Well-Being During Times of Heightened Social Isolation: A Panel Study Examination of the Protective Effects of Social Support Availability

By

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Abstract

The COVID-19 lockdowns had negative impacts on psychological well-being and amplified certain stressors (e.g., social isolation), especially in at-risk populations. My thesis examined social support availability as a coping strategy. Single people living alone (*N*=220) were recruited during the initial 2020 lockdown and followed over a period of six weeks. Each week, participants reported their perceived social support availability, social isolation, and life satisfaction. I hypothesized that greater perceptions of social support availability, both on the within- and between-person levels, would buffer the negative effects of social isolation on psychological well-being. Multi-level modeling results showed that stress-buffering occurred on the between-person level. Associations were analyzed longitudinally, revealing that lagged social isolation did not predict life satisfaction the week after. An interaction was observed between lagged social isolation and lagged social support availability, such that lagged social isolation predicted less life satisfaction when social support was unavailable the week before.

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Well-Being During Times of Heightened Social Isolation: A Panel Study Examination of the Protective Effects of Social Support Availability

During the summer of 2020, large swaths of the world entered into lockdowns in response to the novel coronavirus (COVID-19) pandemic (Hwang, 2021). Specifically, as the virus spread from person-to-person contact, social distancing and "shelter-in-place" measures (i.e., sanctioned behaviours meant to physically isolate people from others outside of the immediate household) were enforced to prevent mass communal outbreaks and the overwhelming of healthcare organizations. While these measures were mandated to physically protect people from the virus, scholars expressed concerns about psychological well-being during this period (i.e., how people can continue to flourish under extreme lockdown circumstances), especially related to the added stressors of life under a global pandemic and, specifically, the exacerbation of social isolation potentially experienced by at-risk populations, such as people who were already living alone before the occurrence of the lockdowns (Galea et al., 2020). Interestingly, although decreases in well-being were reported during the early stages of the lockdowns (e.g., Zacher & Rudolph, 2021), a meta-analysis assessing both natural experiments and longitudinal studies during this period found that the lockdowns did not generally exert long-term detrimental effects on psychological well-being for many people (Prati & Mancini, 2021). These findings suggest that some people were able to find strategies to cope with the difficult context and maintain their psychological well-being despite the many challenges presented by the lockdowns.

One such coping strategy of interest pertains to the availability of social support provisions from the social network, as social support has been found to be protective for psychological well-being in a variety of different contexts (Taylor, 2011). In the pandemic

context, reliance on other people within the social network may have been crucially important for protecting well-being by managing the harmful effects of a specific stressor that was particularly salient during the lockdown period, namely social isolation. Therefore, the first goal of my thesis was to examine whether perceptions of social support availability, especially in a community sample of persons at-risk for social isolation (i.e., single people living alone), acted as a stress-buffer for social isolation during the pandemic lockdown, both overall and on a weekly basis. Additionally, the effects of social support on well-being, especially from a stress-buffering lens, have primarily been examined from a cross-sectional level (i.e., providing a snapshot of social support as a stress-buffer). However, the longitudinal nature of the panel study dataset allowed for the analysis of associations over time. In other words, the second goal of my thesis was to examine whether these stress-buffering effects (i.e., social support availability reducing the negative impacts of social isolation on psychological well-being) persisted over time.

Social Isolation as a Stressor

Social isolation conventionally has been defined as a characteristic to describe the size of one's social network (Zavaleta et al., 2014). Specifically, more socially isolated people typically report their social networks as being very small as compared to less socially isolated people. Therefore, people who report being socially isolated are deprived of meaningful social connectedness opportunities. However, this definition of social isolation has been contested as incomplete to the extent that scholars have proposed adding a quality component of social relations to the construct of social isolation. In essence, the extent to which the social network meets subjective expectations for meaningful relationships is just as important as the number of social contacts within the network. Therefore, a more complete understanding of social isolation

includes not only information about social network size, but also how people subjectively feel about the relationships within their social networks (i.e., whether people believe that the relationships they do have provide meaning and value).

Zavaleta et al. (2014) have proposed loneliness (i.e., aversive feelings that arise when people feel that the quality of their connections with others is deficient; De Jong Gierveld et al., 2006) as a potential construct to assess that missing metric of network quality. However, there are limitations to this suggestion. Specifically, scholars studying both loneliness and social isolation have only found weak correlations between social network size and conventional measures of loneliness (e.g., $r = -.23$; Lee & Ko, 2018). These findings suggest that overarching feelings of loneliness measured as a unitary construct are a distinct phenomenon from social isolation.

The most commonly used measurement tool for loneliness, the UCLA Loneliness Scale (and variants based on this scale; see Alsubheen et al., 2021 for a systematic review of the different UCLA Loneliness Scale variants), has garnered criticism as to its validity (i.e., what is this scale actually measuring?). While the creator of the UCLA Loneliness Scale contended that the measure assessed a unitary construct with a singular factor (i.e., global loneliness; Russell, 1996), additional systematic reviews and factor analyses have found that the family of UCLA Loneliness Scales may actually be measuring several different factors that cause loneliness or are correlated constructs, with the univariate solution yielding the worst fit in some tested populations (Ausín et al., 2019). Notably, Hojat (1982) proposed that the UCLA Loneliness scale contained four factors: “Isolation and withdrawal,” “People,” “Sharing with Others,” and “Absence of an intimate person.” It is this isolation and withdrawal factor, measuring whether people are aware of the presence of their social network and can rely on them, that particularly

stands out, especially when considering the discussion regarding adding network quality to the construct of social isolation. Thus, in pursuit of a unitary global assessment of loneliness, the UCLA Loneliness Scale (and variants based on this scale) may have included items that both measured loneliness *and* social isolation, among other potential constructs. By looking only at a subset of the items within the UCLA Loneliness Scale, especially factors that may pertain specifically to social isolation, researchers may be able to assess the isolated effects of the overlooked quality components in the construct of social isolation.

Through assessing this subjective quality component of the social network within demographics at-risk for social isolation, researchers can investigate the effects of differing perceptions of social isolation. In other words, people belonging to demographics that have fewer social connections than others (and, therefore, are at-risk for experiencing social isolation) may not necessarily *perceive* that they are socially isolated all the time. Instead, perceptions of social isolation may naturally fluctuate within an individual person (i.e., intra-individual variation) or differ between people (i.e., inter-individual variation). Therefore, there may be times where people feel more or less socially isolated than their own usual, and there might be some people who consider themselves to be overall more socially isolated than others over a given period of time. During the COVID-19 lockdown period when social isolation was particularly salient, perceptions of social isolation both on a short-term (i.e., weekly) basis and over a longer-term course of the lockdown period may have been heightened, especially for people who were already at-risk for social isolation before the lockdown period (i.e., single people living alone).

Social Isolation During the COVID-19 Pandemic

Although communication with others could still safely occur over the phone or internet during the lockdown period and, thus, could be used to remain in contact with the social network, studies investigating these communications during the early stages of the COVID-19 pandemic found that more frequent social communication with others while using these technologies was associated with either less psychological well-being (Kim & Florack, 2021) or was not as important of a protective factor for psychological well-being as quality of the interactions (Sommerlad et al., 2021). This suggests that the quality of social interaction may be more important for protecting well-being, while frequency (i.e., accessibility) of interaction is less important. In other words, socially isolated people may still have been able to contact their social networks during the lockdowns due to the accessibility of phone and internet communication technologies. However, that does not necessarily mean they were inherently protected from experiencing lower psychological well-being during this period *because* the ability to communicate was preserved through communication technologies.

Prior to the COVID-19 pandemic, Vézina (2011) prepared a report for Statistics Canada surveying over 19 000 respondents, suggesting that single people living alone (relative to coupled people living with their significant others) indicated that they had fewer relatives that they felt close to, smaller familial networks that they could rely on, fewer acquaintances outside of a circle of close friends, and poorer quality social networks in general. Therefore, single people living alone were at a disadvantage for being able to rely on their social networks even before the lockdowns. Then during the early stages of the lockdowns, an international survey of adults found that living alone was a risk factor for experiencing heightened perceptions of social isolation (O'Sullivan et al., 2021). Therefore, the pandemic lockdown context particularly impacted people who were already living alone, as it acted to exacerbate tendencies towards

social isolation in the population. However, there may have been variability in how isolated this demographic actually felt – especially on a week-to-week basis, where people may have felt more or less isolated than their usual depending on the context of that week – and, therefore, differences in how harmful the stressor of social isolation may have been for psychological well-being.

Social Isolation and Stress

People who are socially isolated, as measured by counting the number of people within one's social network, tend to report less psychological well-being compared to people with robust social networks (Zavaleta et al., 2014). Similarly, when looking at the well-being of adults living alone, researchers have found that living alone is a risk factor for lower psychological well-being. For example, a systematic review of European data collected before the global lockdowns found that adults living alone generally reported less positive psychological well-being compared to adults living with other people, although the evidence was scarce and the findings of the few studies included in the review were slightly inconsistent (Tamminen et al., 2019). Specifically for Canadian populations, Helliwell et al. (2020) prepared a report for Statistics Canada comparing life satisfaction before the lockdowns in 2018 and during the lockdowns in June 2020. For both periods of time, people living alone reported significantly lower psychological well-being compared to people living with others. Therefore, whether social isolation is operationalized by the number of contacts in one's social network or by living arrangements (i.e., living alone as opposed to living with others), there are associated detrimental effects on psychological well-being.

Moreover, heightened perceptions of social isolation have been linked to people experiencing lower psychological well-being (Park et al., 2020). From an evolutionary

standpoint, these subjective feelings of socially disconnectedness and isolation may be a noxious signal to indicate that connections to the social network are waning and people need to reach out to their social networks to repair and maintain their connections with others (Cacioppo et al., 2011). In other words, perceptions of social isolation can act as a stressor to signal a need for a disruption to homeostasis – feeling especially socially isolated is a very unpleasant feeling and people are motivated to resolve these feelings through strengthening their connections with others.

During the early stages of the COVID-19 pandemic and lockdowns, studies reported high rates of perceived stress and mental distress and low rates of positive well-being (e.g., satisfaction with life) especially for certain at-risk populations, such as women, single people who lived alone, and people with lower socioeconomic means (O'Connor et al., 2021; Kowal et al., 2020; Sibley et al., 2021). Interestingly, mental distress generally decreased over time (i.e., over the period of a month), while psychological well-being increased over time – this effect was not moderated by population type (i.e., whether the population was considered to be at-risk or not, psychological well-being increased over time; O'Connor et al., 2021). Additionally, Zacher and Rudolph (2021) found that life satisfaction in a German sample generally decreased between March and May 2020 (i.e., during the initial lockdown stages). However, people who were able to employ coping strategies to manage the stress of lockdown were able to mitigate decreases in life satisfaction. Taken together, these results suggest that, while there were initial decreases in psychological well-being during the lockdowns, many people were able to adapt and find ways to protect their psychological well-being and cope with stress during the lockdowns. While these studies measured general perceptions of stress, social isolation may have been an example of a

distinct stressor exacerbated by the lockdowns that people found ways to cope with through maintaining their bonds with others in their social networks.

Social Support as a Buffer Against Reduced Well-being from Social Isolation

Lazarus and Folkman's (1984) transactional model of stress and coping described the process by which people cope with stressors. Specifically, the capacity to cope and adjust to challenging contexts is a consequence of transactions that occur between people and their environment. Within this framework, the subjective meanings and interpretations (i.e., appraisals) that people ascribe to their environment matter more than the actual features of the environment for experiencing well-being declines and, subsequently, coping with stress. People first appraise situations for potential threat (i.e., primary appraisal; the event is either assessed as stressful or benign). If the situation is assessed as a threat, people appraise whether they possess the resources to cope with the threat or not (i.e., secondary appraisal). In secondary appraisal, coping resources are evaluated and then, if available, deployed to manage the stressor. Within the transactional model, coping strategies can avert the deleterious effects of a stressor on well-being through a) preventing the event from even being appraised as a threat during primary appraisal (i.e., the stressor is never considered a threat because it is not relevant due to pre-existing protective psychological factors) and b) prompting the elicitation of resources to assist in coping with the stressful event during secondary appraisal (i.e., resource mobilization to manage the stressor and reduce its aversive impact, also called stress-buffering). The transactional model has been found to be a useful framework for understanding both how threats to well-being can be avoided through the promotion of protective psychological factors, as well as how these threats, once appraised, can be managed (i.e., buffered) through appropriate coping strategies that can mitigate the deleterious effects on well-being (Biggs et al., 2017).

The resource of social support has been observed to be a crucial component for buffering the detrimental effects of general stress on well-being (Cohen & Wills, 1985; Cohen, 2004), matching the theory outlined in the transactional model of stress and coping (i.e., social support being used as a resource to manage situations which have been appraised as stressful; Lazarus & Folkman, 1984). However, support for the generalizability of the stress-buffering effect in mitigating the deleterious effects of individual and specific stressors has been mixed. For example, while Åslund et al. (2014) found that social support did buffer the detrimental effects of financial distress on psychological well-being, Bryson and Bogart (2020) did not find compelling evidence of the stress-buffering effect in their examination of people coping with the stress of living with rare diseases. Additionally, some studies examining racism as a specific stressor have found that social support buffers the harmful effects of perceived racism, while other studies fail to replicate this effect (Brondolo et al., 2009). Therefore, these mixed findings for the stress-buffering effect suggest that it is not a ubiquitous phenomenon. In other words, it appears that social support is differentially useful for coping in response to mitigating specific stressor's harmful effects on psychological well-being.

Instead of social support having a ubiquitous buffering effect on stressors, it may be necessary for the available social support resources to match the requirements of the stressful situation (Cohen & Wills, 1985; Cohen, 2004; Folkman & Moskowitz, 2004). This may help explain why the stress-buffering effect is not always observed in the empirical literature. If there is a mismatch between the aid that social support can provide and what is needed to alleviate the stressor, stress-buffering will not occur because social support is not useful for managing the stressor in that instance. Especially for demographics at risk for social isolation (e.g., single people living alone), heightened feelings of social isolation may have been especially threatening

and stress inducing during the lockdown period. In this case, the employment of social support as a resource would have been appropriate to reduce heightened feelings of social isolation because resources provided by the social network would have been highly applicable to reducing the threat of social isolation. Therefore, during the lockdown period, people who perceived they had more (vs. less) social support availability overall, as well as people who perceived more social support availability than their own usual on a short-term (i.e., weekly) basis, may have been able to employ these resources to buffer the deleterious effects of the social isolation stressor on psychological well-being.

In terms of social support as a stress-buffering resource, scholars have defined social support in several different ways, but the central components describe the ability to gain access to resources and assistance through interactions with people within the social network. Weiss' (1974) model of social provisions incorporates many of the major components described in different conceptualizations (as noted by Cutrona and Russel, 1987). This model of social provisions delineates various different social provisions (i.e., functions of support) that can be garnered through interpersonal relationships with social others. The provisions can be divided into assistance related and non-assistance related provisions. Guidance (informational support; e.g., advice) and reliable alliance (instrumental support; e.g., physical assistance) are the assistance related provisions. The non-assistance related provisions describe affectional ties, such as attachment (emotional support; e.g., an empathetic ear) and social integration (a sense of belonging). All of these social support resources, in one way or another, may have been useful in buffering the deleterious effects of social isolation on well-being during the lockdown period.

Longitudinal Effects of Social Support

When examining panel data, it becomes possible to study lagged effects (e.g., how an individual experiencing more social support than their usual at one timepoint can predict well-being at the next timepoint; see Biesanz, 2012 for a review of autoregressive longitudinal models). These lagged analyses can help in understanding whether the effects that are found on a cross-sectional level persist over time. In other words, it may be the case that social support is important for protecting well-being in the short term (i.e., on an acute "in the moment" basis) but does not protect psychological well-being from one week to the next. In that case, it is important to know the extent of the protective effects of social support, as this can impact intervention strategies. If social support can act as a protective factor for future well-being, it may be more akin to an inoculation against decreases in well-being instead of people being required to constantly elicit social provisions to protect well-being. These analyses can also help elucidate temporal precedence. It may be the case that people who report higher than their usual psychological well-being also report greater perceived access to social support (i.e., people who feel satisfied with their lives may perceive they have access to high quality social support networks), rather than social support availability acting specifically as a construct to protect well-being. Although this is theoretically thought to be a bidirectional process (Heaney & Israel, 2008), it is important to empirically test the direction of these relationships before conducting further interventional work. Moreover, these longitudinal analyses allow for the examination of the stress-buffering effect of social support over time (i.e., whether social support can reduce the deleterious effects of social isolation over time).

Recent longitudinal studies have been very focused on comparing pre- and intra-lockdown contexts. For example, Zacher and Rudolph (2021) examined whether social support mitigated the decreases in well-being that occurred during the transition to lockdown. However,

to my knowledge, no longitudinal studies have examined whether intraindividual social support fluctuations during the lockdowns themselves (i.e., an individual reporting more social availability than their own usual during a given week of lockdown) protected well-being on a longitudinal basis. Additionally, studies conducted during the lockdown have not examined whether intraindividual social support fluctuations buffered the longer-term deleterious effects of a specific stressor that was potentially heightened at times during the pandemic context (i.e., an individual reporting more feelings of social isolation than their own usual) on well-being.

The Present Study

In the context of the COVID-19 pandemic lockdowns, maintaining well-being was a challenging prospect for many people, especially for people who were at risk for social isolation (e.g., single people living alone). However, during the lockdown period, some people were more resilient and able to withstand these difficult circumstances. Social support was identified as a specific protective factor that may have been particularly useful in maintaining psychological well-being during this context, especially for buffering the deleterious effects of specific stressors that were especially salient (i.e., perceptions of social isolation). Thus, the goal of my thesis was to examine whether social support acted to buffer perceptions of social isolation, both on a short-term basis (i.e., weekly) and on a long-term basis (i.e., stress-buffering effects persisting from one timepoint to the next).

The present study examined a dataset I collected during the Summer 2020 COVID-19 pandemic lockdowns in Ontario, Canada. Single people living alone were recruited in various Ontario cities and asked to respond to surveys administered each week over a month and a half period of time. During the course of the study, the participants responded to six weekly surveys and reported each week about their pandemic experiences. This dataset, therefore, consists of

panel data and assesses the associations of pertinent variables spanning six weeks during the initial stages of the COVID-19 lockdowns. Therefore, my thesis can examine both between-person and within-person associations (i.e., the present research can examine how average differences between people as well as weekly fluctuations within individuals can predict the outcomes of interest), as well as lagged associations over time. The present study offers unique opportunities to examine the experiences of a population which was at risk for social isolation during a novel and challenging time, providing both a snapshot and a longitudinal analysis of the earlier stages of the pandemic which were most implicated in negative outcomes. The present research, therefore, is especially valuable for assessing social isolation (as both an individual difference and as a unique source of stress), social support, and well-being during those early stages of the pandemic lockdowns. The findings of this research can help to inform intervention and coping strategies for similar populations at-risk for social isolation during future difficult contexts and crises.

Assumption Check

As the dataset used for my thesis was part of a larger project examining the experiences of single people living alone during the early stages of the COVID-19 lockdowns, we asked the participants about many variables related to their pandemic experiences. Notably, we asked the participants each week about their perceived stress levels. If social isolation is a type of stressor, social isolation (both on average and compared to one's own usual levels) should be correlated with the participants' experiences of perceived stress.

Hypotheses

First, I hypothesize that overall social support availability will buffer the deleterious effects of chronic social isolation on well-being, such that people who perceive that they are

more (vs. less) socially isolated on average than others during the lockdown period will not be as impacted by this stressor (i.e., the negative association between chronic social isolation and well-being would be weaker) if they perceive they have more (vs. less) social support availability on average during this period. Similarly, on weeks when people feel more socially isolated than their own usual, perceiving more than their own typical social support availability on that week would buffer the deleterious effects of heightened weekly social isolation on well-being. Finally, I hypothesize that the weekly stress-buffering effects of social support will persist on a more long-term basis to protect well-being at the next timepoint (i.e., the week after).

Method

Participants and Design

Over the summer of 2020, from the end of May to early June, 223 participants were recruited from different Ontario city boards (e.g., r/ottawa, r/londonontario, etc.) on reddit.com, a social media platform comprised of various public forums. Potential participants were pre-screened for eligibility (single, living alone, situated in Ontario) via email before inclusion in the study. The participants initially completed a longer intake survey and then five additional shorter surveys at the end of each week for a total of six weekly surveys. Three participants only completed the intake survey and did not continue forward with the weekly surveys; their data were removed from subsequent analyses. Out of the 220 remaining participants, eight participants withdrew (either explicitly or were automatically withdrawn after missing two sequential weekly surveys) over the course of the study. Out of a potential 1320 surveys (i.e., 220 participants multiplied by six surveys), 1267 surveys were either partially or fully completed (95.98% retention rate). Due to the low attrition rate and high adherence to the survey protocol, missing data were not considered to be a problem in this dataset.

Participants were recruited to reflect the Ontario Summer 2020 lockdown period. Therefore, recruitment only progressed within the May-June interval because the lockdown was expected to taper off at the latter portion of the summer and end prior to Fall 2020. Each participants' six-week follow-up period was expected to only reflect lockdown experiences and not include loosening restrictions. The recruitment goal was to include at least 200 participants, while maintaining an appropriate gender balance and only including the target population (i.e., single people living alone) in the study sample.

The final sample of participants included 120 women (54.55%), 98 men (44.5%), one transgender individual (0.45%), and one participant that identified as agender (0.45%). Additionally in the sample, 175 participants identified as heterosexual (79.55%), 23 participants identified as bisexual (10.45%), 12 participants identified as homosexual (i.e., lesbian or gay; 5.45%), and 10 participants identified as another sexual orientation (including asexual, pansexual, and heteroflexible; 4.55%). When asked about ethnic/racial background, 175 participants identified as White (79.55%), 13 participants identified as East Asian (6.50%), 11 participants identified as South Asian (5.00%), 11 participants identified as Multi-racial or another ethnicity (5.00%), five participants identified as Black (2.27%), two participants identified as Latin American (0.91%), one participant identified as Indigenous (0.45%), one participant identified as Middle-Eastern, and one participant declined to answer (0.45%). The participants' ages ranged from 20 to 62 (M = 33.68, SD = 8.75).

Procedure

The present study was part of a larger project funded by Carleton University's COVID-19 Rapid Response Research grant. The larger project was titled "The Psychological Consequences of Social Distancing Measures for Single People during the COVID-19

Pandemic." This study protocol was reviewed and approved by Carleton University's Research Ethics Board-B under the protocol number 105036.

Single people living alone (*N* = 220) were recruited and followed over a period of six weeks. Participants first completed a longer background/intake survey on Qualtrics asking about their experiences during the COVID-19 pandemic lockdown and assessing stable individual difference characteristics (e.g., personality measures). At the end of each week, participants completed shorter Qualtrics surveys asking about their weekly experiences during the lockdown (e.g., perceived stress that week, how much social support they received that week, etc.). Participants were compensated $10 CAD for completing the longer intake survey and $5 CAD for each shorter weekly survey they completed, for a total amount of up to $35 CAD (granted in Amazon gift cards). Additionally, participants were entered into a draw to win one of two Amazon gift cards (valued at $100 CAD each) at the end of the study, with each completed survey adding to the participants' ballots. As participants completed one intake survey and five weekly surveys over the lockdown period, the present study proposes to examine both a month and a half snapshot (i.e., the cross-sectional model) and a longitudinal perspective (i.e., the lagged model) of the COVID-19 lockdown experiences for single people living alone during the summer of 2020 in Ontario.

Measures

Weekly Measures

Social Isolation. Social isolation was assessed via the three items from the 8-item UCLA Loneliness Scale (Hays & DiMatteo, 1987) that specifically measure social isolation and withdrawal (as per Hojat, 1982's factor classification scheme for the family of UCLA Loneliness Scales). The three included items were, "I felt isolated from others," "I was unhappy being so

withdrawn," and, "People were around me but not with me." Participants were asked to indicate how often these statements applied each week on a 4-point scale (1 = *Never* to 4 = *Often*), where higher scores indicated more perceived social isolation. The social isolation scale demonstrated good between-person internal consistency reliability in this sample, while the within-person internal consistency reliability was poorer ($\omega_{Between} = .85$, $\omega_{Within} = .54$).

Social Provisions Scale. A modified version of Cutrona & Russell's (1987) social provisions scale (SPS) was used in the present study to measure participants perceptions of social support availability. The original scale demonstrated high internal consistency reliability for total social support provisions ($\alpha = .92$). Although the original scale contained 24-items, the scale was shortened to 8-items in the present study. Each weekly social provision was assessed with only 2-items, with each subscale consisting of one positively worded item and one reverse-scored item. Participants were asked to indicate to what extent each statement described their current relationships with others in the past week on a 4-point scale (1 = *strongly disagree* to 4 = *strongly agree*), with higher scores indicating more perceived social support availability. The included attachment items were, "I feel that I do not have close personal relationships with other people," and, "I have close relationships that provide me with a sense of emotional security and well-being." The included social integration items were, "I feel part of a group of people who share my attitudes and beliefs," and, "There is no one who shares my interests and concerns." The included reliable alliance items were, "If something went wrong, no one would come to my assistance," and, "There are people who I can count on in an emergency." Finally, the included guidance items were, "There is no one I can turn to for guidance in times of stress," and, "There is someone I could talk to about important decisions in my life." The total SPS demonstrated

excellent between-person internal consistency reliability in this sample, while the within-person internal consistency reliability was poorer ($\omega_{Between} = .97$, $\omega_{Within} = .56$).

Life Satisfaction. Psychological well-being was measured via the Satisfaction With Life Scale (SWLS; Diener et al., 1985). This 5-item scale asks participants to respond to questions such as, "In most ways my life is close to my ideal," and, "I am satisfied with my life," rated on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*), with higher scores indicating greater life satisfaction. The original scale was found to have high internal consistently reliability ($\alpha = .87$) and strongly correlate with other measures of well-being. As life satisfaction has been identified as a cognitive and global assessment of overall quality of life (Pavot & Diener, 1993), the SWLS was deemed appropriate to capture the construct of psychological well-being. Additionally, the SWLS has been used in hundreds of studies since its creation (Pavot & Diener, 2008), establishing it as a standard of measuring psychological well-being in the field of psychology. Moreover, meta-analyses conducted in recent years have confirmed the reliability of the SWLS scale (Busseri, 2018; Vassar et al., 2008), suggesting that the psychometric properties of the scale are robust. The scale demonstrated excellent between-person internal consistency reliability in this sample, while the within-person internal consistency reliability was within the acceptable cut-off range ($\omega_{Between} = .95$, $\omega_{Within} = .71$).

Assumption Check

Perceived Stress Scale. A modified version of Cohen et al.'s (1983) Perceived Stress Scale (PSS) was used to assess participants' self-reported perceptions of how stressed they were feeling each week. The original scale asked participants to indicate how often they felt stressed in the past month based on certain criteria (e.g., how often they were upset because something happened unexpectedly) and contained 14-items. It was found to be reliable in the tested college

and community samples of (coefficient alpha reliability ranged from .84 to .86). Additionally, the original scale was associated with the number and perceived influence of life stressors and predicted symptoms of depression and social anxiety, suggesting that the scale had convergent and predictive validity. Cohen and Williamson (1988) developed a 10-item version of their PSS scale as well, which demonstrated excellent psychometric properties. The PSS is a widely used measure to assess perceptions of stress and meta-analytic reviews have confirmed psychometric soundness of the measure (especially the 10-item measure; Lee, 2012); therefore, the PSS was chosen to assess participants' perceived stress in the present study.

In the present study, the 10-item PSS questionnaire was modified to ask about participants' experiences in the past week instead of the past month. Sample items included, "In the past week, how often have you felt that you were unable to control the important things in your life?" and "In the past week, how often have you felt nervous and 'stressed'?" Participants indicated on a 5-point scale (0 = *never* to 4 = *very often*) how frequently they perceived these feelings of stress. The scale demonstrated excellent between-person internal consistency reliability in this sample, while the within-person internal consistency reliability was poorer ($\omega_{Between} = .96$, $\omega_{Within} = .69$).

Results

As the aims of the study were to examine the stress-buffering effect of social support on social isolation and well-being from both a cross-sectional and longitudinal focus, two separate models were constructed. The first model examined the cross-sectional effects of social support and social isolation on well-being to account for the multi-level nature of the data (i.e., weekly observations nested within participants) and which isolated the effects of between- and within-person variability. The second model was constructed using random intercept cross-lagged panel

model techniques (Usami et al., 2021), which allowed for the between-person variability to be controlled while examining the autoregressive associations (i.e., a variable predicting itself at the next time point), the cross-lagged associations (i.e., a variable predicting another variable at the next time point), and the weekly within-person stress-buffering moderation terms (Speyer et al., 2022).

Descriptives

The variables of interest were first investigated through descriptive analysis. See Table 1 for an overview of the descriptive statistics. Overall, the sample reported experiencing moderate levels of perceived social isolation, life satisfaction, and perceived stress, and moderately high levels of social support availability over the six-week period. Visual inspection of the frequency histograms for these variables indicated an approximately symmetrical distribution for both social isolation and perceived stress (i.e., approximately normally distributed), a left-skewed distribution for social provisions (i.e., more weeks in which people reported less access to social support), and a right-skewed distribution for life satisfaction (i.e., more weeks in which people reported more overall satisfaction with their lives).

Table 1

Descriptive Statistics for the Variables of Interest

	n	*M*	*SD*	[Min, Max]
Weekly Social Isolation	1262	2.54	0.82	[1, 4]
Weekly Social Provisioning	1267	3.03	0.62	[1, 4]
Weekly Life Satisfaction	1262	3.64	1.50	[1, 7]
Weekly Perceived Stress	1263	1.85	0.74	[0, 4]

Note. These descriptive statistics reflect the raw weekly scores that have not been decomposed into between- or within-person variance components.

Cross-Sectional Multi-level Model

As per multi-level modeling recommendations for panel data, the conflated level (i.e., raw weekly score) predictor variables in the present study were disaggregated into their within- and between-person variance components (Curran & Bauer, 2011; Hoffman & Stawski, 2009). The between-person component was extracted by aggregating each participant's weekly scores into one average score across the six-week period. These between-person scores were then grand-mean centered to standardize them. The within-person scores were person-mean centered by subtracting the raw weekly scores from each individual participant's average score over the six-week period, thus representing how much an individual participant scored above or below their own usual each week.

See Tables 2 and 3 for the correlations of the within- and between-person components, respectively. The between-person correlations tended to be stronger than the within-person correlated. Moreover, as per the axiom of my thesis (i.e., social isolation as a specific type of stress), social isolation and perceived stress were significantly correlated on both the within- and between-person levels, $r(1260) = 0.26$ and $r(218) = 0.59$, respectively. Therefore, on weeks when people felt more socially isolated than their own usual, they also tended to feel more stressed than they usually did. Similarly, people who felt more socially isolated than others on average over the course of the study also tended to report feeling more chronically stressed. Social isolation was more strongly correlated with perceived stress on the between-person level compared to the within-person level, suggesting that social isolation was a stronger stressor if it was prolonged (i.e., higher average over six-weeks).

Table 2

Within-Person Correlations for the Variables of Interest

	(1)	(2)	(3)	(4)
Weekly Social Isolation (1)	–			
Weekly Social Provisioning (2)	-.13***	–		
Weekly Life Satisfaction (3)	-.10***	.13***	–	
Weekly Perceived Stress (4)	.26***	-.13***	-.24***	–

Note. Raw weekly scores were person-mean centered to extract within-person variance. N = 1267 weekly observations. *** $p < .001$.

Table 3

Between-Person Correlations for the Variables of Interest

	(1)	(2)	(3)	(4)
Weekly Social Isolation (1)	–			
Weekly Social Provisioning (2)	-.42***	–		
Weekly Life Satisfaction (3)	-.49***	.50***	–	
Weekly Perceived Stress (4)	.59***	-.41***	-.61***	–

Note. Raw weekly scores were aggregated by participant to extract between-person variance. N = 220 participants. *** $p < .001$.

To test the cross-sectional stress-buffering effect on well-being for both the within- and between-person levels, a multilevel model was constructed in R using the lme4 (Bates et al., 2015; version 1.1-23) and lmerTest (Kuznetsova et al., 2017; version 3.1-2) packages. The within- and between-person components of the predictor variables (social provisions and social isolation) and were entered simultaneously into the model, as were the level 2 (between-person) and level 1 (within-person) interactions. There were no cross-level interactions included in the

model. Additionally, the model was specified as random slope and random intercept and estimated using restricted maximum likelihood (REML) techniques. The effects were tested for significance using the Satterthwaite method to estimate degrees of freedom (Luke, 2017; Satterthwaite, 1946). The stress-buffering effect moderations were probed using the Interactions package in R (Long, 2019; version 1.1.0).

The results of the multi-level model indicated that both within and between-person social isolation had significant main effects on well-being (within: b = -0.14, SE = 0.05, t(173.72) = -2.90, p = .02, 95%CI [-0.24, -0.05]; between: b = -0.70, SE = 0.12, t(216.77) = -5.88, p = .004, 95%CI [-0.94, -0.47]). Specifically, controlling for social support availability, people who felt more socially isolated than their own usual, as well as people who felt more socially isolated overall compared to others, also reported feeling less life satisfaction. There were also significant social support main effects on well-being (within: b = 0.31, SE = 0.09, t(157.00) = 3.31, p = .001, 95%CI [0.12, 0.49]; between: b = 0.82, SE = 0.14, t(213.70) = 5.83, p < .001, 95%CI [0.55, 1.10]). Controlling for perceptions of social isolation, people who perceived they had more social support available their own usual, as well as people who reported higher social support availability than others on average, also reported feeling more life satisfaction. These results suggest that greater perceptions of social isolation had a detrimental effect on psychological well-being, while sufficient access to social support was a protective factor for psychological well-being, both on a weekly and overall basis.

Next, the interaction terms were assessed. On the between-person level, the interaction term was significant, b = 0.44, SE = 0.18, t(216.43) = 2.39, p = .02, 95%CI [0.08, 0.80]. The interaction was then probed via simple slopes analyses. The strength of the negative association between social isolation and life satisfaction was twice as strong for people who perceived they

had lower (-1 *SD*) social support availability as compared to the people who perceived higher (+1 *SD*) social support availability on average (lower social support: $b = -0.96$, $SE = 0.17$, $p < .001$, 95%CI [-1.29, -0.64]; higher social support: $b = -0.45$, $SE = 0.16$, $p < .001$, 95%CI [-0.76, -0.15]). Therefore, as expected, people who felt greater amounts of social isolation on average during the lockdown period and also perceived more social support availability were more protected from the deleterious effects of perceived social isolation on well-being relative to people who perceived they had access to less social support on average. On the within-person level, the interaction term failed to reach conventional levels of significance, $b = 0.35$, $SE = 0.20$, $t(44.46) = 1.71$, $p = .09$, 95%CI [-0.09, 0.78]. However, the interaction was nonetheless probed to explore trends in the simple slopes. The trends of the within-person simple slopes were very similar to the between-person interaction effect, where the effect of feeling more socially isolated on a given week compared to one's own usual was less harmful for psychological well-being when access to social support was also higher than usual on a given week (weekly social support availability -1 *SD*: $b = -0.22$, $SE = 0.07$, $p < .001$, 95%CI [-0.35, -0.08]; weekly social support availability +1 *SD*: $b = -0.06$, $SE = 0.06$, $p = .33$, 95%CI [-0.19, 0.06]).

In summary, the cross-sectional multilevel model showed that while social isolation had harmful effects for psychological well-being, perceptions of social support availability was a protective factor for well-being, both overall and on a weekly basis. There was strong evidence to suggest that more (vs. less) social support availability on average buffered the overall deleterious effect of social isolation on well-being. I also observed some evidence of a within-person interaction effect in the model (albeit, it did not reach conventional levels of significance) that alluded to the hypothesized shorter-term, weekly stress-buffering effect of social support and mimicked the between-person findings (i.e., when people felt more socially isolated than their

own usual but also perceived more social support availability than their own usual on a given week, the negative association between social isolation and life satisfaction was less strong relative to those who reported less social support availability that week)[1].

Longitudinal Random Intercept Cross-Lagged Panel Model

When examining cross-lagged associations across different timepoints, researchers can choose from a variety of different models (Usami et al., 2019). As examining whether the within-person stress buffering associations persisted over time was the fulcrum of this analysis, I attempted to find a model that could accommodate within-person lagged moderation. Additionally, as the within-person stress-buffering effect was only supported by weak evidence in the cross-sectional model, where all of the weekly observations were analyzed together, an appropriate model allowed for the nuances in these moderation effects (i.e., the idea that the stress-buffering effect may be present some weeks but not others) to be emphasized. Therefore, although both dynamic structural equation modeling (i.e., DSEM; Asparouhov et al., 2017) and random intercept cross-lagged panel modeling (RI-CLPM; Speyer et al., 2022) were designed to analyze within-person lagged moderation while controlling for between-person effects, RI-CLPM allowed for the examination of individual weekly effects and, therefore, was used in this analysis.

[1]An additional exploratory model was analyzed with social support availability divided into the assistance related provisions (i.e., guidance and reliable alliance) and the affectional tie provisions (i.e., attachment and social integration). In this model, there was a significant stress-buffering effect on the within-person level. Specifically, the exploratory model indicated that only the assistance related provisions were implicated in reducing the negative association between social isolation and life satisfaction on the within-person level. Conversely, on the between-person level, only the affectional tie related provisions reduced the negative association between social isolation and life satisfaction

RI-CLPM is typically specified as a frequentist model in structural equation modeling (SEM) frameworks (Usami et al., 2021). Due to the intensive computational nature of cross-lagged moderation terms, however, frequentist mathematical frameworks are not recommended in implementing these models (Asparouhov & Muthén, 2020). This limits how cross-lagged models *can* be analyzed. DSEM modeling using Bayesian inference has been used as a potential solution to this problem but cannot account for completely within X within interactions. Recently, Speyer et al. (2022) have demonstrated how Bayesian inference can be used in RI-CLPM models to estimate cross-lagged moderation on the within-person level. However, as of the writing of this thesis, the manuscript demonstrating this technique is available only as a preprint.

I followed the RI-CLPM analyses as per the procedure specified by Speyer et al. (2022). The analyses were conducted using the SEM software Mplus using the Bayes estimator (Muthén & Muthén, 2018). As model fit indices were not available after specifying latent interactions terms, I first analyzed a baseline model without the within-person interaction terms to assess model fit (as outlined in Asparouhov & Muthén, 2020). As per prior recommendations, the model was deemed to be a good fit if CFI and TLI were above .95 and RMSEA was below .06 (Hu & Bentler, 1999). Additionally, in Bayesian inference, posterior distributions of each parameter are created using both the likelihood of the observed data and prior knowledge about the distribution, and then the parameter estimates are calculated by using the means of these posterior distributions (van Ravenzwaaij et al., 2018). Speyer et al. (2022) used the default prior distribution in Mplus within their manuscript, which is non-informative and allows the data to have more sway over the estimation of the posterior distribution. According to Asparouhov and Muthén (2010), the results of using non-informative priors would be comparable to typical

maximum likelihood estimation in multilevel SEM modeling. Therefore, I used a non-informative prior distribution for this analysis. Additionally, Speyer et al. (2022) used the Markov Chain Monte Carlo (MCMC) procedure (van Ravenzwaaij et al., 2018) to estimate the posterior distributions, and checked for model convergence by assessing that the potential scale reduction (PSR) values were close to 1 (i.e., if this value is above 1, more iterations of the model are needed for model convergence); as per Speyer et al. (2022)'s specification, I used the MCMC procedure and the PSR criterion for convergence in my model as well. Bayesian techniques also generate credible intervals (van Ravenzwaaij et al., 2018), which indicate that the true estimate is found within the interval within a degree of certainty (i.e., for a 95% credible interval, there is a 95% probability that the true estimate lies within the interval). Therefore, Speyer et al. (2022) recommended using the credible intervals in Bayesian inference as an analogous statistic to the frequentist framework for assessing "an indicator of significance." In other words, if the credible interval did not contain zero, the estimate was considered to be significant.

In terms of extracting the within- and between-person variance for the RI-CLPM models, given the participants' weekly observations within my dataset, I created latent variables in Mplus from all of the weekly observations (as outlined in Mulder & Hamaker, 2020). I also set the measurement error variances to zero to more effectively decompose the variables into the within- and between-person components. Then I specified the autoregressive and cross-lagged structure of the models, with all observations the week before predicting all variables the week after. In the baseline model, I did not add the interaction term and just assessed model fit. Then for the full-interaction model, I used Mplus to create latent variable interactions on the within-person level between social isolation perceptions and social support availability for each week. Finally, for the reduced interaction model, I omitted the interaction terms if they were not considered to

be significant in the full-interaction model (i.e., I excluded the interaction estimates on weeks that the credible interval contained zero), and I probed the remaining significant interactions via simple slopes analysis to assess the effects of lagged social isolation on life satisfaction the week after depending on differential levels of lagged social support. See Table 4 for the weekly variable descriptives and Table 5 for the individual estimates of each model.

The baseline model converged with a PSR value less than 1. It also demonstrated good fit, RMSEA = 0.05, CFI = 0.99, TLI = 0.98. Therefore, I determined that I could proceed with the interaction models. Of note in the baseline model, most of the lagged effects were not found to be significant (i.e., the credible interval contained 0). However, when there were lagged effects, they were very inconsistent. For example, autoregressive effects were sometimes observed, but not every week. Feeling more socially isolated than one's own usual did not predict more social isolation at the next time point, except for week five to week six. Conversely, there was more of a consistent autoregressive association for social support availability, such that people who reported more social support availability the week before also reported more social support availability the week after. However, this association was only observed in three of the five autoregressive pathways. Interestingly, life satisfaction also demonstrated significant autoregressive associations for three of the five weeks. However, two of those weeks positively predicted life satisfaction, and one of those weeks was a negative association. There were only two observed cross-lagged effects, which occurred over the same cross-lag period and both involved social isolation and social support availability. Specifically, people who perceived more social support availability than their own usual on week four reported less social isolation on week five. Similarly, people who reported perceiving more social isolation than their own usual on week four reported less social support availability on week five. Contrary to what would be

expected, the base model did not provide evidence to suggest that social support directly provided psychological well-being benefits from one week to the next or that heightened feelings of social isolation one week predicted worse psychological well-being the week after.

Next, the weekly lagged social isolation and social support interaction terms predicting life satisfaction the next week were added to the model. The full-interaction model converged with a PSR value close to 1. The lagged effects were, again, mostly nonsignificant and slightly inconsistent on a week-to-week basis. However, the interaction terms were significant for two of the five weeks (specifically from week one to week two and week four to week five). The model was specified again, this time with the nonsignificant interaction terms omitted and a simple slopes analysis added to probe the significant interactions (i.e., the reduced interaction model). Again, the model converged with a PSR value close to 1. Probing the significant interaction at week one revealed that people who perceived more social isolation than their own usual and less social support than was usually available to them reported less life satisfaction the next week (b = -0.44, $SD_{Posterior}$ = 0.23, 95%CI [-0.93, -0.03]). However, for people who perceived they had more access to social support than their own usual, there was no association between social isolation the week before and life satisfaction the week after (b = 0.38, $SD_{Posterior}$ = 0.22, 95%CI [-0.07, 0.79]). Similarly, at week four, the results of the simple slope analysis for people who perceived they had less access to social support than their own usual but were more socially isolated than their own usual reported less life satisfaction the week after (b = -1.04, $SD_{Posterior}$ = 0.35, 95%CI [-1.77, -0.43]). Interestingly, also at week four, the association between social isolation and life satisfaction was positive for people who reported that they had more access to social support than their own usual (b = 0.83, $SD_{Posterior}$ = 0.33, 95%CI [0.27, 1.57]). Taken together, it appeared that social isolation only has longer-term negative effects on life satisfaction

if social support was also not sufficiently available, as the negative cross-lagged effect of social isolation on well-being only emerged when the social support interaction term was added (although this effect was inconsistent). Moreover, for one of the weeks, lagged social isolation was actually able to promote life satisfaction the week after if ample social support resources were available – although, again, as this effect was inconsistent and only observed on one week, this effect should be interpreted with caution.

Table 4

Weekly Descriptive Statistics for the Variables of Interest

	n	*M*	*SD*	*Min*	*Max*	*Skew*	*Kurtosis*
Week 1 (Intake) Social Isolation	220	2.76	0.79	1.00	4.00	-0.57	-0.36
Week 2 Social Isolation	214	2.57	0.76	1.00	4.00	-0.36	-0.53
Week 3 Social Isolation	209	2.51	0.80	1.00	4.00	-0.23	-0.81
Week 4 Social Isolation	206	2.51	0.80	1.00	4.00	-0.23	-0.55
Week 5 Social Isolation	203	2.45	0.89	1.00	4.00	-0.05	-0.95
Week 6 Social Isolation	200	2.43	0.87	1.00	4.00	-0.18	-1.06
Week 1 (Intake) Social Provisioning	220	3.04	0.61	1.38	4.00	-0.32	-0.67
Week 2 Social Provisioning	216	3.03	0.61	1.25	4.00	-0.38	-0.29
Week 3 Social Provisioning	211	3.04	0.58	1.13	4.00	-0.34	0.03
Week 4 Social Provisioning	206	3.02	0.64	1.00	4.00	-0.37	0.02
Week 5 Social Provisioning	203	3.04	0.62	1.38	4.00	-0.22	-0.33
Week 6 Social Provisioning	203	3.02	0.64	1.00	4.00	-0.56	0.33
Week 1 (Intake) Life Satisfaction	220	3.62	1.45	1.00	7.00	-0.15	-0.87
Week 2 Life Satisfaction	213	3.69	1.50	1.00	7.00	-0.17	-0.95
Week 3 Life Satisfaction	209	3.63	1.54	1.00	7.00	-0.07	-1.03
Week 4 Life Satisfaction	206	3.65	1.49	1.00	7.00	-0.13	-0.96
Week 5 Life Satisfaction	203	3.59	1.52	1.00	6.80	-0.16	-1.09
Week 6 Life Satisfaction	201	3.71	1.54	1.00	7.00	-0.24	-0.97

Note. Weekly social isolation and social provisioning were measured on a 4-point scale, while weekly life satisfaction was measured on a 7-point scale. Higher values on these measures represent more perceived social isolation, social support availability, and life satisfaction.

Table 5

Summary of Longitudinal Model Estimates

	Baseline Model		Full-Interaction Model		Reduced Interaction Model	
Within-Effects	*b Estimate* ($SD_{Posterior}$)	[CI_l, CI_u]	*b Estimate* ($SD_{Posterior}$)	[CI_l, CI_u]	*b Estimate* ($SD_{Posterior}$)	[CI_l, CI_u]
AR $SI_1 \rightarrow SI_2$	0.13 (0.08)	[-0.04, 0.29]	0.11 (0.09)	[-0.07, 0.27]	0.12 (0.10)	[-0.10, 0.28]
AR $SI_2 \rightarrow SI_3$	0.03 (0.13)	[-0.22, 0.28]	0.08 (0.13)	[-0.35, 0.17]	0.07 (0.14)	[-0.44, 0.58]
AR $SI_3 \rightarrow SI_4$	0.08 (0.11)	[-0.16, 0.28]	0.13 (0.11)	[-0.10, 0.32]	0.10 (0.10)	[-0.11, 0.29]
AR $SI_4 \rightarrow SI_5$	0.22 (0.12)	[-0.03, 0.45]	0.28 (0.11)	[0.05, 0.49]*	0.24 (0.12)	[-0.004, 0.47]
AR $SI_5 \rightarrow SI_6$	0.32 (0.10)	[0.23, 0.50]*	0.35 (0.09)	[0.17, 0.52]*	0.33 (0.10)	[0.14, 0.51]*
AR $SPS_1 \rightarrow SPS_2$	0.33 (0.09)	[0.15, 0.51]*	0.31 (0.09)	[0.14, 0.47]*	0.29 (0.09)	[0.10, 0.46]*
AR $SPS_2 \rightarrow SPS_3$	-0.07 (0.13)	[-0.36, 0.13]	-0.03 (0.10)	[-0.25, 0.16]	-0.08 (0.12)	[-0.34, 0.14]
AR $SPS_3 \rightarrow SPS_4$	0.27 (0.19)	[-0.17, 0.58]	0.31 (0.15)	[0.01, 0.58]*	0.32 (0.17)	[-0.06, 0.60]
AR $SPS_4 \rightarrow SPS_5$	0.30 (0.13)	[0.02, 0.53]*	0.27 (0.13)	[0.01, 0.50]*	0.31 (0.13)	[0.04, 0.54]*
AR $SPS_5 \rightarrow SPS_6$	0.32 (0.11)	[0.09, 0.50]*	0.31 (0.10)	[0.10, 0.49]*	0.34 (0.09)	[0.15, 0.51]*
AR $LS_1 \rightarrow LS_2$	0.44 (0.07)	[0.30, 0.58]*	0.41 (0.07)	[0.27, 0.54]*	0.43 (0.07)	[0.29, 0.56]*
AR $LS_2 \rightarrow LS_3$	0.41 (0.09)	[0.23, 0.57]*	0.32 (0.09)	[0.14, 0.48]*	0.37 (0.09)	[0.19, 0.54]*
AR $LS_3 \rightarrow LS_4$	-0.19 (0.09)	[-0.38, -0.03]*	-0.27 (0.09)	[-0.44, -0.11]*	-0.23 (0.09)	[-0.43, -0.08]*
AR $LS_4 \rightarrow LS_5$	-0.12 (0.22)	[-0.61, 0.24]	-0.10 (0.18)	[-0.52, 0.20]	-0.28 (0.23)	[-0.83, 0.11]
AR $LS_5 \rightarrow LS_6$	0.20 (0.12)	[-0.06, 0.40]	0.22 (0.09)	[0.03, 0.40]*	0.24 (0.10)	[0.03, 0.43]*
CL $SI_1 \rightarrow SPS_2$	0.02 (0.04)	[-0.06, 0.09]	0.04 (0.04)	[-0.04, 0.12]	0.03 (0.04)	[-0.05, 0.12]
CL $SI_2 \rightarrow SPS_3$	-0.01 (0.06)	[-0.12, 0.11]	-0.05 (0.06)	[-0.25, 0.16]	-0.03 (.06)	[-0.15, 0.10]
CL $SI_3 \rightarrow SPS_4$	0.02 (0.05)	[-0.08, 0.13]	0.01 (0.05)	[-0.08, 0.11]	0.02 (0.05)	[-0.09, 0.12]

CL $SI_4 \rightarrow SPS_5$	-0.12 (0.06)	[-0.24, -0.01]*	-0.14 (0.06)	[-0.25, -0.03]*	-0.14 (0.06)	[-0.25, -0.02]*
CL $SI_5 \rightarrow SPS_6$	-0.03 (0.05)	[-0.13, 0.06]	-0.03 (0.05)	[-0.12, 0.06]	-0.03 (0.05)	[-0.12, 0.06]
CL $SI_1 \rightarrow LS_2$	0.003 (0.10)	[-0.18, 0.19]	-0.05 (0.10)	[-0.24, 0.14]	-0.04 (0.10)	[-0.24, 0.15]
CL $SI_2 \rightarrow LS_3$	0.11 (0.14)	[-0.17, 0.37]	0.10 (0.13)	[-0.16, 0.35]	0.09 (0.13)	[-0.17, 0.34]
CL $SI_3 \rightarrow LS_4$	-0.06 (0.11)	[-0.29, 0.16]	-0.04 (0.11)	[-0.25, 0.17]	-0.02 (0.10)	[-0.21, 0.18]
CL $SI_4 \rightarrow LS_5$	-0.09 (0.17)	[-0.42, 0.26]	-0.15 (0.16)	[-0.45, 0.19]	-0.11 (0.17)	[-0.42, 0.25]
CL $SI_5 \rightarrow LS_6$	-0.10 (0.12)	[-0.34, 0.11]	-0.06 (0.10)	[-0.26, 0.14]	-0.05 (0.10)	[-0.26, 0.15]
CL $SPS_1 \rightarrow SI_2$	0.27 (0.15)	[-0.03, 0.57]	0.29 (0.15)	[-0.003, 0.59]	0.31 (0.17)	[-0.003, 0.65]
CL $SPS_2 \rightarrow SI_3$	0.01 (0.22)	[-0.38, 0.48]	0.03 (0.21)	[-0.35, 0.46]	0.02 (0.25)	[-0.44, 0.58]
CL $SPS_3 \rightarrow SI_4$	-0.51 (0.38)	[-1.24, 0.26]	-0.69 (0.29)	[-1.28, -0.13]*	-0.62 (0.31)	[-1.20, 0.03]
CL $SPS_4 \rightarrow SI_5$	-0.58 (0.23)	[-1.05, -0.14]*	-0.57 (0.23)	[-1.03, -0.13]*	-0.61 (0.24)	[-1.10, 0.15]*
CL $SPS_5 \rightarrow SI_6$	-0.08 (0.18)	[-0.43, 0.27]	-0.10 (0.17)	[-0.45, 0.24]	-0.12 (0.17)	[-0.47, 0.22]
CL $SPS_1 \rightarrow LS_2$	-0.26 (0.10)	[-0.63, 0.13]	-0.20 (0.19)	[-0.56, 0.18]	-0.20 (0.20)	[-0.56, 0.21]
CL $SPS_2 \rightarrow LS_3$	0.39 (0.25)	[-0.10, 0.89]	0.57 (0.25)	[0.08, 1.07]*	0.46 (0.25)	[-0.03, 0.97]
CL $SPS_3 \rightarrow LS_4$	0.14 (0.37)	[-0.57, 0.90]	0.24 (0.34)	[-0.43, 0.92]	0.003 (0.33)	[-0.65, 0.65]
CL $SPS_4 \rightarrow LS_5$	0.03 (0.33)	[-0.62, 0.68]	-0.14 (0.33)	[-0.79, 0.51]	-0.17 (0.36)	[-0.84, 0.63]
CL $SPS_5 \rightarrow LS_6$	-0.03 (0.23)	[-0.52, 0.40]	-0.15 (0.22)	[-0.60, 0.26]	-0.03 (0.21)	[-0.45, 0.36]
CL $LS_1 \rightarrow SPS_2$	0.03 (0.03)	[-0.03, 0.09]	0.04 (0.03)	[-0.02, 0.10]	0.04 (0.03)	[-0.02, 0.10]
CL $LS_2 \rightarrow SPS_3$	0.05 (0.04)	[-0.01, 0.13]	0.05 (0.03)	[-0.02, 0.12]	0.05 (0.03)	[-0.01, 0.12]
CL $LS_3 \rightarrow SPS_4$	-0.02 (0.04)	[-0.09, 0.06]	-0.02 (0.04)	[-0.09, 0.06]	-0.03 (0.04)	[-0.10, 0.05]
CL $LS_4 \rightarrow SPS_5$	-0.09 (0.08)	[-0.25, 0.07]	-0.09 (0.06)	[-0.21, 0.03]	-0.10 (0.08)	[-0.26, 0.05]
CL $LS_5 \rightarrow SPS_6$	-0.02 (0.04)	[-0.11, 0.06]	-0.04 (0.04)	[-0.13, 0.04]	-0.04 (0.04)	[-0.12, 0.04]
CL $LS_1 \rightarrow SI_2$	-0.06 (0.06)	[-0.17, 0.05]	-0.09 (0.06)	[-0.21, 0.02]	-0.09 (0.06)	[-0.20, 0.02]

CL $LS_2 \rightarrow SI_3$	0.04 (0.07)	[-0.10, 0.17]	0.04 (0.07)	[-0.10, 0.17]	0.04 (0.07)	[-0.10, 0.17]
CL $LS_3 \rightarrow SI_4$	0.12 (0.08)	[-0.03, 0.27]	0.16 (0.08)	[0.002, 0.33]*	0.14 (0.07)	[0.001, 0.28]*
CL $LS_4 \rightarrow SI_5$	-0.12 (0.15)	[-0.41, 0.18]	-0.09 (0.12)	[-0.34, 0.15]	-0.10 (0.14)	[-0.37, 0.18]
CL $LS_5 \rightarrow SI_6$	-0.03 (0.09)	[-0.20, 0.14]	0.01 (0.08)	[-0.14, 0.17]	0.01 (0.08)	[-0.15, 0.16]
Within-Person Interactions						
CL SI_1 X $SPS_1 \rightarrow LS_2$			0.79 (0.31)	[0.18, 1.41]*	0.68 (0.33)	[0.05, 1.35]*
CL SI_2 X $SPS_2 \rightarrow LS_3$			0.54 (0.35)	[-0.09, 1.30]		
CL SI_3 X $SPS_3 \rightarrow LS_4$			1.26 (0.79)	[-0.33, 2.78]		
CL SI_4 X $SPS_4 \rightarrow LS_5$			1.53 (0.44)	[0.78, 2.52]*	1.56 (0.49)	[0.75, 2.64]*
CL SI_5 X $SPS_5 \rightarrow LS_6$			0.59 (0.37)	[-0.10, 1.35]		

Note. All estimates are unstandardized. AR = autoregressive association, CL = cross-lagged association, * significant interaction (i.e., the credible interval does not contain zero), CI_l = 2.5% credible interval, CI_u = 97.5% credible interval, SI = social isolation, SPS = social provisions scale, LS = life satisfaction.

Discussion

In the present study, single people living alone (i.e., a demographic of concern for social isolation) were tracked across six weeks during the early stages of the COVID-19 2020 lockdown in Ontario, Canada. The present study found evidence to suggest that social isolation was related to perceived stress levels during the pandemic lockdown. Moreover, people who perceived they were socially isolated overall, as well as people who felt more socially isolated than their usual per week, also reported less psychological well-being. However, if socially isolated people perceived that they had social support available to them, the perception of social support availability acted as a buffer to reduce the harmful effects on psychological well-being.

This finding was the most robust on the between-person level (i.e., comparing different participants' average perceptions of social isolation and social support availability across the study period), but there was weak evidence to suggest that a similar effect my have been occurring on the within-person level. In other words, even people who merely felt more socially isolated than their own usual may have been protected from the deleterious effects of social isolation on well-being through greater than their own usual assessments of social support availability. Finally, the present study examined a cross-lagged panel model to assess the longitudinal effects of social isolation and social support on well-being across the six timepoints. This model did not provide evidence to suggest that social support availability directly impacted psychological well-being on a week-to-week basis. Additionally, heightened feelings of social isolation the week before did not seem to predict less psychological well-being the week-after. However, there were select weeks in which there was a significant interaction between lagged social support availability and social isolation on psychological well-being, such that people who felt more socially isolated than their usual and perceived heightened social support availability the week before exhibited both protected *and* enhanced psychological well-being the week after.

Social Support Buffering the Effect of Social Isolation on Well-being Cross-sectionally

Overall, when analyzing the correlations for all of the variables of interest, they were stronger on the between-person level as compared to the within-person level. This may be explained by considering what the correlations mean on different levels of analysis. The between-person correlations examined how different people experienced this time on average as more stable individual differences measures (e.g., some people who experienced social isolation in a certain way when collapsing across the entire study period also tended to experienced stress in a certain way overall compared to other people). However, the within-person correlations

examined how weekly fluctuating experiences were related to each other regardless of individual differences. These within-person correlations, especially when looking at waves of observations over time, tend to be subject to contextual effects, such as environmental factors that change how certain experiences are perceived. In other words, different events and experiences were happening in people's lives during the various timepoints, which may help to explain why the relationships between variables were less strong on the within-person level as compared to the more stable between-person level.

Specifically looking at the correlations between social isolation and perceived stress, people who perceived they were more socially isolated on average during the study period also reported feeling more chronically stressed. Additionally, even the perception of more social isolation than one's usual on a weekly basis was related to feeling more stressed than one's usual that week. Social isolation was more strongly correlated with perceived stress when considering average differences between people compared to looking at intra-individual weekly differences. This might suggest that people's perceptions of social isolation need to develop over time to become a particularly threatening stressor. During times when people felt more socially isolated than they usually perceived themselves to be, they may have felt slightly more distressed than their own usual in the moment, but these findings do not show that people were feeling considerable amounts of stress due solely to experiencing an acutely socially isolating week. However, average social isolation appeared to be more of a risk-factor for chronic feelings of stress, explaining ~35% of the variability in average stress perceptions over the six-week period. Therefore, although perceived social isolation was related to perceived stress on both levels of analysis, it acted as a stronger stressor in this population if these feelings were perceived long-term instead of merely acutely during individual weeks.

Similar to other stressors, perceived social isolation acts as a signal to indicate that certain needs are not being met and, therefore, adaptive adjustments need to be made (Cacioppo & Hawkley, 2003). Specific to perceived social isolation as a stressor, the salient absence of social ties signals the adaptive adjustment towards mobilizing the social network to provide support (i.e., as people feel more socially isolated, they also feel more stressed because stress can prompt action towards reducing these aversive feelings). If people can mobilize the support they need, they can reduce their perceived stress levels and also minimize the deleterious effects that social isolation has on psychological well-being (Cohen, 2004; Lazarus & Folkman, 1984).

In partial support of this theoretical framework, the present study did find evidence that social support buffered the deleterious effects of social isolation on well-being for the between-person level. Specifically, there was strong evidence to suggest that people who felt overall more socially isolated but had greater overall access to social support during the lockdown were more protected from the negative effects of social support on well-being relative to those who had less access to social support during the lockdown period. However, on the short-term weekly basis, the interaction term did not reach conventional standards of statistical significance. Although exploratory analyses of the simple slope trends did suggest that when people felt more socially isolated than their own usual, these feelings only had a negative effect on psychological well-being during weeks when people also reported less access to social support than their own typical. The results of the present study add to the growing literature demonstrating that social support buffered the deleterious psychological effects of many stressors that were heightened during the pandemic lockdown period, such as job insecurity, financial threats, racism against Asian Americans, and worry about the threat of COVID (Alcover et al., 2020; Khoury et al., 2021; Lu & Wang, 2021).

These cross-sectional results suggest that the maintenance of social networks is crucial to protecting well-being for people who are already at-risk for social isolation. For the stress-buffering effect to even occur, people need to be able to draw on social support resources from their social networks. However, people who are more socially isolated than others have more difficulty gaining access to social support in general, and the quality of their social networks tends to be lower on average as well (Gable & Bedrov, 2022; Vézina, 2011). Therefore, it is crucial for people who are at risk of social isolation to cultivate and nurture extant social ties. To that end, this population might benefit from strategies that extend both the breadth and depth of the social network, such as reaching out to more distant social ties (e.g., making connections with friends of friends, especially through social media; Rozzell et al., 2014), spending more leisure time with acquaintances (Hall, 2019), and sharing more personal information with social contacts to enhance relational quality (Sprecher et al., 2013).

Social Support Buffering the Effect of Social Isolation on Well-being Longitudinally

The present study's panel design allowed for the longitudinal examination of how social isolation and social support predict well-being across six weekly timepoints. The lagged effects were inconsistent in this model. Even the autoregressive pathways (i.e., a lagged variable predicting itself the week after) did not consistently yield significant effects throughout the different timepoints. The most consistent autoregressive effect was social support, in that people who reported that they had more access than their own usual to social support during one week also reported greater access to social support in the next week (this effect was observed in three out of five lagged associations). Similarly, three of the five autoregressive life satisfaction pathways were significant. However, while two of these associations were positive one of these associations was negative, suggesting that lagged life satisfaction may have opposite effects on

long-term assessments of psychological well-being in some contexts. Notably, there was only one week in which heightened social isolation the week before predicted heightened perceptions of social isolation the week after. Taken together, these results suggest that there was not necessarily continuity in how people reported experiencing their internal worlds from week to week. In other words, how people felt on a given week was not reliably informed by their experiences the week before, at least during the lockdown period of which this study evaluated.

These observations extended to the cross-lagged effects (i.e., a lagged variable predicting a different variable the week after). Specifically, there were no reliably quantified cross-lagged effects. The only significant cross-lagged effects observed outside of the reduced interaction model described heightened social isolation on Week 4 predicting less social support availability on Week 5 and heightened social support availability on Week 4 predicting less social isolation on Week 5. The fact that these inverse effects occurred on the same week suggest that in some contexts there might be a reciprocal relationship between social support and social isolation. In fact, reciprocal influences are a key feature in conceptual models that describe how social support processes interplay with stressors like social isolation (Heaney & Israel, 2008). For instance, the amount of social support someone perceives is available may act to influence the extent to which the support network is perceived as performing adequately and, thus, whether this network needs to be adjusted. Equally, how socially isolated people feel at one timepoint may translate into social network health metrics and influence the extent to which they can rely on and mobilize the social network at subsequent timepoints.

Notably, other expected cross-lagged effects were not observed in this model. For example, an individual reporting more social support availability than their own usual on one week did not predict life satisfaction the next week for any of the time-points. This result was

contrasted with the findings in the cross-sectional model, where social support availability did have direct protective benefits on well-being independent from stress-buffering effects. The lack of this cross-lagged effect, therefore, suggests that the direct effects of social support availability may be more important in the moment or on a long-term basis rather than providing direct benefits from week-to-week. To potentially explain these findings, prevailing social support theories (Heaney & Israel, 2008) describe how the "direct" benefit of social support is rather a misnomer. Social support does not directly translate into well-being; instead, social support serves several important functions such as bolstering psychological needs, promoting health behaviours, and increasing individual psychological resources (e.g., self-esteem). The enhancement of these important functions through social support provisions is posited to explain the association between social support and well-being. These processes, however, may need continual maintenance through the provision of social support resources. Therefore, cross-lagged models (at least those which reflect week-to-week timescales and do not include these pathways) may not adequately describe the dynamic processes of how social support may function to protect psychological well-being "directly."

Additionally, an individual reporting heightened perceptions of social isolation on one week did not predict life satisfaction the next week for any of the time-points. Feeling more socially isolated than one's usual in one week, therefore, was not found to be a significant detractor from psychological well-being in the next week. It is interesting to note, therefore, that two of the five cross-lagged pathways revealed significant interactions between lagged social support availability and lagged social isolation on psychological well-being the week after. For one of these cross-lagged interaction effects, there was evidence of a stress-buffering effect such that there was no association between heightened social isolation the week before and life

satisfaction the week after if people reported elevated levels of social support availability the week before. However, this cross-lagged association was negative if people reported decreased levels of social support availability the week before. For the other cross-lagged interaction effect, lagged social isolation also had a negative effect on psychological well-being the week after when people reported less social support availability the week before, but there was also evidence to suggest that heightened social isolation the week before actually predicted *greater* life satisfaction the next week when people reported more social support availability the week before. Therefore, social isolation only appeared to be a threat to psychological well-being on a week-to-week basis during select weeks when social support availability was less than one's own usual the week before. Contrary to expectations, social isolation may have had positive impacts on prospective psychological well-being in the presence of heightened social support availability.

These results are slightly surprising, as stress-buffering often occurs as a coping response to a negatively appraised stimulus (Lazarus & Folkman, 1984). It may be the case that, on a week-to-week basis, social isolation is only appraised as a long-term threat if sufficient social support resources are not available and, therefore, ample social provisions are crucial for that primary appraisal process (i.e., heightened feelings of social isolation are only considered to be a prolonged threat if people are unable to muster sufficient social support resources to mitigate that stressor). However, if a stressor is perceived as a challenge (e.g., the situation has the opportunity to promote growth and mastery), it might actually be perceived positively and, therefore, enhance psychological well-being (Blascovich et al., 2003; Tomaka et al., 1993). For a stressor to be perceived as a challenge instead of a threat, people have to be motivated to pursue a goal *and* perceive that they have the resources to achieve that goal. As social isolation was particularly salient during the pandemic lockdown, people might have felt more motivated to

stay connected with their social network. Therefore, a stressor such as social isolation may have been perceived as a challenge if people believed they had sufficient access to social support resources to meet the demands of the socially isolating context of the pandemic lockdown period. However, these observations should be evaluated with caution, as this interaction effect only occurred on select weeks.

Strengths of the Present Study and Implications

The present study tracked over 200 individuals across six weekly timepoints during the novel and socially isolating context of the initial COVID-19 global pandemic lockdowns in 2020. These individuals were sampled from a population of interest (i.e., single people living alone) which was identified to be at-risk for social isolation in Canada. These single people living alone were asked about crucial aspects of their pandemic lockdown experiences, including perceptions of social isolation, social support availability, and psychological well-being. I assessed whether perceptions of social isolation had detrimental effects on psychological well-being during this especially isolating context, as well as whether social support availability buffered these detrimental effects and protected psychological well-being in general. Due to the design of the study (i.e., longitudinal panel data), I was able to examine these effects at several different levels of analysis, including comparisons between people, comparisons within individuals themselves, and lagged effects studying longitudinal associations across different timepoints.

The results of the present study provide insight as to how people coped and maintained their psychological well-being during an exceedingly difficult and threatening time. These results can assist in informing the development of intervention programs that can help people cope better and lessen the chance of negative outcomes such as deceases in psychological well-being

if similar circumstances occur again. For example, the present study demonstrated that people who reported greater access to social support on average were more protected from the negative effects that overall social isolation had on psychological well-being relative to those with less overall access to social support. It may be beneficial for intervention studies, therefore, to focus efforts on helping people to cultivate social networks that they can rely on in difficult times. Moreover, intervention studies may also assist people in developing mobilization strategies to ask their social networks for help when it is needed.

Limitations and Future Directions

First, the present study relied on correlational data. Therefore, this study cannot speak to causal relationships among the variables of interest or draw strong inferences about these effects. Future research should aim to clarify through experimental designs whether social support buffers the negative psychological well-being effects of perceived social isolation as a specific stressor, especially on the within-person level. Moreover, there might be some contexts in which social support is more or less useful in buffering the detrimental effects of perceived social isolation on psychological well-being. Future research should, therefore, examine how various contexts may differentially impact the effectiveness of the buffering effects of social support on perceived social isolation as a stressor.

Next, as measured via multilevel reliability estimation of Mcdonald's (1999) omega (see Geldhoff et al., 2014 for an in-depth explanation of this reliability estimation technique), the internal consistency reliability of the within-person components for the scales used in the present study were poorer than that of the between-person components. Although many of the scales used in the present study were validated by previous research, validation techniques overall were conducted on a completely cross-sectional level without looking at individual fluctuations that

can happen at different timepoints. In other words, the way scales tend to be validated is by looking solely at the between-person level without examining how reliability and validity might differ on the within-person level. Therefore, the within-person results from the present study should be replicated to confirm the integrity of the findings. Moreover, future research should aim to validate scales on different levels of analyses, particularly as researchers interested in longitudinal and experience sampling research designs would benefit from the utilization of validated scales that capture more accurate depictions of how psychological experiences fluctuate over time.

Additionally, although the present study examined a cross-lagged panel model to assess longitudinal associations across time, the week-to-week lagged associations were mostly nonsignificant or inconsistent. Therefore, the longitudinal findings of the present study bear further examination and replication. It may be the case that the time points of the weekly design were too far apart to assess lagged associations. Consequently, more intensive longitudinal research designs such as daily diaries or ecological momentary assessments may help to better elucidate these lagged associations and assess these dynamic processes more effectively across time.

Further, although there were reports of psychological well-being declining during the initial stages of the COVID-19 pandemic lockdowns (e.g., O'Connor et al., 2021), all variables within this sample were relatively stable across time. Therefore, the present study could not confirm that social isolation was particularly heightened or well-being was particularly threatened in this sample during the lockdown itself relative to pre- or post-lockdown periods.

Finally, in the present study I assessed social support in terms of availability; however, just because social support was perceived as available, it did not necessarily mean that people

were utilizing or receiving social support from their networks. There is a debate in the social support literature as to the utility of perceived vs. received social support and which is more useful for coping with stressors and providing support to others (see Nurullah, 2012 for an overview). Future research should further clarify whether it is the support availability or received social support that buffers perceptions of social isolation.

Conclusion

The present study aimed to examine how people who were at-risk for social isolation during the challenging and socially isolating context of the COVID-19 pandemic lockdowns maintained their psychological well-being during this time. Social support was identified as a potential protective factor that may have buffered the stressor of perceived social isolation and, therefore, mitigated the negative effects of social isolation on psychological well-being. In the present study, a sample of single people living alone were followed over a six-week period during the initial stages of the COVID-19 lockdowns. The results of the present study demonstrated that social support availability, both overall and on a weekly basis, did act to buffer the deleterious well-being effects of heightened perceptions of social isolation in this population. Although a stress-buffering effect perse did not appear to occur in the longitudinal model, heightened social isolation the week before may not have been perceived as a threat, and may even have been treated as a challenge to overcome, for people who perceived they had heightened social support availability; thereby reducing the detrimental impacts of social isolation as a stressor on well-being. The findings of this study emphasize the importance of cultivating and maintaining social networks that can readily provide social support as a coping strategy during times of stress. Therefore, future intervention strategies should help people develop their social support networks to receive these protective benefits.

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Appendices

Appendix A: Exploratory Cross-Sectional Model

An exploratory cross-sectional model was constructed to assess whether availability perceptions of the various types of social support differentially protected psychological well-being. In this model, instead of averaging the four types of social support into a composite scale, the items were divided into those that were related to assistance (i.e., guidance and reliable alliance) and those that were related to the affectional ties (i.e., attachment and social integration). As per the previous model, between- and within-person variance components were decomposed by aggregating each participant's weekly scores and person-mean centering the raw weekly scores, respectively. Additionally, the model was again constructed in R using the lme4 (Bates et al., 2015; version 1.1-23) and lmerTest (Kuznetsova et al., 2017; version 3.1-2) packages, while the interaction was probed using the Interactions package (Long, 2019; version 1.1.0). The within- and between-person variance components were entered simultaneously, and the model was specified as random slope and random intercept. Significance of the tests were estimated using the Satterthwaite method (Luke, 2017; Satterthwaite, 1946).

In this model, both the within- and between-person perceptions of affectional tie support availability were associated with significantly greater life satisfaction (within: $b = 0.34$, $SE = 0.07$, $t(133.43) = 5.00$, $p < .001$, 95%CI [0.21, 0.48]; between: $b = 0.71$, $SE = 0.23$, $t(220.59) = 3.04$, $p = .003$, 95%CI [0.25, 1.17]). However, both the within- and between-person perceptions of assistance related support availability were not associated with life satisfaction (within: $b = 0.001$, $SE = 0.08$, $t(144.36) = 0.01$, $p = .99$, 95%CI [-0.16, 0.16]; between: $b = 0.11$, $SE = 0.23$, $t(214.69) = 0.47$, $p = .64$, 95%CI [-0.34, 0.56]). In other words, people who perceived they had more affectional tie support availability their own usual, as well as people who reported higher

affectional tie support availability than others on average, also reported feeling more life satisfaction. Assistance related support, on either level of analysis, did not exhibit a similar effect. Therefore, the immediate effects of social support for protecting well-being appear to be more related to the affectional tie supports rather than the assistance related supports.

The interactions were analyzed next. On the between-person level, assistance related support availability did not buffer the negative effects of social isolation on well-being (b = -0.25, SE = 0.33, t(220.10) = -0.75, p = .45, 95%CI [-0.89, 0.40]), but affectional tie related support availability *did* act as a significant buffer (b = 0.63, SE = 0.31, t(221.07) = 2.00, p = .047, 95%CI [0.01, 1.24]). Specifically, there was a significant negative association between overall feelings of social isolation and life satisfaction for people who perceived less (-1 *SD*) overall affectional tie related support (b = -1.09, SE = 0.24, p < .001, 95%CI [-1.56, -0.62]). However, there was no association between social isolation and life satisfaction for people who perceived more (+1 *SD*) overall affectional tie related support availability (b = -0.32, SE = 0.21, p = .14, 95%CI [-0.73, 0.10]). Conversely, on the within-person level, the interaction results were opposite. On the within-person level, affectional tie related support availability did not buffer the negative effects of social isolation on well-being (b = -0.17, SE = 0.18, t(84.13) = -0.92, p = .36, 95%CI [-0.53, 0.19]), but assistance related support availability had a significant stress-buffering effect (b = 0.50, SE = 0.21, t(117.70) = 2.36, p = .02, 95%CI [0.08, 0.91]). Simple slopes analyses revealed that there was a significant negative association between heightened weekly social isolation and life satisfaction for people who perceived less (-1 *SD*) than their own usual assistance related social support availability (b = -0.27, SE = 0.07, p < .001, 95%CI [-0.41, -0.13]). However, there was no association between social isolation and life

satisfaction for people who perceived more (+1 *SD*) than their own usual assistance related support availability (b = -0.02, SE = 0.07, p = .83, 95%CI [-0.15, 0.12]).

Taken together, these interaction results suggest that how social support might act to buffer the detrimental effects of social isolation on psychological well-being is somewhat complex. On a short-term, weekly basis, it appeared that relying more on tangible and informational support within the social network was more useful for coping with the harmful effects of social isolation on psychological well-being. However, on a long-term, overall basis, people who were able to connect more with their social networks on an emotional level (i.e., feeling like they belong in their communities and are able to emotionally rely on their networks) were better able to cope with the deleterious effects of social isolation on psychological well-being relative to those who perceived less affectional tie support availability. Therefore, optimal strategies to cope with the stressor of social isolation may be different depending on whether it is a more chronic problem or just heightened on a certain week. As these results are exploratory, however, it would be valuable to replicate these findings with additional research.

Appendix B: Online Recruitment Notice

Experiences of Single People During a Pandemic

The purpose of this study is to examine couples' daily relationship experiences in the context a pandemic. We are interested in a variety of experiences single people encounter on a weekly basis during a pandemic such as social support and coping behaviours. In this study, you will complete an online background survey (~30 minutes), and 5 weekly surveys (~15 minutes/week. We do not anticipate any psychological or physical risks to participants. Please be aware that some of our questions are sensitive and personal in nature (e.g., gambling, cannabis use, pornography). Your responses are completely confidential, and you can choose not to respond to a question that makes you uncomfortable.
To thank you for your time, you will receive up to $35 CDN in Amazon.ca gift certificates.

Eligibility requirements:

1) Single (i.e., not in a romantic relationship
2) Living alone

Your participation as well as your responses will be strictly confidential. This research is being conducted by Dr. Cheryl Harasymchuk (Associate Professor) at Carleton University, Ottawa, Canada and is being funded by an internal grant from Carleton University in Ottawa, Ontario.

This study has received clearance by the Carleton University Research Ethics Board–B, Canada (clearance #105036).

If you are interested in signing up for this study and/or would like more information, please contact PAIRlab@carleton.ca

Appendix C: Email Pre-Screening Script

[Participants will respond to online ads or postings and email the designated lab email address if interested in participating]

Hello [participants' name if provided in email],

Thank you for expressing an interest to participate in our relationship study entitled, Experiences of Single People During a Pandemic.

In order to assess your eligibility, we have a few questions for you. First, you should know that your participation in these pre-screening questions is voluntary and the responses you provide are confidential (including contact information).

Do you consent to participate in the pre-screening questions to assess your eligibility for the study?

□ Yes, I agree to participate in the pre-screening questions.
□ No, I do not agree to participate in the pre-screening questions.

If your answer is "No", please do not continue to answer the questions.

Please type your response to each of these brief questions into the form below.
1. What is your current relationship status? Are you single?
2. Do you live alone during the quarantine?
3. Do you live in Ontario, Canada?
4. What is your phone number?

Thank you very much for your input! We will be in contact with you soon.
Sincerely,
Atara/Shamarukh
Positive Activities in Intimate Relationships lab
https://carleton.ca/pair/

[If a participant misses key information in the initial email eligibility reply, we will follow-up to clarify the specific response (e.g., relationship status, living alone). If participants are missing output for many questions, the following email will be sent once. Email communication will end

if there is no reply. Note that we are mostly concerned that they answer *most* of the questions at this point.

Hello [participants' name if provided in email],

Thank you for responding to the brief eligibility questionnaire for the Experiences of Single People During a Pandemic study. Unfortunately, we are missing a response for [number of missing responses] eligibility question[s] (please see below).

[paste missing questions requiring input]

Your input for this question[s] will be greatly appreciated in order to proceed with the next steps for this research study.

Thanks again for your interest and we will be in contact with you soon!
Sincerely,
Atara/Shamarukh
Positive Activities in Intimate Relationships lab
https://carleton.ca/pair/

Appendix D: Informed Consent Form

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent is intended to provide sufficient information, such that you have the opportunity to determine whether you wish to participate in the study.

This study has received clearance by the Carleton University Research Ethics Board–B, Canada (#105036).

Study Title: Experiences of Single People During a Pandemic

Study Personnel Contact: The Principal Investigators of this project are Dr. Cheryl Harasymchuk (Associate Professor) and Atara Lonn (undergraduate student) of Carleton University, and can be contacted at PAIRlab@carleton.ca).

Contact in case of concerns:
In case of ethical concerns about this study, please contact the Carleton University Research Ethics Board (by phone at 613-520-2600 ext. 4085 or by email at ethics@carleton.ca.

Purpose and Task Requirements: The purpose of this study is to understand factors that shape well-being in the context of pandemic. We will ask you questions about social support and coping responses, as well as personal tendencies (e.g., loneliness, self-esteem, and attachment style). We will also ask you some questions about your pandemic-related experiences, concerns about finances, and perceived stress. We cannot explain our hypotheses fully at this point. However, you will receive a debriefing form explaining our research questions and hypotheses following the completion of the study (i.e., after this survey and the 5 weekly surveys).
This study consists of two parts. In Part 1, participants will be asked to complete an online background questionnaire about their social support experiences (i.e., friendship and social network experiences), coping behaviors (e.g., tv watching, gambling, pornography, legal drug use), personal tendencies (e.g., loneliness), pandemic-related experiences, and perceptions of stress (including finances; ~30 minutes). In Part 2, participants will complete weekly online assessments about various social support strategies, coping responses (e.g., tv watching, gambling, pornography, legal drug use), stressors, as well as pandemic-related experiences for 5 weeks (~15 minutes/week).

Participants must meet the following criteria to participate in the study:
• Single
• Living alone

Potential Risk and Discomfort: We do not anticipate any psychological or physical risk to participants. However, it is possible that few participants may experience fleeting negative emotions when they think about their pandemic-related experiences or stressors related to finances. Some of the questions might be potentially embarrassing and sensitive in nature (e.g., pornography use, gambling, overeating, masturbation, legal drug use). Keep in mind that you may skip questions or withdraw from the study and you will not be penalized in anyway if you do this (i.e., compensation earned to date).

If you feel any distress or anxiety during or after participating in this study, there are resources available online to learn more about the agencies in your area that offer confidential services. A list of helplines by town and region can be found at http://www.dcontario.org/centres.html There are also resources available online to learn more about the COVID-19 Pandemic. Please see the following links to the World Health Organization (https://www.who.int/emergencies/diseases/novel-coronavirus-2019) and the Canada Public Health websites (https://www.canada.ca/en/public-health/services/diseases/coronavirus-diseasecovid-19.html).

As well, ConnexOntario provides free and confidential health services information for problems with gambling, alcohol and other substance use, and mental health. You can obtain their contact information at the following link: http://www.connexontario.ca/

Compensation: We are offering eligible participants up to $ 35 CDN in Amazon.ca gift certificates. For completing the background survey, participants will receive $10. For each completed weekly survey, participants will receive $5 (i.e., a potential to earn 5 weeks X $5 = $25) In total, participants can earn up to $35 CDN.

You will receive your compensation via email (sent from our Amazon.ca account) at the end of the study (i.e., after the background and 5 weekly surveys are completed), it will take up to 10 days to send to you.

In addition, participants will also be offered a chance to win one of two $100 Amazon gift certificates for each weekly survey that they complete. As your chances of winning depend on the number of completed entries, we cannot provide an estimate for the lottery draw (however, we can tell you that we are recruiting 200 individuals). Winners of the lottery draw will be contacted via email once the study has been completed (~ August 2020).

Confidentiality: The data collected in this study are strictly confidential. You will be assigned a unique ID code that will be used throughout the duration of this study to connect all of your surveys (i.e., the surveys will NOT contain your name, email, phone number). The identifying

information (i.e., name, email, phone number) and the associated unique ID codes will be stored on password-protected computers of the research team. Following the completion of the study (~August 2020), the ID code file will be downloaded and stored under lock and key on the Carleton campus on a password-protected computer. This information will be deleted following 10 years after publication. The stored data files (i.e., containing your questionnaire responses) will be anonymized (i.e., no identifying information) following the completion of data collection (~ August 2020) and will be retained indefinitely. The published data will be presented in aggregate form (i.e., we are only interested in group averages, not individual responses). Anonymized data might be shared with trusted colleagues for academic purposes and may eventually be made available online on the Open Science Framework (a non-profit website dedicated to making research more transparent, reproducible, and open). The data from this study may be published in an academic journal, presented at an academic conference, analyzed in future research, or used for teaching purposes, but it will not be possible to identify any participants from this data.

We collect data through the software Qualtrics, which uses servers with multiple layers of security to protect the privacy of the data (e.g., encrypted websites and password protected storage). The data will be deleted from the Qualtrics account once the study is complete. Your data will be stored and protected by Qualtrics on Toronto-based servers but may be disclosed via a court order or data breach. With your consent to participate in this study you acknowledge this.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions.* As well, you have the right to withdraw from the study at any time and your compensation earned to date (i.e., the parts of the study that have already been completed) will not be affected.

If you choose to withdraw from the study, we will email you one last time with data removal options. Participants who do not actively withdraw from the study will have one week from the point of last email contact to select their withdrawal option. If no options are selected, the data will be retained.

* If a participant fails to respond to 2 consecutive weekly surveys, they will be automatically withdrawn from the study.

I have read the above form and understand the conditions of my participation. My participation in this study is voluntary, and if for any reason, at any time, I am also aware that my participation as well as the data gathered in this study is confidential.

This study consists of an online background measure (Part 1), and 5 weekly surveys (Part 2).

Do you consent to participate in the online background survey and 5 weekly surveys?
□ Yes, I agree to participate in a background survey (Part 1), and weekly surveys (Part 2)
□ No, I do not agree to participate in a background survey (Part 1), and weekly surveys (Part 2)

Appendix E: Ineligibility Debriefing

Thank you for your interest in the Experiences of Single People During a Pandemic.

At this time, we regret to inform you that you are not eligible to participate in this study.
If you have any questions or concerns, you may contact Dr. Cheryl Harasymchuk (Associate Professor) and Atara Lonn at PAIRlab@carleton.ca.

Thanks again for your time and consideration.

Appendix F: Weekly Email Template

Email sent using the Qualtrics emailing function

From: noreply@qemailserver.com
Name: Carleton University Relationships Lab
Reply-to email: Cheryl_Harasymchuk@carleton.ca

Good evening [first name of participant],

Thank you once again for participating in the Experiences of Single People During a Pandemic study. Your participation is extremely valuable in understanding more about the people's psychological experiences during a pandemic.

To access week X of the survey you may click on the following link:
${l://SurveyLink?d=Take the survey}
Or copy and paste the URL below into your internet browser: ${l://SurveyURL}
You will have access to the survey link for 24 hours.

For any questions, please email us using the email address below.

Once again, we greatly thank you for your participation in this study. We couldn't do our research without participants like you!

Sincerely,
Dr. Cheryl Harasymchuk, Associate Professor
Positive Activities in Intimate Relationships lab
https://carleton.ca/pair/
PAIRlab@carleton.ca.

To withdraw from this study, click here. [link]

Appendix G: Full Debriefing

Thank you for your participation in the study Experiences of Single People During a Pandemic! Now that the study is complete, we are providing you with the final debriefing form where we highlight the purposes and hypotheses of this research in full.

What are we trying to learn in this research?
This project is part of a larger project on people's psychological experiences during a pandemic. Broadly, we are trying to learn about psychological factors that make people more resilient (vs. more vulnerable) to pandemic related stress and its consequences. Such factors include social support strategies (e.g., communicating with others to feel cared for, validated and understood) and how much people believe that money is an important aspect of how they value themselves. These factors may shape people's experiences (e.g., loneliness, financial stress, life satisfaction) and behaviours to cope with pandemic-related stress (e.g., financial stress).

What are the key hypotheses?
There are two hypotheses:
• We expect that people who use more social support-seeking strategies and who have a more secure attachment style (i.e., more likely to trust others and get close to them) will experience greater well-being and less problematic coping behaviours.
• We expect that people who value financial success as a life goal will be more likely to engage in maladaptive coping behaviours compared to people who do not value financial success as a life goal when they experience financial stress

Why is this important to scientists or the general public?
This research will increase our understanding of how people's experiences are shaped by the unique stressors associated with a pandemic.

Where can I learn more?
For scientific articles on the topics of this study, see:
Winstead, B. A., Derlega, V. J., Lewis, R. J., Sanchez-Hucles, J., & Clarke, E. (1992). Friendship, social interaction, and coping with stress. *Communication Research*, *19*, 193-211.
Tabri, N., Wohl, M. J. A., Eddy, K. T., & Thomas, J. J. (2017). Me, myself, and money: Having a financially focused self-concept and its consequences for disordered gambling. *International Gambling Studies, 17*(1), 30 – 50. doi: 10.1080/14459795.2016.1252414

Is there anything I can do if I found this experiment to be emotionally upsetting?
Yes. It is normal to feel some distress or anxiety when thinking about your engagement in behaviors such as gambling, drinking, or cannabis use. These emotions are sometimes necessary in order to research or study relationships between somewhat sensitive variables. If you are

feeling distressed from answering questions about this experience and would like to talk to someone about it, please feel free to contact one of the helplines nearest to your location. Distress and Crisis Ontario helpline offers an open space for anyone who feels distress to talk about their feelings anonymously and be heard. A list of helplines by town and region can be found at http://www.dcontario.org/centres.html

As well, ConnexOntario provides free and confidential health services information for problems with gambling, alcohol and other substance use, and mental health. You can obtain their contact information at the following link: http://www.connexontario.ca/
As well, there are a number of agencies that offer confidential services. Please see the following links to the World Health Organization (https://www.who.int/emergencies/diseases/novelcoronavirus-2019) and the Canada Public Health websites (https://www.canada.ca/en/publichealth/services/diseases/coronavirus-disease-covid-19.html) for more information regarding the COVID-19 pandemic.

Contact Information
For additional questions or comments, please contact the principal investigators of this project: Dr. Cheryl Harasymchuk (Associate Professor) at Cheryl.Harasymchuk@carleton.ca and Atara Lonn at PAIRlab@carleton.ca.

In case of ethical concerns about this study, please contact the Carleton University Research Ethics Board (by phone at 613-520-2600 ext. 4085 or by email at ethics@carleton.ca.
This study has received clearance by the Carleton University Research Ethics Board–B (#105036).

For maximum confidentiality, please close this window.

Appendix H: Email Withdrawal Form

Experiences of Single People During a Pandemic

[Participants who withdraw from the survey will be emailed the following form. Note that participants will have one week from the point of last email contact to select their withdrawal option. If no options are selected, the data will be retained.]

Dear [first name of participant],

According to our records, you have indicated that you would like to withdraw from the study Experiences of Single People During a Pandemic. If this is incorrect and you would like to continue as a participant in this study, please exit this browser now and go back to the most recent email from PAIRlab@carleton.ca where we sent you a unique link to the survey.
Any compensation earned to date will be awarded within 10 days.

Reminder about Compensation: Eligible participants may receive up to $35 CDN (up to $35 $65 CDN) in Amazon.ca gift certificates.
For completing the background survey, participants will receive $10. For each completed weekly survey, participants will receive $5 (i.e., a potential to earn 5 weeks X $5 = $25). You will receive your compensation via email (sent from our Amazon.ca account).

Please select one of the following options so we know how to proceed with your data. Please note that once you have selected your response, it cannot be changed or undone.

□ Option 1: withdraw now (I no longer want to participate, but keep the data I have completed so far)
□ Option 2: withdraw and erase data from Part 1 (background survey) only
□ Option 3: withdraw and erase data from Part 2 (weekly surveys) only
□ Option 4: withdraw and erase data from Parts 1 and 2 (background survey and weekly surveys)

Thank you for your interest and participation.

Sincerely,
Dr. Cheryl Harasymchuk, Associate Professor
Positive Activities in Intimate Relationships lab
https://carleton.ca/pair/
PAIRlab@carleton.ca

Appendix I: Email Template for Debriefing Form (only to participants who withdraw)

Dear [participants first name],

This email is to inform you that we have received your selection for how you would like your data to be withdrawn from the study.

Now that you have finished your participation in this study, please see the debriefing form (below) where we state the purpose of this research.

Once again, thank you for your interest and participation.

Sincerely,
Dr. Cheryl Harasymchuk, Associate Professor
Positive Activities in Intimate Relationships lab
https://carleton.ca/pair/
PAIRlab@carleton.ca
[insert final debriefing form from Appendix G]

Appendix J: Ethics Approval

Clearance: Change to Protocol (Project # 105036)

Alisha.Seguin@carleton.ca <Alisha.Seguin@carleton.ca>
Tue 4/28/2020 8:57 AM

To: Shamarukh Chowdhury <ShamarukhChowdhury@cmail.carleton.ca>;Harasymchuk Cheryl(Primary Investigator) <Cheryl_Harasymchuk@Carleton.ca>;Atara Lonn <AtaraLonn@cmail.carleton.ca>;Tabri Nassim(Collaborator) <nassim.tabri@carleton.ca>;Fehr Beverley(Collaborator) <b.fehr@uwinnipeg.ca>

Cc: Ethics Mailbox <ethics@carleton.ca>;AlishaSeguin@CUNET.CARLETON.CA <AlishaSeguin@CUNET.CARLETON.CA>

Office of Research Ethics
4500 ARISE Building | 1125 Colonel By Drive
Ottawa, Ontario K1S 5B6
613-520-2600 Ext: 4085
ethics@carleton.ca

CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The Carleton University Research Ethics Board-B (CUREB-B) has granted ethics clearance for the changes to protocol to research project described below and research may now proceed. CUREB-B is constituted and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2).

Ethics Clearance ID: Project # 105036 15-097

Principal Investigator: Dr. Cheryl Harasymchuk

Co-Investigator(s) (If applicable): Dr. Cheryl Harasymchuk (Primary Investigator)
Shamarukh Chowdhury (Research Assistant)
Nassim Tabri (Collaborator)
Atara Lonn (Collaborator)
Beverley Fehr (Collaborator)

Project Title: The Psychological Consequences of Social Distancing Measures for Single People during the COVID-19 Pandemic

Funding Source:

Awards File No	Title	Status	
104057	Spicing Things Up: Responses to Relational Boredom and the Role of Approach Goals	Completed	A. CORIS Awards

Effective: April 28, 2020 Expires: April 30, 2021.

Upon reasonable request, it is the policy of CUREB, for cleared protocols, to release the name of the PI, the title of the project, and the date of clearance and any renewal(s).

Appendix K: Questionnaires

Social Isolation Scale (3-items from ULS-8)

Scored from 1 (Never) to 4 (Often)

Please indicate how you felt in the past week.

I felt isolated from others.
I was unhappy being so withdrawn.
People were around me but not with me.

Social Provisions Scale (Social Support Measure), Cutrona & Russell, 1987

Instructions: In answering the following questions, think about your current relationships with friends, family members, co-workers, community members, and so on. Please indicate to what extent each statement describes your current relationships with other people in the past week. Use the following scale to indicate your opinion.

STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1	2	3	4

2.I feel that I do not have close personal relationships with other people.

3.There is no one I can turn to for guidance in times of stress.

8.I feel part of a group of people who share my attitudes and beliefs.

10.If something went wrong, no one would come to my assistance.

11.I have close relationships that provide me with a sense of emotional security and well-being.

12.There is someone I could talk to about important decisions in my life.

14.There is no one who shares my interests and concerns.

23.There are people who I can count on in an emergency.

Guidance: 3*, 12
Social Integration: 8, 14*
Attachment: 2*, 11
Reliable Alliance: 10*, 23

Diener Scale of Life Satisfaction

Instructions: Below are five statements that you may agree or disagree with. Using the 1 -7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item.

7 - Strongly agree
6 - Agree
5 - Slightly agree
4 - Neither agree nor disagree
3 - Slightly disagree
2 - Disagree
1 - Strongly disagree

____ In most ways my life is close to my ideal.
____ The conditions of my life are excellent.
____ I am satisfied with my life.
____ So far I have gotten the important things I want in life.
____ If I could live my life over, I would change almost nothing.

Perceived Stress Scale (Cohen, Kamarck, & Mermelstein,1983)

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

During the past week, how often have you

1. been upset because of something that happened unexpectedly?
2. felt that you were unable to control the important things in your life?
3. felt nervous and "stressed"?
4. felt confident about your ability to handle your personal problems?
5. felt that things were going your way?
6. found that you could not cope with all the things that you had to do?
7. been able to control irritations in your life?
8. felt that you were on top of things?
9. been angered because of things that were outside of your control?
10. felt difficulties were piling up so high that you could not overcome them?