



Examining the impact of the  
**HUGR AUTHENTIC  
CONNECTIONS**  
Digital Mental Fitness APP  
on mitigating isolation and  
loneliness in the workplace

January 29, 2022

In partnership:





**Examining the impact of the Hugn Authentic Connections digital mental fitness app on mitigating isolation and loneliness in the workplace**

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## Table of Contents

Examining the impact of the Hugn Authentic Connections digital mental fitness app on mitigating isolation and loneliness in the workplace.....	4
The Loneliness Epidemic .....	7
The COVID-19 pandemic’s strain on social connections .....	8
Loneliness and social isolation are growing risk factors in the workplace .....	9
Summary of the development of the Hugn app project and research study.....	11
Considerations when evaluating mental fitness apps like Hugn Authentic Connections app ...	18
Summary.....	20
Appendix A: Hugn Authentic Connections app Research Study Summary .....	22
Purpose .....	22
Methods and Procedures.....	23
Procedure .....	23
Measures .....	24
Hugn Authentic Connections app .....	26
High-level summary of Hugn Authentic Connections app features .....	26
Data analysis .....	28
Participants.....	28
Usage of the app.....	29
Changes over time.....	31
Impact of the app over time (Test 1 to Test 3).....	32
Key observations .....	33
Recommendations based on the literature to increase engagement and retention with Hugn Authentic Connections app.....	33
Recommendations to increase the impact of Hugn Authentic Connections app.....	35
References.....	49

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## **Examining the impact of the Hugn Authentic Connections digital mental fitness app on mitigating isolation and loneliness in the workplace**

In March 2020, most Canadians were unclear what “COVID-19” was, other than a new virus that was quickly disrupting how work was organized. It also rapidly and dramatically began to interrupt social interaction and connections. Within the first few months of the pandemic, “lockdowns,” “stay at home” orders, and social distancing restrictions were put in place by governments under the advice of public health policy. What this virus was or when it would be gone was not clear. What was becoming crystal clear was that this pandemic was negatively impacting an entire population’s social connections.

Science has determined that humans have been genetically programmed for social connection and need relationships for a high quality of life [1]. Authentic relationships, where both parties feel safe and valued, are critical to human well-being. When people cannot access their network of relationships, they are at increased risk of experiencing authentic connections gaps. For example, when people are isolated in their homes or sheltered with nuclear family members, any prior strains in the relationships are exacerbated by the added pressure of lockdowns. Furthermore, options to socialize through the workplace are lost. The COVID-19 pandemic has impeded people’s ability to interact, increasing the psychosocial risk factor of isolation and the potential for the psychosocial hazard of loneliness.

Isolation and loneliness can be measured by the degree a person feels socially and emotionally disconnected from meaningful relationships with others. Both isolation and loneliness can negatively impact a person’s mindset about their intrapersonal relationship (i.e., how one feels and thinks about self) and interpersonal relationships (i.e., how one feels and thinks about others) [2]. Loneliness is a self-perceived discrepancy between personal

relationships and the social environment that can be described as a breakdown in one's ability to engage in social interactions or build and maintain quality social connections [3].

One silver lining in the COVID-19 pandemic is that it has resulted in more employers recognizing the importance of supporting employees' mental health. A critical issue for employees' mental health is how well they can navigate risks of isolation and loneliness. The cure for loneliness is authentic connections [4]. In other words, a person with a meaningful, authentic connection with themselves and with others they value in their personal and professional lives is much less likely to experience loneliness.

It is worth noting that isolation and loneliness were public health challenges well before the pandemic. For example, in 2019 one in five Canadians rated themselves as lonely [5]. The pandemic illuminated for employers the psychosocial risk factor of isolation and the psychosocial hazard, loneliness. The COVID-19 pandemic increased these risks, as aspects associated with the pandemic (e.g., remote work, physical distancing) increase experiences of loneliness and isolation. An Ipsos poll reported that during the first month of the COVID-19 pandemic, 54% of Canadians responded that physical distancing left them feeling lonely or isolated [6].

With the COVID-19 pandemic bringing unprecedented impact on how work is organized and the potential impact on social connections, in early April 2020, Lynn Brownell, CEO of WSPS, and Dr. Bill Howatt discussed the potential role digital app technology could play in providing a scalable, low-cost solution to mitigate employees' risk of isolation and loneliness and help them build and maintain authentic connections. This conversation was playing out as the level of fear around COVID-19 and massive changes in social networks in the workplace

(e.g., remote work) mounted. Media reports highlighted the growing concern for employees' isolation and loneliness.

One key issue described by Dr. Howatt was the challenge for employers to support employee isolation and loneliness because neither meets clinical diagnostic criteria in the DSM-V. There is no "disorder" associated with feeling isolated or lonely that could lead to disability supports or accommodations. In other words, employees cannot get disability leave for feeling isolated or lonely; they must have another mental illness. From Dr. Howatt's 30 years of clinical experience, it was clear that we are now in a grey zone, as there is ample evidence that isolation and loneliness, if not managed, could negatively impact employees' mental health [7]. Additionally, within the workplace context, when not correctly managed, isolation and loneliness can result in mental injury that can impair an employee's ability to perform, productivity, emotional well-being, and perceived psychological safety.

The COVID-19 pandemic sparked an increased interest in applying cognitive behavioural therapy (CBT) provided online for the treatment of anxiety and depression. Governments spent millions of dollars to help the general public access CBT. For example, the Government of Ontario offered online CBT to all residents aged 16 and older [8]. After conducting a review of available digital apps that used CBT or were designed for prevention using a cognitive behavioural approach (CPA) to support employees who felt isolated or lonely, it was determined there was a gap in the market. There was an opportunity to provide an accessible, low-cost solution for employers to support their workers facing the mental health concerns of isolation and loneliness.

As a leader in workplace mental health in Ontario, WSPS decided to fund the development of a minimally viable product (MVP) digital app focused on isolation, loneliness,

and building authentic connections with a relatively small budget. This app would be piloted and tested with an independent, academic research study and made available to WSPS clients through the research project. Additional funding from the Johnston Group (Administrator of the Chambers of Commerce Group Insurance Plan) was used to assist in the development of the app and assist in funding the research study. The goal was to obtain lessons for implementing a digital app as a workplace mental health solution targeting isolation, loneliness, and building and maintaining authentic connections.

The Hugn Authentic Connections app research project allowed WSPS to offer its client base a digital mental health app, to be known as the Hugn Authentic Connections app. The app would be provided at no cost to support employees in the workplace as the first step to piloting and testing its effectiveness. Based on the results of this pilot, WSPS could potentially explore creating a commercial partnership to distribute Hugn Authentic Connections app through its future Roadmap micro-site as a cost-effective, scalable, evidence-based mental health product to support employees struggling with isolation and loneliness.

Given how the COVID-19 pandemic dramatically impacted how work is organized, there is a need for this kind of product. Furthermore, there is a high potential for a larger percentage of employees to continue to work remotely (e.g., hybrid workforce), which suggests the need for this type of product is likely to remain and increase.

### **The Loneliness Epidemic**

Before the COVID-19 pandemic, many employers may have been unaware of that isolation and loneliness are a massive population health challenge. In 2017, United States Surgeon General Dr. Vivek Murthy declared that loneliness was an “epidemic” and a serious public health concern [9]. Numerous studies show significant rates of loneliness and social



isolation. In 2018, 22% of United States adults said they often or always feel lonely or socially isolated [10], and in a 2019 study, one in five Canadians identified as lonely [11]. In 2018, the United Kingdom appointed a “minister for loneliness” to address the issue [12].

Social connection has long been known to be a basic human need [13], and numerous studies have shown that loneliness and social isolation significantly impact health. A meta-analysis of 148 prospective studies, which included 300,000 participants, found that having a more robust social connection was associated with 50% greater odds of survival [14].

Furthermore, the risk to mortality of the adverse effects of social isolation may be comparable to or greater than other well-established mortality risk factors such as smoking, obesity, and physical inactivity [15]. Social connection also has buffering effects on other chronic health conditions, such as type 2 diabetes mellitus, depression, and anxiety. It benefits other health characteristics such as mobility and functioning in activities of daily living [16].

In contrast, loneliness has been shown to negatively affect deteriorating cardiovascular health and contribute to increased risk of dementia, poor sleep patterns, gait speed and mobility, and biological function [16]. One study found that loneliness increases the chance of stroke or coronary heart disease, the leading cause of death in developed countries, by 30% [17].

Loneliness can also increase negative thoughts and reduce resilience. Rates of stress and depression are higher in lonely individuals than those who are not lonely, and increases the development and progression of physical illness and disease [16], [18].

### **The COVID-19 pandemic’s strain on social connections**

The COVID-19 pandemic has brought an unprecedented impact on social connections. Remote work, lockdowns, and quarantines all significantly impacted social connections.

Numerous studies showed that mental health distress rose significantly across the population as a global threat impacted virtually every aspect of life and work [19]–[27]. A study from the Conference Board of Canada and the Mental Health Commission of Canada in July 2020 found that 84% of responders reported that their mental health concerns have worsened since the onset of the COVID-19 pandemic [28].

Loneliness and social isolation also increased during the pandemic. In a study of 50,609 participants in Europe, 29% reported feeling lonely. Among those, 40% said that their loneliness had increased since the pandemic's start [29]. This study also found that there was a six- to 10-fold increase in risk of mental health symptoms for those who reported increases in loneliness, including depressed mood, anxiety, and sleep problems. In a study of 3,800 Canadians during the pandemic, 60% reported feeling lonely multiple times per week, and 46% reported feeling lonely every day [30]. In a multi-national study of 31,092 people in 31 countries, 36% of workers in Canada reported feeling isolated, which was higher than the global average of 27% [31].

### **Loneliness and social isolation are growing risk factors in the workplace**

Loneliness and social isolation have implications for the workplace. A study by the New Economics Foundation in the UK found that workers who reported being lonelier also reported poorer work performance and less job satisfaction [32]. Another study of 477 workers in 99 workgroups found that loneliness was associated with lower organizational commitment, performance, and aspects of team functioning such as offering help.

Remote work became a prevalent issue facing workplaces during the pandemic, directly impacting social connections. Some studies found that quarantine, social distancing policies, and remote work were associated with poorer mental health. For example, one study found that quarantine and delays in returning to work were associated with poor mental health symptoms in

the general Chinese population [33]. Additionally, researchers found that loneliness, social exclusion, and quarantines were among the causes of 69 deaths by suicide in India during the pandemic. Other factors included fear of infection, financial distress, and work-related stress [34].

One WSPS report found that perceived isolation and loneliness were associated with more self-reported sick days, more days of feeling unwell (i.e., presenteeism), and lower daily effort (i.e., discretionary effort) [35]. The results suggested that workers who reported lower loneliness and social isolation reported a minimum of 30% lower average cost to productivity.

Even frontline providers were not protected from the potential isolating effects of the pandemic. Researchers found that many healthcare workers were advised to limit their time with their loved ones and socially isolate themselves after work hours to decrease the risk of bringing the virus to their families [36]. As a result, it was more difficult for healthcare workers to receive support from their friends and families. Such social exclusion as a potentially higher risk group for the virus was a predictor of distress in past epidemics such as SARS [37].

However, when both remote work and social isolation were examined as predictors, studies suggested that remote work in and of itself does not necessarily cause social isolation and that social isolation is the better predictor compared to remote work. In a Canadian sample of 1,055 university staff and 925 university students, researchers found that remote work predicted presenteeism and absenteeism but only when remote work was also associated with higher levels of social isolation [38].

Several other studies showed that workplaces could potentially mitigate the negative impact of the pandemic on employees. Researchers examined mental health differences among employed and unemployed individuals during the social distancing implementation of COVID-

19 [39]. Results indicated that unemployed individuals experienced higher psychological distress, loneliness, and lower overall quality of life. The study suggested that employed respondents could minimize their feelings of social isolation by remaining connected with their colleagues compared to unemployed respondents. Another study examined factors that impacted job satisfaction with remote work during the COVID-19 pandemic and found that positive employee relations and trust could positively impact job satisfaction and employee well-being during remote work [40]. In a Canadian sample, researchers found that job insecurity was a strong predictor of lower well-being [41]. However, workplace disaster preparedness, workplace programs for mental health support, and positive social relationships at work mitigated some of the effects of job insecurity on well-being.

### **Summary of the development of the Hugn app project and research study**

From the first conversation in April 2020 to February 2021, there was a rapid development of a mental health app focused on supporting workers experiencing isolation and loneliness. This minimally viable product was named the Hugn Authentic Connections app (see [www.hugn.ca](http://www.hugn.ca)).

The goal of this project was to create an interactive cognitive behavioural approach (CBA) app to help workers understand and recognize the risk of isolation and loneliness and get coaching on how to reduce isolation and build and maintain authentic connections. This app was designed as a preventive resiliency tool, not a treatment. It provided users with clear guidance that the app was a tool to support mental fitness (not a clinical intervention).

The goal was lofty, and the timelines were short to produce a commercial-grade MVP that had all necessary security requirements to protect users. Within 30 days, WSPS provided the

funding envelope to make the Huger Authentic Connections app a reality. The process used to create the app was intentional and clear once the decision was made to invest in this mental health innovation. The goal was to support the WSPS client base to mitigate the risk of isolation and loneliness created by the pandemic. Dr. Howatt connected WSPS and Territorial who created the app. One member of the Territorial team had relevant lived experience with mental illness and had been working on an early version of a Huger mental health app that had no focus on isolation or loneliness. This experience along with Dr. Howatt's subject matter expertise were leveraged to design and build the Huger Authentic Connection app that would be used for the study. Dr. Dayna Lee-Baggley was hired to be an independent researcher to conduct the research study including submitting the proposed research through the institutional research ethics board (REB) at Saint Mary's University (SMU), where she is a faculty member. She was tasked to provide an independent evaluation of the app that met an academic standard.

Prior to beginning this study WSPS, the Globe and Mail and Dr. Howatt had been working collaboratively studying the issue of loneliness and isolation in the workplace before the COVID-19 pandemic. This work was published in the CEO Health and Safety Leadership Network "*Exploring the relationships between perceived isolation, loneliness and resiliency*" [42]. This prior work served as the guiding evidence to move forward with this project because of the potential value for creating a scalable digital app that targeted the psychosocial risk factor of *isolation* to mitigate the risk the psychosocial hazard of *loneliness*. Dr. Howatt and the CEO of WSPS were concerned of the potential impact of remote work on worker well-being with respect to isolation and loneliness.

Existing and emerging research supports this focus as the risk associated with isolation and loneliness in employees and the need to address it by employers continues to mount. For

example, The Lancet recently reported why employers must pay attention to isolation and loneliness. Regarding “the workers assigned periods of perceived isolation,” it highlighted that even less than 10 days of isolation can have long-term effects, including psychiatric symptoms up to three years later [43]. With more employees working remotely nearly half of employees in one survey by World Economic Forum and Ipsos reported feeling isolated and lonely [44]. Workers’ short-term disability claims due to mental health issues increased by 6% and the duration increased by 12% in 2021 [45].

The next step in this journey was to develop the content for the app. This began with Dr. Howatt writing *The Cure for Loneliness* in April to June 2020 that became a Globe and Mail bestseller. Content was taken from early galley versions of this book and modified by Dr. Bill Howatt and Territorial for the Hugn AC app. The app content includes: non-clinical assessments, resiliency tools, cognitive behavioural approach (CBA) educational modules, and insights on building and maintaining authentic connections.

Once the content was prepared, Territorial worked with Dr. Howatt to take the content from the book to create a digital solution for loneliness and social isolation in the workplace. The goal was to develop a program that facilitated the journey mapped out in *The Cure for Loneliness*, designed to assist a person in addressing perceived internal barriers to building and maintaining authentic connections.

WSPS was involved in the design and development through weekly meetings with Dr. Howatt and Territorial over five months of development. Once developed the app was piloted within the target population that was invited to participate in this study by WSPS and Territorial. The Territorial team took several additional technical steps, including producing eight version updates for ongoing improvement, meeting security standards, and getting the app approved for

distribution on the Apple App Store and Google Play Store that have stringent approval requirements.

The secondary funder for this project was the Johnston Group (Administrators of the Chambers of Commerce Group Insurance Plan), who became a co-sponsor and contributed to building the app to offer it to their members from the Chambers of Commerce at no cost. The Johnston Group, along with their strategic partner Arete (a national provider of member mental health and assistance programs for employees, retirees, businesses and organizations in Canada), were hopeful that the app could become an evidence-based commercial product to support workers' mental fitness around isolation and loneliness and build authentic connections.

A study was initiated in October 2020 through SMU to provide an independent evaluation of the app's effectiveness. This research project was approved by the institutional REB at SMU and conducted February-September 2021. Detailed results can be found in Appendix A.

Through invitations and sharing this opportunity with the WSPS client base and connections from Territorial, 26 companies expressed some level of interest within a 60-day recruiting window in the fall of 2020. In February 2021, 16 companies signed up for the study and promoted the opportunity to access Hugn Authentic Connections app to their employees. A requirement to access the app with WSPS clients was to opt in to the research study. Of 22,402 employees invited to participate, 150 signed up by completing the first comprehensive assessment (0.67% opt-in rate). Chamber Plan members did not have to agree to participate in the research project in order to access the app. Not unexpectedly they therefore had much lower participation rates.

These results demonstrated one of the first challenges with the app, which was how to effectively on-board organizations to offer a mental health app and how best to engage employees. Some of the first organizations approached were uncertain about how the app might add to or be unique from existing services. We provided information that there may be gaps in understanding the complexity of isolation or loneliness and how a CBA approach could be helpful.

Some organizations were uncertain about their role in offering the app (e.g., “What’s my responsibility?”) regarding supporting employees. Unlike many other mental health apps, Huger Authentic Connections app was presented as a standalone solution with no employer role. One key lesson when orienting to a mental health app was the need for focused and strategic on-boarding that includes thoughtful client education that provides a clear link to how the app supports or adds to existing mental health initiatives.

Based on feedback from organizations, one agile response our team took was a change in the recruiting process, where education was layered in. For example, the on-boarding process for organizations was changed to provide more information and context, resulting in several webinars delivered by Dr. Howatt on “Jasmine’s Journey.” These webinars followed a fictitious employee, “Jasmine”, and explained the CBA approach used in Huger Authentic Connections app. In addition, several blogs, facilitated through WSPS resources and networks, provided more information for organizations.

Despite some hesitations, many organizations approached were open and responded favourably to the idea of the resource, recognizing it was addressing a key concern (i.e., social isolation and loneliness) for many during the pandemic. However, some did not have the capacity to promote the app to their workforce properly or were unclear how to best position it



with their employees. The good news is that many organizations were interested in learning more about the app following the research study when they believed they might have more time to focus on understanding the value of using and promoting the app to their workforces.

Another challenge was that several organizations were required to offer services for their employees in both French and English, but only an English version of the app was available at the beginning of the study. Several organizations indicated they would have participated had the app been available in French. This important feature was added as part of the rollout of Hugn for Chambers Plan members and also made the app more viable for federal and national organizations. This was an example of the app's agility and maturity throughout the research study period.

Because participants who joined the study were primarily female and Caucasian, we cannot comment on the app's potential impact on more diverse populations. Addressing that factor will require more tailored research.

The second major issue that emerged was engagement with the app. Initially, we thought that people with a higher level of loneliness would be more interested in engaging with the app and taking advantage of the resource. However, the data did not support this hypothesis. The results suggested no difference in the key variables regarding who used the app. In other words, there was no difference in engagement with the app when we compared participants who reported a high degree of loneliness to those who reported a low degree.

Engagement overall with the app became the critical challenge for gaining data. Although initial engagement was high, this decreased significantly over time. It is usual for app attrition to be relatively high. In this study, many users engaged with the app four to five times a month during the first three months. This included interactions like opening the app and not necessarily

having meaningful interactions with its features. A recent systematic review suggested that while use and adherence with mental health apps range between 44% and 99% in research settings, rates in real-world settings may range between 1% and 29% [46]. It appears that Huger Authentic Connections app engagement levels in the real world fell within the range purported in this study. This was consistent with the study's goals to evaluate the app's "real-world" effectiveness.

Ideally, to validate the effectiveness of Huger Authentic Connections app, we would require a much higher sample size and more participation. The remedy for this may be a combination of more structured client education and on-boarding, on-site sponsors and champions within the organizations promoting the app, and some form of intervention to provide context. The latter might include a series of webinars on the topics of isolation, loneliness, and authentic connections to provide Q&A sessions for users.

It is common to lose participants to research over time. However, the ongoing willingness of 66 participants to complete the study's surveys three times (note: that was done outside the app, using an online survey) suggested ongoing interest in isolation and loneliness and workplace mental health (note: only 62 of these 66 also used the app). However, this level of interest did not transfer into engaging in Huger Authentic Connections app directly at levels needed to determine the app's effectiveness to change behaviour or to facilitate resiliency. This study had a much lower dropout rate with the three surveys than with the Huger Authentic Connections app. We have provided some evidence-based suggestions for consideration for future versions of the app to address these issues (see Appendix A).

Appendix A provides an overview of the research study's data collected on participation levels and Huger Authentic Connections app engagement and changes on measures of anxiety, depression, and loneliness to test the app's impact over time. We used measures of loneliness

and social isolation to see if the app impacted the sense of social connection and perceptions of loneliness and isolation. Measures of anxiety and depression tested whether the app affected mental health variables. This analysis was based on past literature indicating that loneliness is strongly related to mental health outcomes [47] and our applied clinical experience.

It is worth noting that the researchers conducted numerous analyses to detect any significant differences due to engagement with Hugn Authentic Connections app. Due to the low sample size and low engagement and high attrition rate with the app, it is not possible to identify any significant changes that may have been present. Thus, we cannot determine whether Hugn Authentic Connections app is an effective remedy for isolation and engagement in its current form. What we do know based on the current research and the retention of the research participants to complete the independent research survey test 1-2-3 the topic of isolation and loneliness clearly are and becoming a growing concern for workers psychological health and safety. It would also be beneficial to incorporate a short evaluation survey within the app itself moving forward, to better capture the experience of future users.

### **Considerations when evaluating mental fitness apps like Hugn Authentic Connections app**

It is estimated there are more than 300,000 health applications in the mobile app stores worldwide today, with the mental health segment accounting for the largest growth in the market [48]. One key lesson researchers noted for future consideration is for employers to be clear on the why, how, and what, when incorporating any health app into their workforce. Random apps for mental health that are launched without project management, thoughtful communications plan, and leadership buy-in and support, are at greater risk of failing to get employees' attention

or optimal levels of participation. This study had ambitious timelines and a limited budget to engage WSPS clients fully.

Unlike the WSPS experience, Chambers Plan had a multi-pronged communications and promotion plan that was comprised of 15 different pieces and a variety of mediums that was guided by a project manager (Arete). An additional feature added to HUGR as part of the Chambers Plan implementation was a digital access point so users could be connected to professional support (Arete's intake team) should they wish to access professional counselling services. As only a few research participants were from the Chambers Plan, the research study could not analyze the impact of these additional aspects of rollout for facilitating worker engagement. We do feel strongly from this experience that to deliver a mental health solution communications and engagement are critical and must be well thought out.

The issue addressed by HUGR Authentic Connections app will continue even as the crisis of the pandemic recedes. The researchers suggest that because of the magnitude of the loneliness epidemic, employers may benefit from more education on how they can mitigate isolation and loneliness, especially considering the growing hybrid workforce and the percentage of employees who will be working remotely permanently. Employers would be prudent to explore what they can do to help employees build and maintain authentic social connections, like the recommendations in the WSPS Roadmap [49].

With HUGR Authentic Connections app as a standalone mental health digital solution, a body of research suggests that “people need people” for mental health interventions to have the maximum potential for success. The research literature on self-help resources indicates that these rarely show effectiveness without some human component [50], [51]. Contact may be a phone call, email check-in, or community forum on the app. Overall, the literature suggests that there

are no shortcuts to supporting mental health, and it is not a “check-the-box” type of activity for workplaces. Innovative, scalable, efficient resources are needed, and technology can play a vital role in those resources [50]–[55]. However, a technology-based, standalone solution cannot reproduce critical aspects needed to support employees’ mental health. Those can be fulfilled only by human interaction (e.g., acknowledging emotions).

At face value, it would be reasonable to think that isolation and loneliness would be such a significant concern during the COVID-19 pandemic that many employees offered a no-cost resource would opt in. This study found that despite the unprecedented risk of loneliness and social isolation in a pandemic, there was low uptake and engagement, limiting our ability to determine the effectiveness of Hugn Authentic Connections app. Participants did not engage at levels high enough to test its impact. However, there is no evidence suggesting that Hugn Authentic Connections app cannot impact employees’ behavioural and mental health outcomes. Based on this study and literature reviews, this app would likely perform better as a part of an integrated solution that includes human interaction (e.g., webinars, open Q&A, message boards, or virtual events for sharing experiences).

## **Summary**

The Hugn Authentic Connections app addresses the critically important topics of loneliness and social isolation that were a challenge before the COVID-19 pandemic and will likely continue during and beyond the pandemic. Loneliness, social isolation, and authentic relationships became even more critical during the pandemic with a high potential to significantly influence employees’ mental health. Furthermore, many potential risks of isolation,

such as hybrid and remote work, may continue to be aspects of the workforce long past the pandemic.

The Huger Authentic Connections app is an innovative, low-cost, sustainable option for addressing workers' concerns about loneliness and social isolation and providing guidance on creating authentic relationships. We contend that integrative, innovative, scalable solutions have a role in supporting workplace mental health. Although more research is needed, with continued improvements and adding modules like mental fitness, Huger Authentic Connections app can support employees' workplace mental health. We believe that proper on-boarding, client engagement and buy-in, and educating employees on the why, what, and how are critical steps for all mental health apps and ensuring there is human interaction — because people still need people.

## **Appendix A: Hugr Authentic Connections app Research Study Summary**

### **Purpose**

The purpose of this research study was to conduct an independent investigation to examine the effectiveness of the mental health, self-directed cognitive behavioural digital app *Hugr Authentic Connections app* (see [www.hugr.ca](http://www.hugr.ca)) to impact isolation and loneliness and promote authentic connections.

This study's target population was adults who were employed, had access to a smartphone, and had an interest in isolation, loneliness, and building authentic connections.

The motivation was to explore whether the scalable, digital mental health app could impact users' perceptions of isolation and loneliness and help them build and maintain their desired authentic connections. The rapid onset of COVID-19 lockdowns in March 2020 quickly moved many employees to work remotely. Their risk of experiencing isolation and loneliness increased dramatically, potentially negatively impacting their mental health (e.g., anxiety and depression).

This research study was done quickly, from conception to development to launching the app and collecting data. A lean, agile IT and IP approach was used to maximize the available budget and launch Hugr Authentic Connections app for testing and getting user feedback. Updates were made to the app throughout the study. This study was funded by WSPS and co-sponsored by Johnston Group (Administrators of the Chambers of Commerce Group Insurance Plan). Howatt HR made in-kind contributions to support the development and promotion of the app. This independent and scientific study was approved by the institutional research ethics board at Saint Mary's University (SMU REB File #20-003).

## **Methods and Procedures**

### *Procedure*

The first wave of recruiting was completed by WSPS, which leveraged its clients, two open webinars that introduced Huger Authentic Connections app, and WSPS mailing lists and council groups. Organizations were also recruited through Territorial's connections. Interested organizations that wanted to provide their employees with the opportunity to participate in the study (which was required to get access to Huger Authentic Connections app) opted in. Once an organization opted in, it was provided with a pre-recorded webinar delivering information on the study and followed by individual meetings with the lead PI to answer any questions.

Organizations that agreed to participate completed a company intake form that included basic demographic information such as company size and sector. The organizations were provided with a standard email and distribution materials regarding the study to send to their employees internally. Employees interested in participating contacted the researchers directly, such that organizations did not know if they were participating in the study.

The second wave of recruiting was facilitated by the Johnston Group (Administrators of the Chambers of Commerce Group Insurance Plan) in April 2021. Johnston Group, through their strategic service partner, Arete, promoted and made available the Huger app to all members of the Chamber of Commerce Group Insurance Plan. Chambers Plan members were also invited to participate in the research study but were not required to participate in the study in order to access the app and therefore, understandably, had lower participation rates. Most participants (over 98%) were recruited via organizations connected with WSPS or Territorial. Arete and its partners may have additional data on the Chambers Plan members' engagement that is outside the scope of this research study, which followed the ethical guidelines of the SMU Research



Ethics Board and could only use data from participants who had consented to be part of the research study.

Interested participants sent a link to an online consent form. If they consented, they were provided with the link to the “pre-survey” (Time 1). Individuals who completed the survey were provided with a link to download Hugn Authentic Connections app onto their smartphones. The Time 2 survey (i.e., mid-point) was administered three months after using the app and the Time 3 survey (i.e., post-survey) at the end of the study, six months after the study started.

All three surveys measured perceived isolation, loneliness, anxiety, and depression. The Time 1 survey also collected basic demographic data about the participants. Participants were automatically entered into a draw for a \$100 gift card after completing each of the three surveys (three draws of \$100 each). Winners were contacted via the email address provided. Issues with the surveys were handled directly by the research team, and issues with Hugn Authentic Connections app were handled by the Hugn technical support team.

### *Measures*

When reviewing the below data, it is helpful to keep in mind that a Cronbach alpha of 0.70 is acceptable; 0.80 or greater is preferred, with the general rule higher is better [56]. If scores are in the mid to high 90s, there may be value in checking the scales to ensure items are not measuring the same thing (e.g., to reduce scale redundancy).

Following is a summary of the scales used in this study:

*Anxiety* was measured using the General Anxiety Disorder-7 (GAD-7) [57]. Used to screen and assess severity of anxiety, the seven-item self-report questionnaire asks how often participants faced the mentioned symptoms during the last two weeks [58]. The items are linked to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)

diagnostic criteria (e.g., “feeling nervous, anxious or on edge) [59]. The four-point Likert scale is recorded as “not at all,” “several days,” “more than half the days,” and “nearly every day” [60]. The GAD-7 was validated in a large sample and had good psychometric properties [57]. It showed high reliability in our sample with a Cronbach alpha of .90.

*Depression* was measured using the Centre for Epidemiologic Studies Depression Scale (CES-D) [61]. Designed to measure the symptoms of depression in the general population, this measure is a structured, self-report questionnaire consisting of 20 items related to depressive symptoms that occurred in the past week [62]. Participants respond to items such as “I thought my life had been a failure” on a four-point Likert scale ranging from “rarely or none of the time (less than one day),” “some or little of the time (1-2 days),” “occasionally or a moderate amount of time (3-4 days),” and “most or all of the time (5-7 days)” [61]. The CES-D showed high reliability in our sample with a Cronbach alpha of .93.

*Loneliness* was measured using the UCLA Loneliness Scale (Version 3) [63]. The measure includes 20 items: 11 negatively worded items (e.g., How often do you feel that you lack companionship?) and nine positively worded items (e.g., How often do you feel outgoing and friendly?). Responses are recorded on a four-point Likert scale ranging from “never (1),” “rarely (2),” “sometimes (3),” to “always (4),” and negatively worded items are reverse-scored [64]. The scores are combined to provide a total loneliness score. A higher score indicates higher levels of loneliness [65]. This scale showed high reliability in our sample with a Cronbach alpha of .94.

*Loneliness* was also measured by the Howatt Loneliness Scale. This 12-item scale includes seven positively worded items (e.g., I am confident in my ability to meet new people) and five negatively worded items (e.g., I often felt left out). Responses are recorded on a five-

point Likert scale ranging from “Very True” to “Very Untrue.” This scale had a Cronbach alpha of .84, which represents a high reliability of this scale in our sample.

*Perceived Isolation* was measured by the Howatt Perceived Isolation Scale. The version employed for this study had 29 items asking participants to rate their level of concerns toward different aspects of their work and life (on a five-point Likert scale ranging from “No issue” to “Extremely concerned”). This scale had a high level of reliability within our sample (Cronbach alpha = .91).

*Hugr Authentic Connections app*

The Hugr Authentic Connections app facilitates a program based on where the user is on their journey. The app includes a blend of assessments, content, and monitoring tools to accomplish this. It also has a feature to share personal experiences and thoughts with a trusted, authentic connection. The cognitive behavioural approach modules and resiliency content used in Hugr Authentic Connections app was modified from *The Cure for Loneliness* [4].

**High-level summary of Hugr Authentic Connections app features**

Hugr Authentic Connections app has gone through various updates since developed in the fall of 2020 consistent with Territorial’s commitment to continuous improvement. The Hugr AC IT team continues to address any technical issues, improve features, and seek out user feedback.

<b>On-boarding</b>	<p>After registering on the app, users were asked to complete short measures of social connections, readiness for change, perceived isolation, and loneliness.</p> <p>Decision tree intake assisted the user in determining which of the eight modules to begin. The modules were designed to move a person through a phased-steps program.</p>
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	<p><i>Opportunities for future consideration:</i></p> <ul style="list-style-type: none"> <li>• Add a visual of the Hugn Authentic Connections app journey</li> <li>• Leverage short videos to orient the client on the process</li> </ul>
<b>Discover</b>	<p>Eight modules include multiple articles reviewing evidence-based information on building authentic connections. Users had the option to read or listen to each module.</p> <p><i>Opportunities for future consideration:</i></p> <ul style="list-style-type: none"> <li>• Use curriculum design knowledge and expertise to break up content with the author’s oversight to create more activities to promote engagement to enrich the learning experience.</li> <li>• Have more behavioural nudges to leverage gamification to provide encouragement and recognition.</li> </ul>
<b>Track</b>	<p>Using single items, users could log their perceived level of social connections, perceived isolation, and loneliness daily. Users also could track other topics such as mood, medication use, energy, sleep, activities, and open text journal entries.</p> <p><i>Opportunities for future consideration:</i></p> <ul style="list-style-type: none"> <li>• Re-think emotional mood tracking to be aligned to Yale research on emotional literacy.</li> <li>• Have scheduled comparisons of improvements that request to redo onboarding assessments to measure progress, in addition to daily tracking.</li> </ul>

	<ul style="list-style-type: none"> <li>• Create a dashboard for employers monitoring app utilization and impact.</li> </ul>
<b>Connect</b>	<p>This function allows users to connect with a trusted authentic connection.</p> <p><i>Opportunities for future consideration:</i></p> <ul style="list-style-type: none"> <li>• Add functionality similar to many other social connections tools that allow for private conversations within the app.</li> <li>• Allow users to invite their authentic connection supporter(s) and share their progress on the app. Currently, this is a one-way function with no functionality to chat within Hugn Authentic Connections app. All communication would need to happen outside the app.</li> <li>• Explore the benefits of allowing direct communication through the app as a private messenger, or at least provide more instruction and clarity on how to leverage and use this function and why or how it can be useful.</li> </ul>

**Data analysis**

*Participants*

As seen in Table 1, 26 companies were invited to offer this mental health support resource to their employees. A total of 16 companies expressed their interest and promoted it to their employees (total number of employees = 22,402). Out of 22,402 invited to participate in this study, 150 completed the first comprehensive assessment (0.67% opt-in rate). Of the 150 initial participants, 66 completed all three assessments. Figure 1 indicates the participation frequency at each assessment time point.

Table 2 provides information on the participants at the Time 1 assessment. Based on the responses, participants were mostly from Ontario (n = 72, 49.7%) and Saskatchewan (n = 68, 46.9%). Most (56%) were employed in provincial government; 27.9% worked in the private sector; and 15.3% worked in non-profit organizations. Most were on full-time employment (n = 148, 98.7%) and about one-third were union members (n = 54, 36%). About half were frontline employees (n = 85, 57%); the others worked in supervisory or managerial roles.

As was expected, due to pandemic circumstances, 74.5% of participants were working from home when completing the Time 1 assessment. About half had been working in their occupation for five to 20 years. In terms of education, 64% had a bachelor's or master's degree, and 79.4% had a salary over \$60,000 per year. About half reported taking three to four weeks of vacation each year.

Participants were predominantly female (n = 106, 70.7%) and Caucasian (n = 125, 79.1%). About 67% were in a relationship (e.g., married or common law). Participants were evenly distributed across several age groups, and 42%, 36.6%, and 16.6% had childcare, pet care, and elderly care responsibilities, respectively.

#### *Usage of the app*

Table 3 provides information on usage of the app. Of the 150 participants who completed the Time 1 assessment, 69 registered an account on Hugn Authentic Connections app. There was a total of 62 participants who completed all three assessments and registered on the app. At the end of the study, participants were classified into three categories based on assessment completion and level of engagement with the app. The first group included 26 participants who completed all assessments and had no interaction with the app. The second group included 33 participants who completed all three assessments and used the app between one and 15 times

(i.e., minimal interaction). The third group included three participants who completed all three assessments and interacted with the app more than 15 times (i.e., meaningful interaction).

Table 4 provides information on engagement with different features of the app. After registering, participants were asked to complete short measures of social connections, readiness for change, perceived isolation, and loneliness to track their progress through the *Track – On-boarding* feature. Of 69 participants who registered, 60 completed all short measures in the app at least once; 28 engaged with the *Discover* feature, which included eight modules; and 13 viewed more than five articles/modules on the app. Additionally, 15 participants invited a supporter(s) and shared their progress with them through the *Connect* feature. There were 61 users who used the *Track* feature between at least once, 3 used this feature more than 15 times.

Figure 2 illustrates the monthly engagements with the app throughout this study. As shown, most of the interaction with the app occurred in the first three months of this study, peaking in March 2021 with 42 unique users and 177 engagements when most participants were being on-boarded. The number of unique users went down steadily, from 42 in March to two in July and August 2021. The slight uptick in usage in August may have been because participants were completing the final assessment.

One issue arose regarding collecting data usage statistics with a feature designed to give participants control over privacy. If participants did not provide consent for the app to collect data, it did not track their usage data. Because we had obtained consent during the informed consent process to collect their app data, it was possible to go back to retrieve this data. Based on numerous consultations with Territorial, we believe we retrieved all relevant data for these analyses for the 62 participants who completed assessments at time 1, 2, and 3. Therefore, these analyses represent all the data collected, regardless of the consent for the app to collect data.

The Territorial team was responsive to feedback and changed this feature in the app so that usage data can be shared with organizations or teams in future offerings. To protect privacy, organizations should not have access to specific user data; only aggregated usage statistics over time. This feature is important as it will allow employers to know what percentage of employees are using a mental health tool they purchased and what level of perceived benefit they are getting. It would also be prudent to explore the kind of employer dashboards that can be created to show the following types of aggregated data:

- Number of employees who have downloaded the app
- Average authentic connection, perceived loneliness, and isolation scores
- Number of interactions with the app and number of users monthly

#### *Changes over time*

Changes in the key variables over the course of the study were examined. Table 5 shows the mean and standard deviation of five key variables among the 62 participants who completed all three assessments.

Table 6 shows participant changes in the key variables over the three time points. The results show a significant decrease in loneliness as measured by the Howatt Loneliness Scale but no other significant differences. Therefore, except for the Howatt Loneliness Scale, the participants reported no change on any variables. Figure 3 shows the changes, which do not represent a significant change except for the Howatt Loneliness Scale, although they decrease visually.



These results suggest no significant changes in participants' reports of anxiety, depression, loneliness, and perceived isolation over the three time points. The only exception was the Howatt Loneliness Scale that indicated a significant decrease in loneliness.

*Impact of the app over time (Test 1 to Test 3)*

Differences over time based on usage of the app were also investigated. The results of one-way ANOVA showed no significant difference among users who had no interaction, had minimal interaction, or had meaningful interaction with the app at each time point of this study. As seen in Table 7, this indicates there were no differences between participants who had no interaction, minimal interaction, or meaningful interaction with the app at Time 1 regarding their level of anxiety, depression, loneliness, and perceived isolation.

There also were no differences between participants who had no interaction, minimal interaction, or meaningful interaction with the app at Time 2 or Time 3 in terms of their level of anxiety, depression, loneliness, and perceived isolation. This suggests that usage levels of the app did not impact participants' anxiety, depression, loneliness, or perceived isolation over time.

Changes over time based on usage of the app were then investigated. The results indicated a significant change in loneliness measured by the Howatt Loneliness Scale among those who had no interaction with the app, suggesting the considerable overall change in loneliness was caused by external circumstances, not by app usage. There were no other significant changes over time in any of the groups' variables.

The results suggest that app usage could not account for changes in the Howatt Loneliness Scale. Although these findings do not support the app's effectiveness, they are not conclusive. The sample size was not statistically sufficient nor consistent across three groups (no interaction = 26; minimal interaction = 33; meaningful interaction = 3).

### *Key observations*

Attrition rates and engagement are challenges with most digital apps. This study showed a low engagement rate where most participants engaged fewer than 15 times over the six months.

This section aims to provide some suggestions, based on existing literature, that may help with improving engagement. Ideally, when users engage the app, they are clear of what it does and how it can help them make desired changes. It is evident that user experience and clarity on what and how to use the app are critical for retention. For a cognitive behavioural approach to provide value, an individual would typically need to be active for a minimum of four weeks — ideally up to 10 or 12 — to provide them time to begin creating new habits and beliefs.

The vision for the Hugn Authentic Connections app was not to be predominantly content. It was to be a program that would identify where the person is and help them on a journey to improve and retain the number of their authentic connections.

### **Recommendations based on the literature to increase engagement and retention with Hugn Authentic Connections app**

- **Gamification** — Many studies indicate features of apps that may make them more engaging [66]–[71]. “Gamification” involves adding elements commonly used in video games to improve engagement [72]. There are several potential forms of gamification for the Hugn Authentic Connections app. One option would be encouraging more flow or the sense of a “journey” through aspects of the app. For example, enhancing the user’s experience by providing clarity on the Hugn Authentic Connections app journey (e.g., Jasmine’s Journey; see [www.hugn.ca](http://www.hugn.ca) to review). One vision could be using a graphic with a short video that engages the person on “what is the Hugn Authentic Connections

app journey” and where they are on this journey. This could encourage more engagement and retention using Huger Authentic Connections app as they are directed through its various aspects via their journey. Other facets of gamification might include “points” or “awards” for completing multiple elements of the app. These could be further incorporated into the “Huger Authentic Connections app Journey” by using gamification to keep users’ attention, and unlock content as recognition for achieving milestones. Finally, adding multimedia content such as short videos, CBA worksheets (e.g., leverage *The Cure for Loneliness Journal*) and images could enhance the existing written/audio content. Part of a successful CBA approach is not only reading and listening but also engaging in exercises.

- **Curriculum design review** — having the current content reviewed by a curriculum design expert to break up the content into more interactive lessons that could assist with learning and transformation. *The Cure for Loneliness* has many activities and examples that provide context and ideas. Leveraging gamification and some curriculum design modifications may help users interact better with the app to support their learning journey.
- **Explore the value of having Huger Authentic Connections app facilitate e-chats** — The Connect feature is an ideal opportunity to share information and engage in short text conversations within the app. This function is common practice in industry-leading social connections tools such as Facebook, LinkedIn, WhatsApp, Instagram, and apps like Meetup and Meet My Dog that have a private, secure message chat function. Such a function could dramatically change the app to facilitate social connections. It could also track the number of conversations a person has and provide a reminder to reach out to

contacts with whom they may not be interacting. This could increase engagement as users use this function to communicate with their meaningful relationships. Based on the data, the current version of the Connect function is not utilized nor favoured.

### **Recommendations to increase the impact of Huger Authentic Connections app**

- **Consider how this app can support programs** — Huger Authentic Connections app’s impact could be enhanced by using it to support people-led interventions. Besides a standalone solution, the app could be used to support interventions to facilitate and help employees build and maintain authentic communications, especially when this might be challenging (e.g., hybrid workforce). Studies show that virtual facilitation, email contact, phone, and live facilitation enhance engagement with self-help resources [46]. Huger Authentic Connections app could be used in this context to increase accountability, practice between sessions, and translation of the skills to everyday life. This is consistent with the idea of using Huger Authentic Connections app to track practice and skills, much like a Fitbit, for authentic connections. Facilitators would likely need some training but not clinical-level expertise to facilitate such a program. The facilitator would need only a curriculum and some training to provide employees with a program designed to support mental fitness. One core pillar of mental fitness is the quality of a person’s authentic connections.
- **Team-based approach** — A department or unit within an organization could use Huger Authentic Connections app to improve connection as a team. This is especially important given the high likelihood that hybrid workplaces and remote work will continue well past the pandemic. Remote work does not automatically generate loneliness and social

isolation, but employees face an increased risk of loneliness and social isolation [73]. Hugn Authentic Connections app could be an effective tool to manage remote workers and increase the sense of connection with the team. It would also normalize the need and provide informal ways to connect. Although technology has been well used in the pandemic for formal meetings, it was not well used for information connections that are critical aspects of social connection [74], [75]. Hugn Authentic Connections app could be a valuable tool for a manager to oversee a hybrid workforce and minimize the risks of remote work.

Table 1. Recruitment and participation

Variable	Frequency
<b>Recruitment</b>	
Number of companies invited	26
Number of companies that got involved	16
Potential number of employees based on company size	22,402
<b>Assessment</b>	
Number of participants who did time 1 assessment	150
Number of participants who did time 2 assessment	76
Number of participants who did time 3 assessment	86
<i>Number of participants who did all three assessments</i>	<i>62</i>

Figure 1. Frequency of participation in three comprehensive assessments

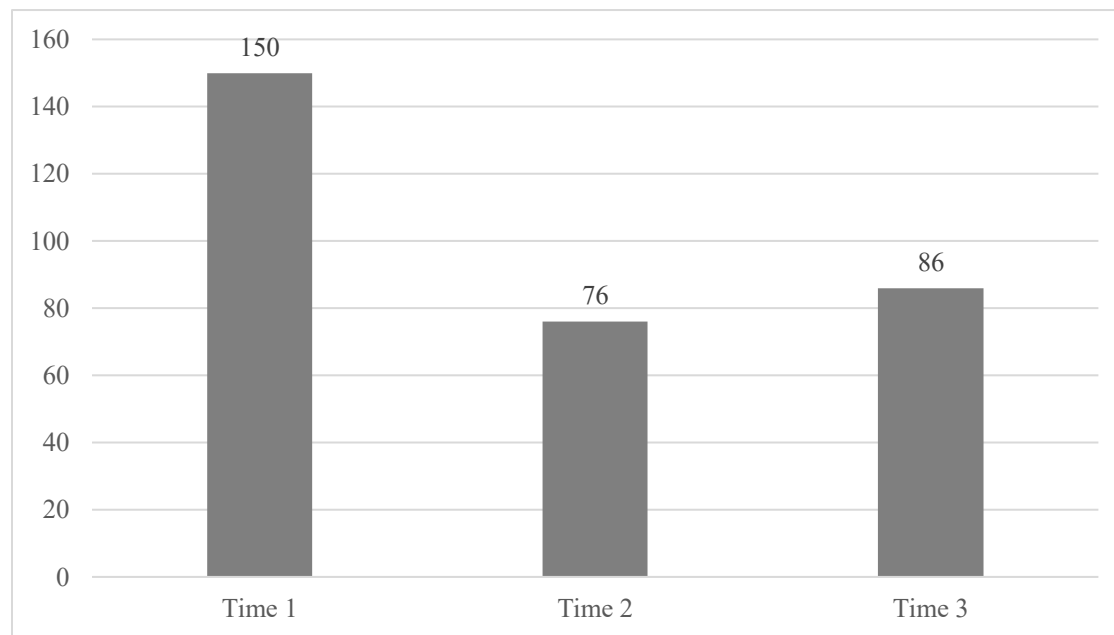


Table 2. Demographics of participants at time 1 assessment

Variable	Total n	Frequency	Percent (%)
<b>Province</b>	<b>145</b>		
Ontario		72	49.7
Saskatchewan		68	46.9
Alberta		2	1.4
British Columbia		1	0.7
New Brunswick		1	0.7
Nova Scotia		1	0.7
<b>Community</b>	<b>150</b>		
Rural		29	19.3
Urban		121	80.7
<b>Business Type</b>	<b>150</b>		
Private – Small business (under 100 employees)		5	3.3
Private – Middle size business (101 to 499 employees)		23	15.3
Private – Large business (over 500 employees)		14	9.3
Provincial Government		84	56
Municipality		1	0.7
Non-profit		23	15.3
<b>Member of Union</b>	<b>150</b>		
Yes		54	36
No		96	64
<b>Employment Status</b>	<b>150</b>		
Full-time		148	98.7
Part-time		1	0.7
Independent contractor/consultant		1	0.7
<b>Organizational Role</b>	<b>149</b>		
Frontline worker		85	57
Supervisor		11	7.4
Middle manager		34	22.8
Senior leader		10	6.7
Executive leader		9	6
<b>Working Environment</b>	<b>149</b>		
In the office		34	22.8
From home		111	74.5
Travelling (e.g., driving, airport, hotels, clients' homes)		1	0.7
In community		3	2
			38

Variable	Total n	Frequency	Percent (%)
<b>Tenure</b>	<b>146</b>		
Less than 1 year		18	12.3
1-2 years		19	13
3-4 years		21	14.4
5-6 years		26	17.8
7-8 years		9	6.2
9-10 years		3	2.1
11-15 years		27	18.5
16-20 years		9	6.2
21+ years		14	9.6
 <b>Salary</b>	 <b>150</b>		
\$0-\$19,000		1	0.7
\$20,000-\$29,999		2	1.3
\$30,000-\$39,999		5	3.3
\$40,000-\$49,999		8	5.3
\$50,000-\$59,999		15	10
\$60,000-\$69,999		23	15.3
\$70,000-\$79,999		18	12
\$80,000-\$89,999		22	14.7
\$90,000-\$99,999		22	14.7
\$100,000-\$119,000		19	12.7
\$120,000-\$149,999		10	6.7
\$150,000-\$199,999		4	2.7
\$200,000 and above		1	0.7
 <b>Education</b>	 <b>145</b>		
High school graduate, diploma or the equivalent		15	10.3
Some post-secondary credit, no degree		15	10.3
Trade/technical/vocational training		13	9
Associate degree		4	2.8
Bachelor's degree		66	45.5
Master's degree		27	18.6
Professional degree (MD, DDS, etc.)		2	1.4
Doctorate (PhD)		3	2.1
 <b>Yearly Vacation Plan</b>	 <b>147</b>		
I do not take vacation		1	0.7
Less than one week		4	2.7
One to two weeks		25	17
Three to four weeks		82	55.8
Five or more weeks		35	23.8



<b>Variable</b>	<b>Total n</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Marital Status</b>	<b>148</b>		
Single, never married		29	19.6
Married		82	55.4
Common Law		17	11.5
Widow/Widower		2	1.4
Divorced/Separated		18	12.2
<b>Ethnicity</b>	<b>150</b>		
White/Caucasian		125	79.1
Other		10	6.3
South Asian (e.g., Indian, Sri Lankan, etc.)		7	4.4
Indigenous North American (e.g., First Nations, Metis, etc.)		5	3.2
Black/African American		4	2.5
Chinese		3	1.9
Southeast Asian (e.g., Indonesian, Filipino, Thai, etc.)		3	1.9
Latin American		1	0.6
<b>Age</b>	<b>149</b>		
18-25		4	2.7
26-30		17	11.4
31-35		27	18.1
36-40		17	11.4
41-45		22	14.8
46-50		22	14.8
51-55		24	16.1
56-60		10	6.7
61-65		6	4
<b>Gender</b>	<b>150</b>		
Female		106	70.7
Male		43	28.7
Non-binary		1	0.7
<b>Care Responsibilities Outside Workplace</b>	<b>150</b>		
Yes		80	53.3
No		70	46.7
<b>Type of Care Responsibility</b>	<b>80</b>		
Childcare		63	42
Pet care		55	36.6
Elderly care		25	16.6
Disability care		6	4
Other		1	0.7

Table 3: Usage of the app

Variable	Frequency
<b>App</b>	
Number of participants who registered on the app	69
Number of registered users who did not use the app	2
Number of registered users who used the app between 1 and 15 times	59
Number of registered users who used the app more than 15 times	8
<b>Assessments and App</b>	
Number of individuals who completed all assessments and registered on the app	62
Number of individuals who completed all assessments but had no interaction with the app <sup>a</sup>	26
Number of individuals who completed all assessments and had minimal interaction with the app <sup>b</sup>	33
Number of individuals who completed all assessments and had meaningful interaction with the app <sup>c</sup>	3

Note. <sup>a</sup>: interaction < 1 time; <sup>b</sup>: 1 =< interaction < 15 times; <sup>c</sup>: interaction >= 15 times.

Table 4. Engagement with the different features of the App

Variable	Frequency
<b>Track feature</b>	
Number of users who did not use track	26
Number of users who used track 1-14 times	59
Number of users who used track 15 or more	3
<b>Discover feature (Articles/Modules)</b>	
Number of users who read articles/modules on the app	28
Number of users who read between 1 and 5 articles/modules	15
Number of users who read between 6 and 15 articles/modules	8
Number of users who read more than 15 articles/modules	5
<b>Connect feature</b>	
Number of users who invited a supporter	15
Number of users who invited only one supporter	11
Number of users who invited more than one supporter	4
<b>Track – On-boarding feature</b>	
Number of users who completed social connections scale	61
Number of users who completed readiness for change scale	61
Number of users who completed perceived isolation scale	60
Number of users who completed loneliness scale	60

Figure 2. Number of engagements with the app over the period of this study

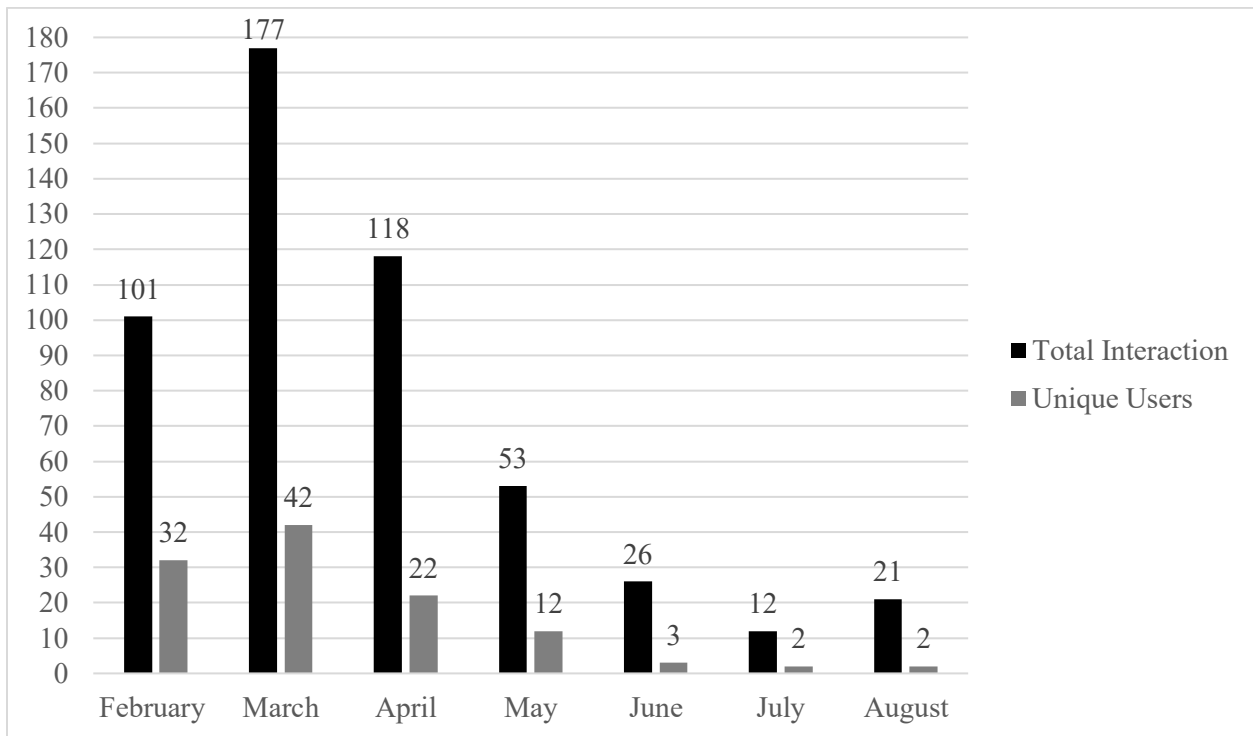


Table 5. Mean and standard deviation of five key variables of this study among participants who completed all three assessments (66 participants)

	Time 1		Time 2		Time 3	
	M	Sd	M	Sd	M	Sd
Anxiety <sup>a</sup>	1.00	0.84	0.85	0.77	0.71	0.61
No Interaction	0.99	0.86	0.76	0.74	0.80	0.64
Minimal Interaction	1.00	0.82	0.89	0.74	0.63	0.58
Meaningful Interaction	1.05	1.15	1.43	2.02	0.94	0.82
Depression <sup>b</sup>	1.04	0.57	0.93	0.56	0.81	0.48
No Interaction	1.06	0.60	0.91	0.51	0.91	0.52
Minimal Interaction	1.03	0.57	0.93	0.59	0.73	0.44
Meaningful Interaction	1.05	0.48	1.03	0.68	0.87	0.62
Loneliness <sup>c</sup> (UCLA)	2.51	0.59	2.44	0.60	2.31	0.59
No Interaction	2.54	0.69	2.46	0.67	2.92	0.81
Minimal Interaction	2.50	0.54	2.40	0.57	2.28	0.53
Meaningful Interaction	2.35	0.28	2.72	0.28	2.28	0.37
Loneliness <sup>d</sup> (Howatt)	3.09	0.68	2.85	0.70	2.57	0.65
No Interaction	3.09	0.76	2.92	0.81	2.56	0.76
Minimal Interaction	3.13	0.64	2.82	0.63	2.59	0.57
Meaningful Interaction	2.67	0.08	2.67	0.63	2.42	0.68
Perceived Isolation <sup>e</sup>	69.84	18.79	68.28	18.41	65.05	15.13
No Interaction	71.04	18.93	70.60	15.85	67.68	15.59
Minimal Interaction	69.57	19.63	67.09	20.48	63.79	16.40
Meaningful Interaction	65.67	8.32	57.50	14.85	53.00	24.04

Note. <sup>a</sup>: mean score across items was used, which ranged from 0 to 3, higher scores indicate higher anxiety; <sup>b</sup>: mean score across items was used, which ranged from 0 to 3, higher scores indicate higher depression; <sup>c</sup>: mean score across items was used, which ranged from 1 to 4, higher scores indicate greater loneliness; <sup>d</sup>: mean score across items was used which ranged from 1 to 5, higher scores indicate greater loneliness; <sup>e</sup>: total score was used which ranged from 29 to 145, higher scores indicate greater isolation.

Table 6. Testing the significance of the change in key variables among all participants who completed all three assessments

	df	Mean Square	F	Sig.
Anxiety	2 (178)	1.29 (0.56)	2.28	0.11
Depression	2 (178)	0.81 (0.29)	2.75	0.07
Loneliness (UCLA)	2 (178)	0.66 (0.36)	1.87	0.16
Loneliness (Howatt)	2 (178)	4.24 (0.47)	9.06	0.00*
Perceived Isolation	2 (178)	361.42 (307.33)	1.18	0.31

*Note.* \* Tukey HSD post-hoc:  $p$  (time 1,2) = 0.17;  $p$  (time 2,3) = 0.04;  $p$  (time 1,3) = 0.00

Figure 3. Change in key variables among those who completed all three assessments (no significant change)

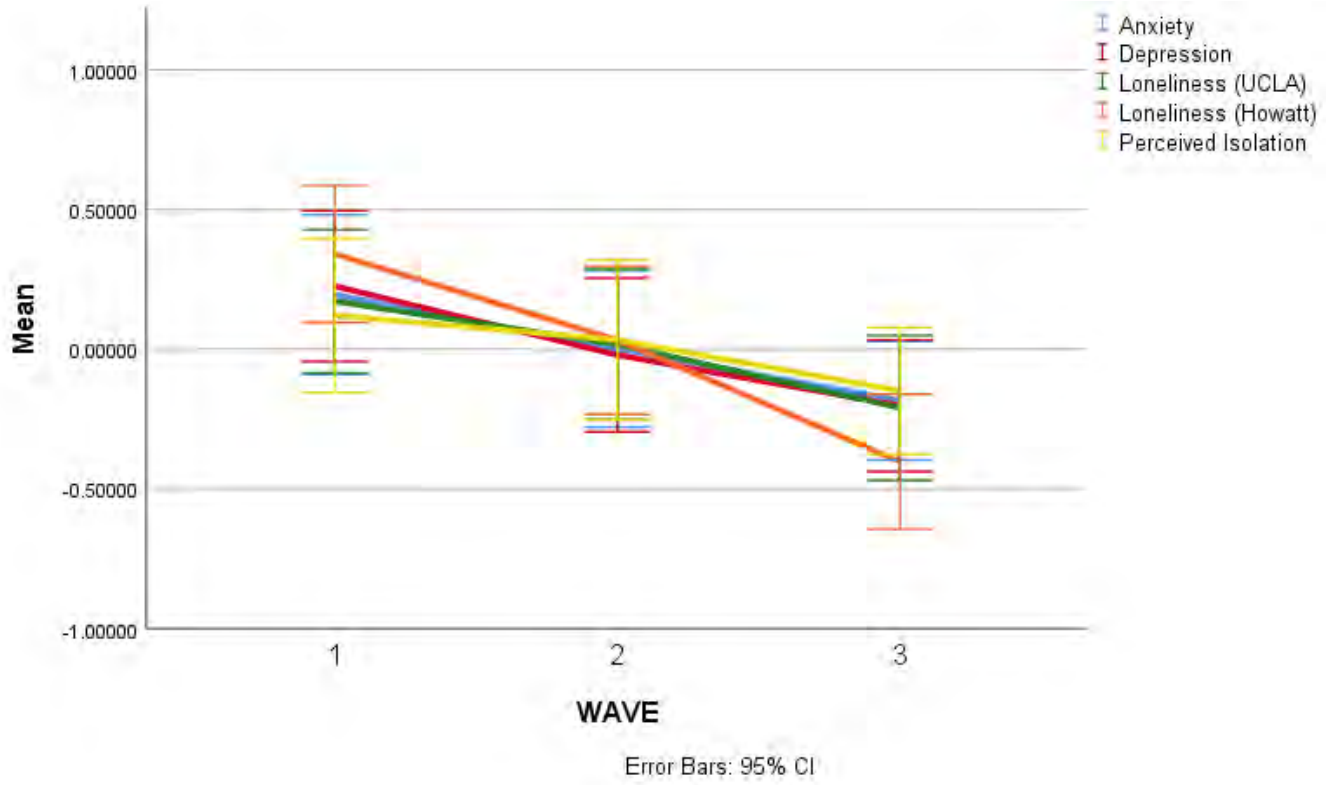


Table 7. Testing the significance of the difference in key variables between three groups of participants (no interaction, minimal interaction, and meaningful interaction) at each time point

		df	Mean Square	F	Sig.
Time 1	Anxiety	2 (58)	0.01 (1.29)	0.01	0.99
	Depression	2 (59)	0.02 (1.14)	0.02	0.98
	Loneliness (UCLA)	2 (59)	0.14 (1.03)	0.14	0.87
	Loneliness (Howatt)	2 (59)	0.59 (0.92)	0.64	0.53
	Perceived Isolation	2 (59)	0.16 (1.18)	0.14	0.87
Time 2	Anxiety	2 (57)	0.74 (1.01)	0.69	0.50
	Depression	2 (58)	0.03 (1.08)	0.03	0.97
	Loneliness (UCLA)	2 (57)	0.36 (1.02)	0.35	0.70
	Loneliness (Howatt)	2 (59)	0.26 (1.00)	0.25	0.77
	Perceived Isolation	2 (56)	0.67 (1.12)	0.60	0.55
Time 3	Anxiety	2 (58)	0.36 (0.66)	0.55	0.58
	Depression	2 (59)	0.72 (0.79)	0.91	0.41
	Loneliness (UCLA)	2 (58)	0.18 (1.00)	0.18	0.83
	Loneliness (Howatt)	2 (57)	0.13 (0.89)	0.15	0.86
	Perceived Isolation	2 (57)	0.84 (0.74)	1.13	0.33



Table 8. Testing the significance of the change in key variables among those who completed all three assessments based on their level of engagement with the app

		df	Mean Square	F	Sig.
No Interaction	Anxiety	2 (74)	0.63 (1.00)	0.63	0.53
	Depression	2 (75)	0.65 (1.02)	0.64	0.53
	Loneliness (UCLA)	2 (74)	0.62 (1.28)	0.48	0.62
	Loneliness (Howatt)	2 (74)	3.83 (1.21)	3.17	0.05*
	Perceived Isolation	2 (73)	0.27 (0.84)	0.32	0.72
Minimal Interaction	Anxiety	2 (57)	2.15 (0.91)	2.36	0.10
	Depression	2 (58)	2.44 (0.98)	2.49	0.09
	Loneliness (UCLA)	2 (57)	1.34 (0.85)	1.57	0.21
	Loneliness (Howatt)	2 (59)	4.52 (0.75)	6.45	0.00**
	Perceived Isolation	2 (56)	0.82 (1.16)	0.70	0.49
Meaningful Interaction	Anxiety	2 (58)	0.44 (3.37)	0.13	0.88
	Depression	2 (59)	0.11 (1.32)	0.09	0.92
	Loneliness (UCLA)	2 (58)	0.46 (0.28)	1.64	0.27
	Loneliness (Howatt)	2 (57)	0.16 (0.67)	0.25	0.79
	Perceived Isolation	2 (57)	0.34 (0.76)	0.44	0.67

*Note.* \*: the change between time 1 and time 3 was significant ( $p = 0.04$ ) \*\*: the change between time 1 and time 3 was significant ( $p = 0.002$ )

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