○	○	○	○
I worry too much over something that really doesn't matter	○	○	○	○
I am happy	○	○	○	○
I have disturbing thoughts	○	○	○	○
I lack self-confidence	○	○	○	○
I feel secure	○	○	○	○
I make decisions easily	○	○	○	○
I feel inadequate	○	○	○	○
I am content	○	○	○	○
Some unimportant thought runs through my mind and bothers me	○	○	○	○
I take disappointments so keenly that I can't put them out of my mind	○	○	○	○
I am a steady person	○	○	○	○
I get in a state of tension or turmoil as I think over my recent concerns and interests	○	○	○	○

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate HOW OFTEN you felt or thought a certain way.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
In the last month, how often have you felt nervous and "stressed"?	○	○	○	○	○
In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
In the last month, how often have you been angered because of things that were outside your control?	○	○	○	○	○
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

The following questions ask about the effect of your health problems on your ability to work and perform regular activities. By health problems we mean any physical or emotional problem or symptom.

Question 1. Are you currently employed (working for pay)?

- ○ No
- ○ Yes

The next questions are about the past seven days, not including today.

Question 2. During the past seven days, how many hours did you miss from work <u>because of your health problems</u>? Include hours you missed on sick days, times you went in late, left early, etc., because of your health problems. Do not include time you missed to participate in this study.
HOURS:

Question 3. During the past seven days, how many hours did you miss from work because of any other reason, such as vacation, holidays, time off to participate in this study?
HOURS:

Question 4. During the past seven days, how many hours did you actually work?
HOURS:

Question 5. During the past seven days, how much did your health problems affect your productivity while you were working?
Think about days you were limited in the amount or kind of work you could do, days you accomplished less than you would like, or days you could not do your work as carefully as usual. If health problems affected your work only a little, choose a low number. Choose a high number if health problems affected your work a great deal.

Consider only how much <u>health problems</u> affected productivity <u>while you were working</u>.

Health problems had no effect on my work (0)		Health problems completely prevented me from working (10)

Question 6. During the past seven days, how much did your health problems affect your ability to do your regular daily activities, other than work at a job?

By regular activities, we mean the usual activities you do, such as work around the house, shopping, childcare, exercising, studying, etc. Think about times you were limited in the amount or kind of activities you could do and times you accomplished less than you would like. If health problems affected your activities only a little, choose a low number. Choose a high number if health problems affected your activities a great deal.

Consider only how much health problems affected your ability to do your regular daily activities, other than work at a job.

Health problems had no effect on my daily activities (0)

Health problems completely prevented me from doing my daily activities (10)

Do you have a paying job?

- ○ Yes
- ○ No

The following questions refer to your work. That is work that you get paid for.

Please first read the explanation above the question.

Question 1. What is your occupation?

Question 2. How many hours a week do you work?

Count only the hours that you get paid.

HOURS:

(0) (168)

Question 3. How many days a week do you work?

DAYS:

(0) (7)

Question 4. Have you missed work in the last 4 weeks as a result of being sick?

(Only count the missed work days in the last 4 weeks)

- ○ No
- ○ Yes, I have missed ___ days: _____

Question 5. Did you miss work earlier than the period of 4 weeks due to being sick?

This is referring to one whole uninterrupted period of missed work as a result of being sick.

- ○ No
- ○ Yes

Question 6. When did you call in sick?

____/__/__ (YYYY/MM/DD)

Question 7. During the last 4 weeks have there been days in which you worked but during this time were bothered by physical or psychological problems?

- ○ No
- ○ Yes

Question 8. How many days at work were you bothered by physical or psychological problems?
(Only count the days at work in the last 4 weeks)

WORK DAYS:

Question 9. On the days that you were bothered by these problems, was it perhaps difficult to get as much work finished as you normally do? On these days how much work could you do on average?
A 10 means that you were able to do as much work as you normally do. A 5 means you were able to do half as much as you normally do. A 0 means that you were unable to do any work on these days.

On these days I could not do anything (0)

I was able to do just as much as I normally do (10)

Explanation
Even for unpaid work, you can be bothered by physical or psychological problems. Sometimes as a result you (might) do less. For example you have trouble caring for your children or doing voluntary work. Or you are unable to run errands and pick up groceries, or to work in the garden. The following questions refer to this.

Question 10. Were there days in which you were forced to do less unpaid work because of physical or psychological problems?
Only days in the last four weeks.

- ○ No
- ○ Yes

Question 11. How many days did this happen?
Only count the days in the last 4 weeks.

DAYS:

(0)  (28)

Question 12. Imagine that somebody, for example your partner, family member or friend helped you on these days, and he or she did all the unpaid work that you were unable to do for you. How many hours on average did that person spend doing this on these days?

On average …….. hours on these days

(0)  (24)

In the past 4 weeks, do you feel that your work or school productivity has changed?

- ○ I think I was **MORE** productive.
- ○ I think I was **LESS** productive.
- ○ I think my productivity stayed about the same.

Select the option that best describes your position at UBC:

- ○ Student
- ○ Staff
- ○ Faculty
- ○ Other, please specify... _____

Please give year of study:

- ○ First year (1)
- ○ Second year (2)
- ○ Third year (3)
- ○ Fourth year (4)
- ○ Fifth year (5)
- ○ Other (please specify) _____

Program/Faculty:

- ○ Anthropology
- ○ Computer Science
- ○ Economics
- ○ French
- ○ Gender and Women's Studies
- ○ Geography
- ○ Indigenous Studies
- ○ Latin American Studies
- ○ Medieval and Renaissance Studies
- ○ Philosophy

... 31 additional choices hidden ...

- ○ Not associated with a faculty/program
- ○ Other

Please specify: [ ]

Have you ever been diagnosed with a mental health disorder?

- ○ Yes
- ○ No
- ○ Prefer not to disclose

If you answered "yes" to the question above, what diagnosis have you received:

- ☐ Schizophrenia
- ☐ Bipolar disorder
- ☐ Depression
- ☐ Anxiety disorder
- ☐ Schizoaffective disorder
- ☐ Dually diagnosed (substance use and mental illness)
- ☐ Other, please specify... _____

Are you currently receiving mental health services?

- ○ Yes
- ○ No

If you answered "yes" to the question above, for how long have you received these services:

- ○ Less than 1 year
- ○ 1-2 years
- ○ 3-5 years
- ○ More than 5 years

Select all levels of educational background that you have completed:

- ☐ High school (but did not graduate)
- ☐ High school
- ☐ CEGEP
- ☐ College
- ☐ Non-college-based apprenticeship, trades certificate or diploma program
- ☐ University undergraduate program
- ☐ University graduate program
- ☐ Other, please specify... _____

Thank you for completing this survey!

This information will be used in Rebecca Lee's masters thesis. A copy of this thesis will be publicly available on UBC's cIRcle. If you have any questions, please contact the lead researcher (mary.jung@ubc.ca).

Your participation is appreciated and will provide valuable data for our research project. Please provide the SAME email that you used to participate in this study (i.e. to correspond and receive the app download code).

Please provide a valid e-mail address below to receive your $25.00 Amazon gift card and app code. This can be the same e-mail as above, or a different e-mail.

Thank you for your participation in our study. You will receive the app code in your e-mail within a few days. We recommend using the app 5 days a week and following what is known as the Core program. Would you like to use the app and complete a second follow-up survey in approximately 4 weeks time? If so, we will send you instructions on how to set up the app's Core program. Also, those who complete the additional survey will be entered into a draw to win one of ten $50 gift cards.

- ○ Yes, please!
- ○ No, thank you.

Great! We will send you the app code and download instructions.

If you have any questions or comments, please respond below: