Distressed yet Bonded: A Longitudinal Investigation of the COVID-19 Pandemic's Silver Lining Effects on Life Satisfaction

Abstract

It is a common understanding that the 2019 coronavirus pandemic (COVID-19) significantly harmed mental health. However, findings on changes in overall life satisfaction have been mixed and inconclusive. To address this puzzling phenomenon, we draw upon the domain-specific perspective of well-being and research on catastrophe compassion and propose that the pandemic can have opposing effects on mental health and communal satisfaction, which then differently relate to people's overall life satisfaction. Longitudinal analyses of the Household, Income and Labour Dynamics (HILDA) Survey of Australia (N = 12,093) showed that while there was a greater decrease in mental health in the first COVID-19 pandemic year (2019-2020) than in previous years (2017-2019), an increase in communal satisfaction also occurred, demonstrating a potential silver lining effect of the pandemic on people's satisfaction with family, community and neighborhood. Moreover, consistent with socioemotional selectivity theory, changes in mental health, communal satisfaction and life satisfaction were related to age such that older adults generally reported less harmful and more beneficial psychological changes. We further found that age was associated with stronger associations of mental health and communal satisfaction with life satisfaction during the pandemic year. Overall, our findings speak to the importance of communal life in life satisfaction during the pandemic and age-related differences in the process, shedding light on the need to devise customized support to address inequalities in pandemic effects on public well-being.

Keywords: life satisfaction, mental health, communal satisfaction

As of December 2022, the COVID-19 pandemic has led to more than 650 million confirmed cases, among whom more than 6 million people died (World Health Organization, 2022). The pandemic and associated policies (e.g., lockdown, social distancing, and stay-at-home orders) pose not only physical but also psychological threats to global public health (Moreno et al., 2020; O'Connor et al., 2021; Petersen et al., 2021; Pfefferbaum & North, 2020; Venkatesh & Edirappuli, 2020). Extant research has reported a worldwide prevalence of psychological distress and mental health problems (for a review, see Aknin et al., 2022), although more rigorous research with matched representative samples before and after the pandemic is still needed to estimate the actual effects (e.g., Daly et al., 2020; De France et al., 2022; Kwong et al., 2021; Petersen et al., 2021). Since mental health serves as an essential basis of life satisfaction (Fergusson et al., 2015; Lombardo et al., 2018; Olatunji et al., 2007), it seems intuitive to expect a decrease in life satisfaction after (vs. before) the pandemic outbreak. Although generally plausible, we argue that this perspective is incomplete in terms of *predicting* how the pandemic shapes life satisfaction as well as *interpreting* some empirical findings. Indeed, evidence concerning the change in overall life satisfaction is mixed (Aknin et al., 2022), with studies reporting decreased (e.g., Wanberg et al., 2020; Ke & Chen, 2022; Bezzo et al., 2021), increased (e.g., Meireles et al., 2022), and stable life satisfaction (e.g., Helliwell et al., 2021; Kivi et al., 2021; Shavit et al., 2021; Wettstein et al., 2022) from before to after the pandemic.

When considering how life satisfaction changes during this global crisis, a sole focus on the negative side, such as mental health issues, seems limited because it may ignore two important theoretical notions. First, the predictors of life satisfaction involve not only individual factors, such as physical and mental health, but also social/environmental factors, including interpersonal/group relationships (Headey et al., 1991; Heller et al., 2004). Second, while the effects of shared threats (e.g., natural disasters and infectious diseases) on people's

mental health are mostly corrosive, multiple theories have long suggested that they do not necessarily impair the social aspects of life or may even motivate people to build stronger connections with one another due to a sense of common fate (Dovidio & Morris, 1975; Drury, 2018; Hamblin, 1958; Tajfel & Turner, 1982, 1986). As an unparalleled "social threat" (Guan et al., 2020; Xin et al., 2020), the COVID-19 pandemic may simultaneously exert opposite effects in different domains of life, casting a cloud with a silver lining. The coexistence of such conflicting effects has yet to be systematically examined, although preliminary evidence has shown that people tend to invest more in relationship-oriented activities and engage in more positive social behaviors during the pandemic (Bussing et al., 2021; Cox et al., 2021; Kowalski et al., 2022), a phenomenon dubbed by psychologists as "catastrophe compassion" (Zaki, 2020).

In the current research, we aim to offer a more balanced view on the dynamics of changes in life satisfaction during the pandemic. To do so, we examine whether the pandemic activates distinct changes in different well-being domains and whether domain-specific positive changes produce silver lining effects on life satisfaction. Given the importance of protecting public psychological well-being and reducing social inequality caused by the pandemic (McVeigh & MacLachlan, 2022; Zacher & Rudolph, 2021), an investigation of the mixed mechanisms and boundary conditions for the related change is warranted. We are particularly interested in age as a key contingency factor for changes of mental health and communal/life satisfaction because on the one hand, COVID-19 has disproportionate risks for the physical health of older people (Chen, Klein, et al., 2021; Shahid et al., 2020), but on the other hand, older people may have stronger resilience strategies (Carstensen, 2021; Yeung & Fung, 2007). We draw upon the perspective of "catastrophe compassion" (Zaki, 2020) and insights from socioemotional selectivity theory (SST; Carstensen et al., 1999) to develop our hypotheses. We focus on two specific domains, namely mental health and communal life,

because they represent quintessential individual and social contributors to life satisfaction, respectively (Headey et al., 1991; Heller et al., 2004). We propose that although the pandemic hurts life satisfaction via decreasing mental health, it might promote positive changes in people's communal life (i.e., home, neighborhood, and community) via elevated collective coping activities and emotional connections (Zaki, 2020). The combination of decreased mental health but increased communal life satisfaction may help explain the pandemic's mixed effects on overall life satisfaction. Moreover, we hypothesize that while older adults may have more health risks during the pandemic, the more limited future time perspective of older (vs. younger) adults (as stated in SST) may motivate them to better regulate their emotions and utilize the benefits of communal life. To test these predictions rigorously, we used longitudinal panel design data (2017 to 2020) from a nationally representative sample of Australians (N=12,093). Piecewise latent trajectory modeling (Byrne & Crombie, 2003; Flora, 2008) and cross-lagged panel modeling (Selig & Little, 2012) were used to test the unique changes and interrelations of people's mental health, communal satisfaction, and overall life satisfaction during the pandemic outbreak year.

Life Satisfaction During the Pandemic: The Mental Health Domain

There are different perspectives accounting for stability and change in life satisfaction (Diener et al., 2018; Heller et al., 2004). A top-down perspective considers individuals' life satisfaction to be stable and trait-like (e.g., DeNeve & Cooper, 1998; Headey & Wearing, 1992; Lykken &Tellegen, 1996). For example, the hedonic treadmill theory (Diener et al., 2006) posits that individuals tend to minimize the impact of life events and restore life satisfaction to the individual's set point, even when facing extreme hardships or unexpected good fortune (Brickman et al., 1978; Fredrick & Loewenstein, 1999; Hellmich, 1995). Although this approach helps to explain the stability of life satisfaction during the pandemic, it cannot fully address the mixed changing patterns found in empirical studies, such as the

counterintuitive findings of increases in life satisfaction (e.g., Meireles et al., 2022). A complementary perspective is a bottom-up view highlighting the separate roles of domain-specific life experiences in contributing to overall life satisfaction (Headey et al., 1991; Heller et al., 2004). That is, despite its relative stability, life satisfaction is also affected by changes in specific domains, such as physical conditions, mental health, family relations, and employment experiences (Heller et al., 2006). As the pandemic may have distinct impacts across life domains, a bottom-up approach is essential for understanding the mechanisms of life satisfaction change. In this study, we focus on mental health and communal life as two specific domains and examine how their distinct changes may produce opposite effects on people's overall life satisfaction.

The COVID-19 pandemic impacts mental health through different paths. Direct impacts include threats to physical health (Talevi et al., 2020), the unpredictability, instability, and uncertainty of the pandemic (Godinić & Obrenovic, 2020), and loss of income and/or employment (Mimoun et al., 2020). Indirectly, lockdown and physical distancing practices decreased access to face-to-face social interactions and resources (Simon et al., 2021), reduced healthy physical activities (Stockwell et al., 2021), and increased unhealthy activities such as alcohol and online gambling (Ezpeleta et al., 2020; Moreno et al., 2020). Indeed, empirical studies found that people in 35 societies experienced stress, depression, and anxiety symptoms after the outbreak (Chen, Ng, et al., 2021) and that individuals reported increased anxiety and emotional distress during the pandemic (Daly et al., 2020; Kwong et al., 2021; Petersen et al., 2021). In Australia, as elsewhere, extended lockdowns, travel restrictions, and tight social distancing measures characterized the 2020 year. Employing latent curve modeling (Bollen & Curran, 2006) and analyses of change scores, this study comprehensively examined the changing patterns of mental health from before the pandemic to after the pandemic, with the focus on whether the pandemic year (2019-2020) induced

unique changes compared to previous years (2017-2019).

Hypothesis 1a: As compared to the pre-pandemic period (2017-2019), there was a decrease in mental health in the first pandemic year (2019-2020).

Taking a bottom-up view, mental health has been established as a significant predictor of life satisfaction (e.g., Lombardo et al., 2018). For instance, in cross-sectional data, individuals reporting poorer mental health also reported a significantly lower level of life satisfaction (Lombardo et al., 2018). In a longitudinal study, individuals reporting more mental health disorders were less satisfied with life (Fergusson et al., 2015). As such, the pandemic could significantly decrease life satisfaction because it induces psychological distress and decreased mental health (Duong, 2021; López-Núñez et al., 2021; Möhring et al., 2021; Zacher & Rudolph, 2021). To provide better evidence for this possibility, we conducted a full cross-lagged model of mental health and life satisfaction before and during the pandemic year (2019-2020) to test the following hypothesis:

Hypothesis 1b: After cross-lagged auto-regression and reciprocal relations are controlled, mental health would be positively associated with life satisfaction.

Life Satisfaction During the Pandemic: The Communal Life Domain

Although infection risks and lockdown disruptions may harm people's life satisfaction via decreased mental health, we argue these threats may also lead to positive changes in people's communal life, thereby producing a silver lining effect on overall life satisfaction. Communal life satisfaction is mainly determined by the extent to which individuals perceive a sense of similarity, belonging, and interdependence in their group; it manifests itself in strong emotional connectedness and beliefs that group members' needs will be met through commitment to unity and mutual support (McMillan & Chavis, 1986; Prezza & Costantini, 1998; Sarason, 1974). We believe that COVID-19 can heighten these elements critical to communal life satisfaction.

Different from a personal stress event (which affects the focal individual but not necessarily others around them), the highly contagious COVID-19 virus may affect all people sharing a communal environment, such as a home, neighborhood, and community (Guan et al., 2020; Xin et al., 2020). As a result, COVID-19 poses a common threat, in which the shared risks of being infected or quarantined may elevate the sense of "common fate" for people sharing a given communal environment (Moloney & Moloney, 2020). Extensive research has shown the uniting power of a common threat or "common fate." For example, a common threat can elevate shared social identity and activates perceptions of interdependence (Drury, 2018; Gaertner & Insko, 2000; Tajfel, 1970), leading individuals to perceive more similarity with each other (Flade et al., 2019; Turner et al., 1994) and show more cooperative behaviors (Dovidio & Morris, 1975; Vezzali et al., 2016). It can also bond people emotionally due to the experience of similar difficulties and challenges (Kivi et al., 2021; Luchetti et al., 2020). It follows that the common threat produced by the pandemic may also elicit such a sense of shared identity and interdependence from people because people are prompted to enter a "communal coping" mode (Helgeson et al., 2018; Lyons et al., 1998; Prime et al., 2020), pooling information, resources, and actions from communal environments (e.g., family, neighborhood and community) to combat adversity. Indeed, mutual support and connectedness have been widely observed during the pandemic. Recent research has revealed the critical roles of communal identity and sense of belongingness to family and community in promoting altruism (Resta et al., 2022), health-related preventive behaviors (Kim et al., 2022; Marinthe et al., 2022), donation intentions (Zagefka, 2022), and generosity (Fridman et al., 2022). In a longitudinal survey study, Luchetti et al. (2020) found that people reported increased support after the pandemic compared to before. All these perceptions and altruistic activities may help to sustain and enhance people's communal satisfaction and well-being (Gayatri & Irawaty, 2022; Jiang & Fung, 2022; Mannarini et al., 2022; Maytles et al., 2021).

In sum, by inducing a sense of common threat, the pandemic may increase people's feelings of similarity and belonging within their communal environments and promote mutual support and unity, which could help increase communal satisfaction. As communal life is an important part of one's life (McMillan & Chavis, 1986; Nunkoo & Ramkissoon, 2011; Prezza & Costantini, 1998; Sarason, 1974), we expect increased communal life satisfaction to be positively associated with overall life satisfaction.

Hypothesis 2: As compared to the pre-pandemic period (2017-2019), there was an increase in communal satisfaction during the pandemic year (2019-2020) (H2a); after cross-lagged auto-regression and reciprocal relations are controlled, communal satisfaction would be positively associated with life satisfaction (H2b).

Exploring Moderation Effects of Age

In addition to the changes and relations discussed above, we examined whether the pandemic produced unequal psychological changes in mental health and communal satisfaction across age groups. Given that coping with infection risks and life disruptions during the pandemic entails energy exhaustion and resource loss, the adequacy of self-regulatory resources may determine the success of adaptation. For example, impoverished individuals have been found to be more vulnerable to the pandemic than their more prosperous counterparts, because the latter have more capacity to engage in coping and benefit-finding activities to maintain their mental health and well-being (Aknin et al., 2022; Bussing et al., 2021; Cox et al., 2021).

Intuitively, one might think older adults are also more vulnerable because age is positively associated with increased COVID-19 infection risks and death rates (Chen, Klein, et al., 2021; Shahid et al., 2020). However, SST (Carstensen et al., 1999) suggests otherwise, emphasizing the strengths and advantages of older adults in emotion regulation. Specifically, SST posits that individuals' future time perspective shapes their goal prioritization: When

future time is perceived as expanded, typically in younger adulthood, individuals are more motivated to pursue goals aimed at future payoffs (e.g., knowledge acquisition); in contrast, when future time is perceived as limited, typically in older adulthood, individuals are more motivated to prioritize current and emotionally meaningful goals concerning "feeling states, emotional satisfaction, and a sense of belonging, purpose, and worth" (Carstensen, 2021, p. 1190) (e.g., savoring the present moment and maintaining positive relationships with meaningful social partners). This characteristic of goal orientation prompts older people to "pay more attention to the emotional quality of social exchanges and engage in strategic attempts to optimize emotional aspects of important social relationships" (Carstensen et al., 1999, p. 171); it also makes them more aware of the fragility of life and thus cherish what they have in the present (Carstensen, 2021). Indeed, instead of suffering more negative emotions, older adults have been found to be emotionally adaptive and resilient in the face of public infectious disease crises (Carstensen et al., 2020; Yeung & Fung, 2007).

In line with SST, we expect that these advantages of the emotion regulation of older people will help them "weather the storm" of the pandemic. Specifically, older people are likely to pay more attention to and emphasize positive experiences (Mather & Carstensen, 2005) and may downplay the negative sides of the pandemic. As a result, they have been found to be better at coping with the emotional threats caused by the pandemic (Bruine de Bruin, 2021; Carstensen et al., 2020; Jiang, 2020, 2022; Wilson et al., 2021). Earlier, we argued that mental health should have worsened after the start of the pandemic, as compared to the pre-pandemic period (Hypothesis 1a). Because of prioritizing emotionally meaningful goals, older people may be better at regulating their emotions during the pandemic. Thus, the pandemic's negative effects on mental health should be less salient among older people.

Similarly, we have suggested a counterintuitive positive change in communal satisfaction during the pandemic (Hypothesis 2a) that may be enhanced among older adults.

According to SST (Carstensen et al., 1999), older (vs. younger) people prioritize maintaining positive relationships with meaningful social partners to a greater extent. Relationships with family members, the neighborhood, and the community become particularly important and meaningful during the pandemic as they are vital to combating adversity (Pennebaker & Harber, 1993; Vezzali et al., 2016; Zaki, 2020). Indeed, older adults are found to derive happiness and enjoyment from interacting with important social partners, such as family and friends, during the pandemic (Whitehead & Torossian, 2021). However, younger adults have to face more family-related stress than older adults as the pandemic led to increased maladjusted behaviors of children and an unprecedented rate of unemployment (Prime et al., 2020), which may, to some extent, make them less able to appreciate their interactions with family and the community. In addition, older people are also found to display more empathy (Sze et al., 2012) and express more feelings of gratitude (Chopik et al., 2019), which, especially if they were more likely to receive and give help during the pandemic period, could facilitate their positive social interactions. Due to these reasons, it seems plausible to expect a positive change in communal satisfaction to be stronger among older people. These arguments are reflected in the following hypotheses:

Hypothesis 3: Age would moderate the changing trajectories in mental health and communal satisfaction such that older adults would experience less negative changes in mental health (H3a) and more positive changes in communal satisfaction (H3b) during the pandemic year.

To more deeply understand the role age plays in people's life satisfaction during the pandemic, we also investigate how age moderates the paths from mental health and communal satisfaction to overall life satisfaction. Informed by SST, we expect these relationships to be stronger in older than younger people. To reiterate, the central premise in SSI is that age influences people's goal prioritization due to its impact on their time

perception: an expanded time perspective in younger people motivates them to pursue knowledge-related achievements, whereas a limited time perspective in older people orients them to focus on emotional needs and social relationships (Carstensen, 2021). While mental health and communal life satisfaction are both contributors to overall life satisfaction generally, the strength of their effects may hinge on the relative weight people attach to them. In other words, both mental health and communal life satisfaction will be positively associated with overall life satisfaction to the extent that they are both valued and fulfill people's personal needs (Fung et al., 2001).

Both mental health and communal life satisfaction fall into the category of emotionally oriented goals (Carstensen, 2021). Because older adults see emotional fulfillment and social relationships as more important, the satisfaction of these should carry greater weight in their assessment of overall life satisfaction (Charles & Carstensen, 2010). Therefore, the associations of mental health and communal life satisfaction with overall life satisfaction should be stronger among this group of people. On the other hand, younger adults consider knowledge goals as more important and may give less weight to the pursuit of goals related to emotional satisfaction such as mental health and communal life satisfaction (Carstensen, 1995). Thus, the associations of mental health and communal life satisfaction with overall life satisfaction should be weaker among younger adults. Our theorizing is summarized in the following hypotheses:

Hypothesis 4: Age would moderate the relationship between mental health and overall life satisfaction (H4a) as well as the relationship between communal satisfaction and overall life satisfaction (H4b), such that the positive relationships during the pandemic year would be greater in older than younger adults.

An overview of the research hypotheses is shown in *Figure 1*.

Method

Ethics, Transparency and Openness

This study was approved by the Research Ethics Committee of the Applied Psychology Program, The Chinese University of Hong Kong (Shenzhen), approval ID: EF20220528002. We describe our data source, the handling of missing data, and all measures used in this study. We adhere to the methodological checklist of the American Psychological Association. The analysis code and relevant data files are available upon request from the corresponding author. This study was not preregistered because it was based on existing social surveys.

Sample and Procedures

The data of this study were extracted from the Household, Income and Labour Dynamics (HILDA) Survey of Australia (Summerfield, 2010). Funded by the Australian Department of Social Services, the HILDA Survey is the largest and longest running longitudinal survey in this country (Department of Social Services of Australia, 2022). The survey started in 2001 with data collected from a nationally representative sample of 13,969 residents. The same households and individuals were interviewed every year, and their children and all subsequent descendants were also added to the sample when they were over 15 years old. During the wave 11 data collection, an additional 5,462 individuals were added to the sample to ensure its representativeness. The data used in this study were collected from 2017 to 2020, with an initial sample of 15,993 individuals. The number of participants with full data across four waves was 12,093, yielding a retention rate of 76% across three years. The sampling and data collection processes were managed reasonably well for such a large-scale national longitudinal survey, which should effectively reduce the selection and attrition effects. The multilevel piecewise growth model analysis was based on the data from 2017 to 2020 because the data for 2017, 2018, and 2019 (Waves 1, 2, and 3) were collected before the outbreak of the pandemic while the data for 2020 (Wave 4) were collected during the

pandemic. The variables used in this study were assessed via self-report questionnaires (Wooden & Watson, 2007). The key variables (mental health, communal satisfaction, and overall life satisfaction) were measured every year from 2017 to 2020 (Waves 1 to 4); the demographic information was collected in 2020 (Wave 4). Participants were removed from the analyses if they missed any wave of the survey. As a result, data of 12,093 Australians who completed all four waves from 2017 to 2020 were used for analysis, with 5,524 males (45.7%) and 6,569 females (54.3%). Their ages ranged from 18 to 99 years (M = 49.53, SD = 18.28). We also conducted a sensitivity analysis by comparing results from the listwise deletion sample (N = 12,093) and the full sample (N=15,993). Specifically, we followed previous research and modeled missing values at T2, T3 and T4 with full information maximum likelihood estimation (e.g., Fasbender et al., 2020; Graham, 2009). The results showed that the key findings remained stable and significant in the hypothesized direction when we used the full sample.

Measures

Mental health. The 5-item Mental Health index from the 36-item Short-Form (SF-36) health survey was used to measure mental health (Ware, 2000). This measure has been extensively used in previous research, and shows good reliability and validity in predicting mental health outcomes such as depression (e.g., Barbosa-Leiker et al., 2022; Friedman et al., 2005). Participants rated how much of the past four weeks they had been "nervous" (reverse coded), "down in the dumps" (reverse coded), "calm and peaceful", "down" (reverse coded), and "happy". Participants rated each item on a 6-point Likert type scale (1 = *All of the time*, 6 = *None of the time*). The Cronbach's alpha coefficients for the four years were .86, .86, .86, and .86, respectively.

Communal satisfaction. Three items were used to measure satisfaction with the communal environment (Nunkoo & Ramkissoon, 2011). Participants were asked to rate how

satisfied they were with their home, neighborhood, and local community, respectively, on an 11-point Likert type scale (0 = *totally dissatisfied*, 10 = *totally satisfied*). A higher score represented a higher level of communal satisfaction. The Cronbach's alpha coefficients for the four years were .67, .69, .68, and .69, respectively.

Overall life satisfaction. Participants were asked to respond to the item "all things considered, how satisfied are you with your life?" using an 11-point Likert type scale (0 = *totally dissatisfied*, 10 = *totally satisfied*). The one-item measure has been found to have satisfactory criterion validity (e.g., Cheung & Lucas, 2014; Gnambs & Buntins, 2017), and is commonly used in large-scale survey studies (e.g., Realo & Dobewall, 2011).

Demographics. Information on sex (1 = *Male*, 2 = *Female*), age, and household financial year gross regular income (in Australian dollars) was collected. Age was calculated from participants' birth year.

Data Preparation

Mental health was calculated as the mean of the five items at each round after necessary reversed coding so that higher scores represented higher levels of mental health. Communal satisfaction was the mean of the three corresponding items. Mental health, communal satisfaction, and life satisfaction scores were standardized to range from 0 to 100 to facilitate illustrations.

Analytic Plan

According to our hypotheses, the outbreak of the COVID-19 pandemic in Australia in early 2020 would be likely to make a difference in the trajectories of the public's mental health, communal and life satisfaction. Piecewise growth modeling (PGM) was used "to approximate the nonlinear function through the use of two or more linear piecewise splines" (Bollen & Curran, 2006, p. 103), which allows us to examine if the rate of change accelerates or decelerates at a given time point, and provides ratings of three aspects of growth: its initial

status, and the separated growth rates before and after the selected transition point. Because participants in our study did not complete the survey at the same time at each wave, a growth model with individually varying times of observation was fit. The first time variable was calculated as the difference between the date of the survey at T1 (2017) and, respectively, T2 (2018), T3 (2019), or T4 (2020). The first time variable (first linear slope) captured the "base rate" of the change for the entire period of four time points (2017, 2018, 2019, 2020). The second time variable (second linear slope, named "slope difference") captured the change in the growth rates from before and after the advent of the pandemic (*Figure 2*).

Because participants were nested within households, a multilevel growth model was fit by using TYPE=COMPLEX in Mplus 8.0. Specifically, we first constructed the multilevel piecewise growth model for the three core variables, respectively. After that, we introduced demographic variables into the multilevel PGM models to explore how age, sex, and income affected the psychological changes after the outbreak of COVID-19. Additionally, to disentangle reciprocal relationships and test lagged effects over time, full cross-lagged panel models (CLPM) were used for all the core variables. We conducted the CLPM in Mplus 8.0 using the Robust Maximum Likelihood estimator to account for any violation of multivariate normality. The comparative fit index (CFI) and the standardized root-mean-squared residual (SRMR) were used to evaluate the model fit.

In preparation for these analyses, we conducted a series of confirmatory factor analyses (CFA) and Heterotrait-Monotrait (HTMT) analyses on the three core variables to demonstrate the independence of these measures and alleviate concerns about common method variance (Clark & Watson, 2016). The fit indexes of CFA across the four waves of data consistently supported the superiority of the three-factor model (CFI = .92, SRMR = .04 for 2017; CFI = .91, SRMR = .04 for 2018; CFI = .91, SRMR = .05 for 2019; CFI = .93, SRMR = .04 for 2020) over the two-factor (communal and life satisfaction combined, mental

health and life satisfaction combined, mental health and communal satisfaction combined) and one-factor (all items combined) models, with all ΔCFIs higher than the critical value of .01 (Cheung & Rensvold, 2002). In addition, all the HTMT indexes among factors across the four years ranged from .43 to .66, which were below the cut-off point of .85, supporting the distinctiveness of these measures (Clark & Watson, 2016).

Results

Descriptive Statistics and Correlations

Table 1 presents the means, standard deviations, and correlations for all the variables.

Test of Hypotheses

The results of the piecewise growth model indicated that mental health had a base growth rate of -0.28 (S.E.=.07, p<.001); from 2019 to 2020, it had a steeper decline, with a difference of -1.19 between the growth rate in the pre-pandemic and pandemic periods (S.E. = .17, p < .001), supporting H1a. Regarding communal satisfaction, the base growth rate was 0.43 (S.E. = .06, p < .001); from 2019 to 2020, the growth rate significantly increased by 0.37 (S.E. = .15, p < .05), supporting H2a. For life satisfaction, the base growth rate was 0.21 (S.E. = .06, p < .001); from 2019 to 2020, the growth rate deteriorated, indicated by a difference of -0.30 (S.E. = .14, p < .05). The mean scores are depicted in *Figure 3*.

A longitudinal cross-lagged panel model was used to test the reciprocal temporal relationships among mental health, communal satisfaction, and life satisfaction. The data fit the cross-lagged panel model well (CFI = .90, SRMR = .07). Assumptions about stabilities and synchronicities of cross-lagged panel design were fulfilled in our data, in which all variables presented moderate levels of stability from 2017 to 2020, and the variables in the same year were significantly correlated with each other (*Figure 3*). After controlling for their corresponding cross-lagged auto-regression and reciprocal relations, mental health (b = .14, p < .001) and communal satisfaction (b =.12, p <.001) in 2019 were significantly associated

with life satisfaction in 2020, yielding support for H1b and H2b.

Next, we examined the moderating role of age on the change of growth rate between 2019 and 2020, with sex and household financial year gross regular income as control variables (*Figure 3*). The results showed that the growth rate changes in mental health and communal life satisfaction were significantly moderated by age (see Table 3, mental health: $b = .07$; communal satisfaction: $b = .05$; both $ps < .001$), suggesting that the negative change in the growth rate of mental health was weaker among older than younger adults and that the positive change in communal satisfaction growth rate was greater in older than younger adults during the pandemic year, compared with the previous years. Hence, H3a and H3b were supported. Although not formally hypothesized, we also examined whether age could shape the change in overall life satisfaction and found that older adults experienced less negative change in overall life satisfaction ($b = .02$, $p < .001$). To illustrate the moderation effects of age more explicitly, we show the change trajectories of these three variables for younger and older age groups ($M = 49.53$ years old as the cut-off point) in *Figure 3*.

The results from cross-lagged panel analysis showed that age moderated the relationship between mental health and life satisfaction ($b = .03$, $p < .01$), as well as the relationship between communal satisfaction and life satisfaction ($b = .02$, $p < .01$). These results supported Hypothesis 4a and 4b. To illustrate the moderation effects of age more explicitly, we show the coefficients of younger and older age groups ($M = 49.53$ as the cut-off point) in *Figure 4*. Specifically, the path from mental health to life satisfaction was stronger for the older group ($b = .15$, $p < .001$) than the younger group ($b = .12$, $p < .001$); the path from communal satisfaction to life satisfaction was also stronger for the older group ($b = .14$, $p < .001$) than the younger group ($b = .10$, $p < .01$).

Discussion

Despite rich empirical findings on the impact of the pandemic on life satisfaction,

little attention has been paid to the mixed mechanisms underlying stability and changes in life satisfaction. Inspired by the idea of "catastrophe compassion", this study demonstrates that the pandemic can have opposing effects on different domains of well-being, thereby producing mixed effects on overall life satisfaction. While mental health decreased after the start of the pandemic (which was negatively associated with overall life satisfaction), communal satisfaction improved (which was positively associated with overall life satisfaction in these difficult times). Moreover, building on socioemotional selectivity theory (SST), we found that older adults experienced less negative and more positive psychological changes during the pandemic. Consistent with SST, the associations of mental health and communal life satisfaction with overall life satisfaction were also stronger among older adults.

Theoretical and Practical Implications

First, given the detriments and inconveniences caused by COVID-19 in many aspects of people's lives, it would be tempting to assume that their overall life satisfaction would decline during the pandemic. By adopting a domain-specific perspective on life satisfaction and recognizing that shared crises may elicit a sense of shared fate and togetherness, we demonstrate that the pandemic can have double-edged sword effects on life satisfaction via decreased mental health and increased communal life satisfaction (Headey et al., 1991; Heller et al., 2004). Empirically, these findings can help to explain the mixed change patterns of life satisfaction during the pandemic (Aknin et al., 2022). The existence of opposite changes in different domains may explain the conflicting negative (e.g., Wanberg et al., 2020; Ke & Chen, 2022; Bezzo et al., 2021), positive (e.g., Meireles et al., 2022), or null changes (e.g., Helliwell et al., 2021; Kivi et al., 2021; Shavit et al., 2021; Wettstein et al., 2022) in overall life satisfaction found in the literature. Theoretically, our research provides a more complete picture of people's experiences and responses during the pandemic. A sole focus on the

pandemic's negative impact on the mental health domain (or other domains) may have missed the opportunity to capture the silver lining effects of this challenging time. Therefore, the integration of negative changes in mental health and positive changes in communal satisfaction provides theoretical richness in extending our understanding regarding how life satisfaction is shaped in the time of COVID-19.

Second, our study substantiates and extends the notion of "catastrophe compassion" (Zaki, 2020), which is concerned with the surprising prosocial, compassionate, and relationship-oriented responses to calamities that produce feelings of community and solidarity. Although the idea of catastrophe compassion is well-grounded in historic records (Zaki, 2020), some scholars have voiced reservations and called for empirical research to specifically track changes in prosociality and empathy over the course of the pandemic (Seitz et al., 2020). On the one hand, we acknowledge that we did not directly measure these variables because of the nature of our data (i.e., archival data). On the other hand, we believe that the finding that people experienced better rather than worse communal satisfaction offers some preliminary evidence to support the existence of "catastrophe compassion" during the pandemic, because mutual support and stronger interpersonal connections are likely the primary reasons behind enhanced communal satisfaction. Indeed, empirical findings have revealed that interdependence was significantly associated with self-reported and actual prosocial behavior in response to the COVID-19 pandemic across cultures (Chen et al., 2022).

Third, the use of longitudinal data and the cross-lagged model has implications for two distinct views – the top-down and bottom-up perspectives – to understand life satisfaction (Diener et al., 2018; Heller et al., 2004, 2006). The top-down perspective suggests that overall life satisfaction is superordinate and predicts communal satisfaction and mental health, whereas the bottom-up perspective suggests the opposite. The

comprehensiveness of our data and analyses allowed us to simultaneously test these two different directions and yield support for both (*Figure 4*). Our findings contribute to a more comprehensive and dynamic view of how the pandemic may affect the public's life satisfaction. They also pave the way for future research on how changes in other domains may impact life satisfaction and vice versa. In a more general sense, these findings also have implications for understanding stability and changes in overall life satisfaction.

Finally, in addition to studying the changes in mental health, communal satisfaction, and their relationships with overall life satisfaction, this study considers the critical role of age in shaping these changes during the pandemic. Older adults showed more positive changes and fewer negative changes due to the pandemic than their younger counterparts. In addition, mental health and communal satisfaction were associated with the overall life satisfaction of older adults to a greater extent than younger adults, consistent with an SST explanation of why older adults would be more likely to benefit from these social and emotional aspects of well-being. These findings provide substantial evidence of older adults' resilience and unique emotion regulation strengths during the pandemic, further validating SST in a new and extreme context. Based on cross-sectional data without a pre-pandemic baseline in their sample, Carstensen and colleagues (2020) found that age was correlated with greater emotional well-being at the beginning of the pandemic. Our study complements these findings with a more rigorous longitudinal design that involves panel data and allows direct comparisons between growth rates before and after the start of the pandemic.

From a practical standpoint, these findings are noteworthy because they provide a lens on multiple strategies that can be used to protect well-being during the pandemic. Our findings highlight the importance of communal coping and a sense of togetherness in helping the public to maintain their life satisfaction. Thus, we suggest policymakers and practitioners should be made aware of the potential benefits of promoting communal identity in combating

the detrimental effects of the pandemic. According to our data, community-oriented interventions may be as important as individual mental health interventions in promoting overall well-being during the pandemic. The results also counterintuitively show that the pandemic is more likely to trigger negative changes among young people. Thus, policymakers are recommended to provide more tailored support for them to mitigate the unequal psychological impacts of the pandemic (McVeigh & MacLachlan, 2022; Zacher & Rudolph, 2021).

Limitations and Future Directions

Although our findings are based on a longitudinal design with rigorous tests utilizing latent curve modeling and cross-lagged modeling, there are still several limitations. First, the sample of this study is from Australia, which may affect the generalizability of the results. Compared with other nations (e.g. USA, UK), the death toll of the pandemic in Australia was well-controlled, while COVID-related restrictions were relatively strict. In addition, Australia is a developed country with a low population density. People may have better support and resources to cope with the pandemic, thereby displaying more positive responses in this situation (Moloney & Moloney, 2020). Future research should continue to examine whether the findings revealed in this study can be replicated in other nations and whether there are institutional or cultural factors that may moderate these effects (Guan et al., 2020). Second, we only focused on changes after (vs. before) the pandemic but did not examine how these changes evolved after the pandemic. As the pandemic has evolved into a long-lasting global crisis, future research should continue to offer more insights into these crucial questions. Third, although there has been empirical evidence supporting the reliability and validity of the self-reported measures used in this study, self-reported measures may still raise concerns about perceptual bias (e.g., Thombs et al., 2018) and common method variance (Podsakoff et al., 2003). Future research should adopt alternative methods, such as diagnostic interviews

and behavioral measures (e.g., Shevlin et al., 2023), to corroborate the findings of this study. That said, our confirmatory factor analyses (CFA) and Heterotrait-Monotrait (HTMT) analyses should alleviate these concerns to some extent by demonstrating the independence of these measures (Clark & Watson, 2016). Fourth, because of the nature of secondary data analysis, we used mental health and communal satisfaction as the indicators of emotionally meaningful states in the current study, which are not the typical indicators used to study SST, such as social preference tasks and social convoy measures (Fung & Carstensen, 2006; Fung et al., 1999; Fung et al., 2020; Lang, 2000; Lang & Carstensen, 1994). Future studies should continue to validate the findings of this study by using alternative instruments.

Conclusion

Using large-scale longitudinal data, this study found a decrease in mental health and an increase in communal satisfaction during the COVID-19 pandemic year, offering important insights on the mixed effects of the pandemic on life satisfaction. We also found that older adults experienced less harmful changes and more positive changes during the pandemic and that their overall life satisfaction was more strongly associated with mental health and communal life satisfaction. These findings highlight the importance of using communal-oriented and age-sensitive approaches to address pandemic threats to public well-being.

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Table 1

Means, Standard Deviations, and Correlations for Study Variables (n=12,093)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Mental Health (T1)	1.00														
2. Mental Health (T2)	**.68**	1.00													
3. Mental Health (T3)	**.64**	**.69**	1.00												
4. Mental Health (T4)	**.62**	**.64**	**.68**	1.00											
5. Communal Satisfaction (T1)	**.35**	**.32**	**.30**	**.29**	1.00										
6. Communal Satisfaction (T2)	**.32**	**.36**	**.31**	**.30**	**.65**	1.00									
7. Communal Satisfaction (T3)	**.30**	**.32**	**.34**	**.30**	**.62**	**.67**	1.00								
8. Communal Satisfaction (T4)	**.30**	**.31**	**.32**	**.34**	**.55**	**.59**	**.65**	1.00							
9. Life Satisfaction (T1)	**.49**	**.41**	**.39**	**.37**	**.54**	**.44**	**.42**	**.39**	1.00						
10. Life Satisfaction (T2)	**.42**	**.51**	**.41**	**.39**	**.43**	**.54**	**.44**	**.42**	**.62**	1.00					
11. Life Satisfaction (T3)	**.41**	**.44**	**.50**	**.42**	**.42**	**.44**	**.53**	**.45**	**.60**	**.64**	1.00				
12. Life Satisfaction (T4)	**.39**	**.40**	**.42**	**.49**	**.40**	**.41**	**.43**	**.55**	**.54**	**.59**	**.62**	1.00			
13.Age	**.16**	**.17**	**.17**	**.20**	**.15**	**.16**	**.16**	**.19**	**.06**	**.08**	**.07**	**.09**	1.00		
14.Sex[a]	**-.08**	**-.07**	**-.08**	**-.09**	**.03**	**.03**	**.03**	**.04**	.01	**.02**	**.03**	.00	.01	1.00	
15.Income[b]	**.08**	**.08**	**.08**	**.07**	**.07**	**.07**	**.06**	**.06**	**.07**	**.06**	**.08**	**.08**	**-.22**	**-.04**	1.00
Mean	73.84	73.45	73.29	71.80	75.57	76.39	76.44	77.37	79.59	79.98	80.03	79.99	49.53	1.54	132.74
SD	17.42	17.56	17.69	17.91	14.21	13.95	13.94	13.25	13.79	13.62	13.56	13.29	18.28	.50	115.84

Note. Bolded values indicate *p* values below .05, nonbolded values indicate *p* values .05 and greater. [a]1=male and 2=female. [b] Income stands for household income. The measurement unit of household income is one thousand Australian dollars.

Table 2.

Unconditional Piecewise Growth Models of Mental Health, Communal Satisfaction and Life Satisfaction

	Est.	S.E.	*P* value
Mean			
Mental Health			
Intercept	73.81	.18	<.001
Slope 1	-.28	.07	<.001
Slope Difference	-1.19	.17	<.001
Communal Satisfaction			
Intercept	75.68	.17	<.001
Slope 1	.43	.06	<.001
Slope Difference	.37	.15	<.05 (.01)
Life Satisfaction			
Intercept	79.65	.14	<.001
Slope 1	.21	.06	<.001
Slope Difference	-.30	.14	<.05 (.03)

Table 3

Conditional Piecewise Growth Models of Mental Health, Communal Satisfaction and Life Satisfaction

	Est.	S.E.	*P* value
Covariates predicting the slope difference			
Mental Health			
Age	.07	.01	<.001
Gender	-.86	.22	<.001
Income	.003	.001	<.01
Communal Satisfaction			
Age	.05	.01	<.001
Gender	.39	.17	<.05 (.02)
Income	.003	.001	<.001
Life Satisfaction			
Age	.02	.01	<.001
Gender	-.31	.17	>.05 (.07)
Income	.003	.001	<.001

Note. Est. stands for estimate. S.E. stands for standard errors. Age, gender, and income are standardized scores.

Figure 1

Overview of Hypothesized Relations

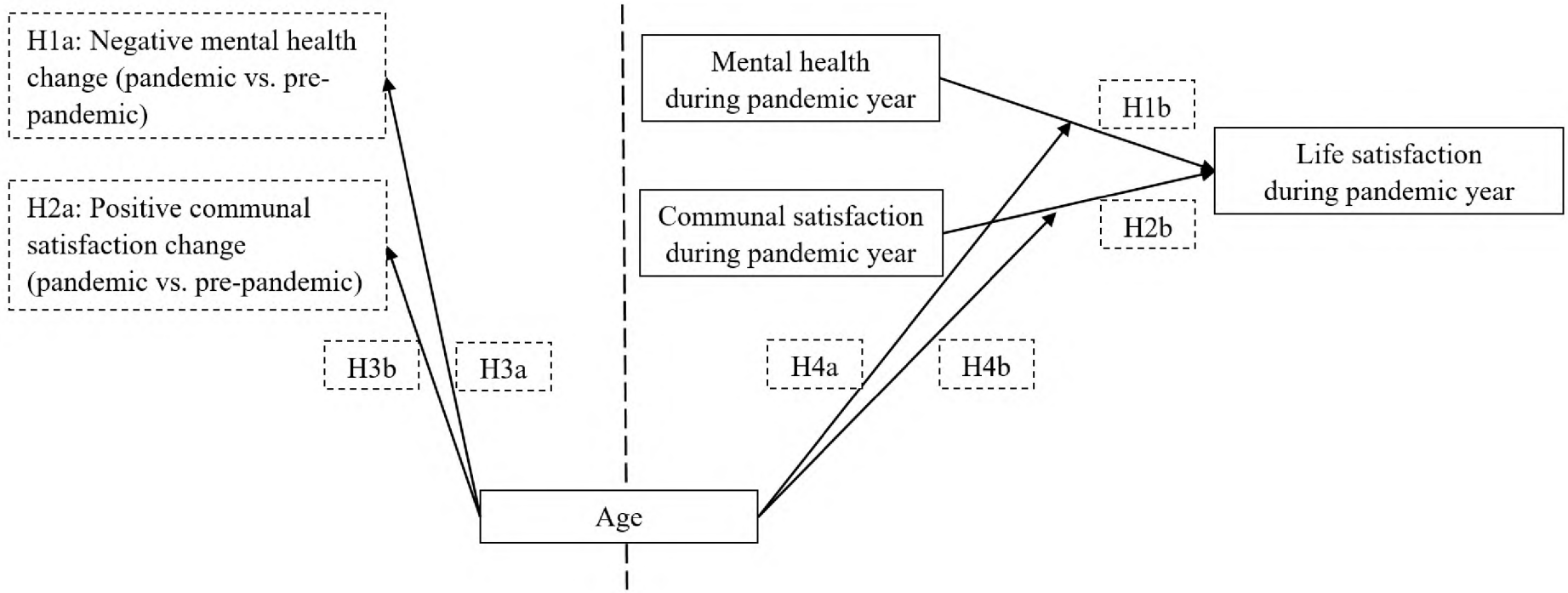

Figure 2

Piecewise Growth Model for Four Repeated Measures of Mental Health, Communal Satisfaction and Life Satisfaction

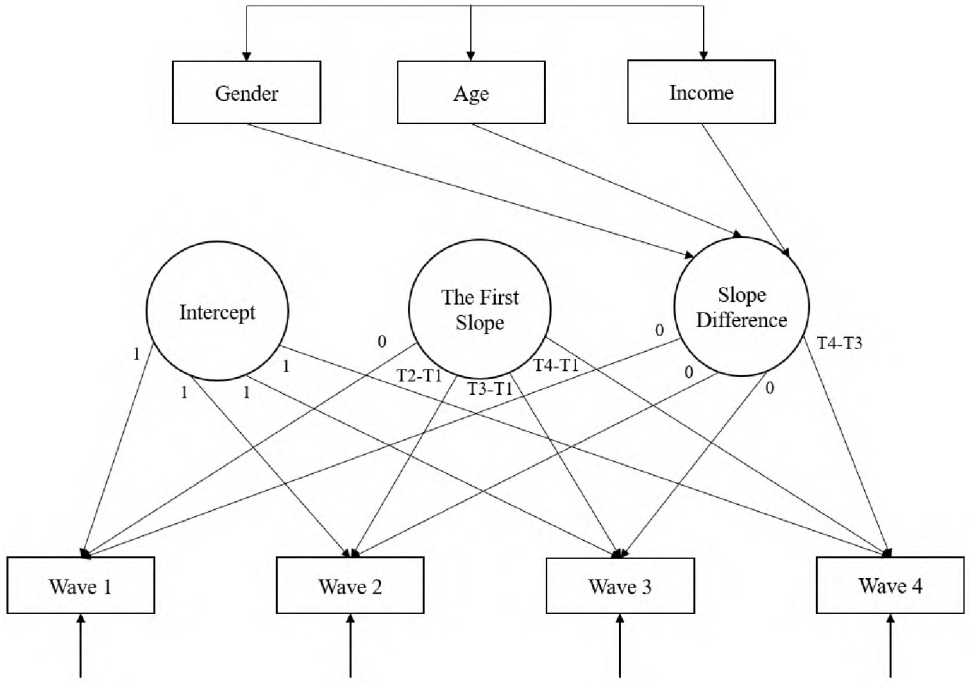

Figure 3

Trajectories of Mean Scores for Mental Health, Communal Satisfaction and Life Satisfaction from 2017 to 2020

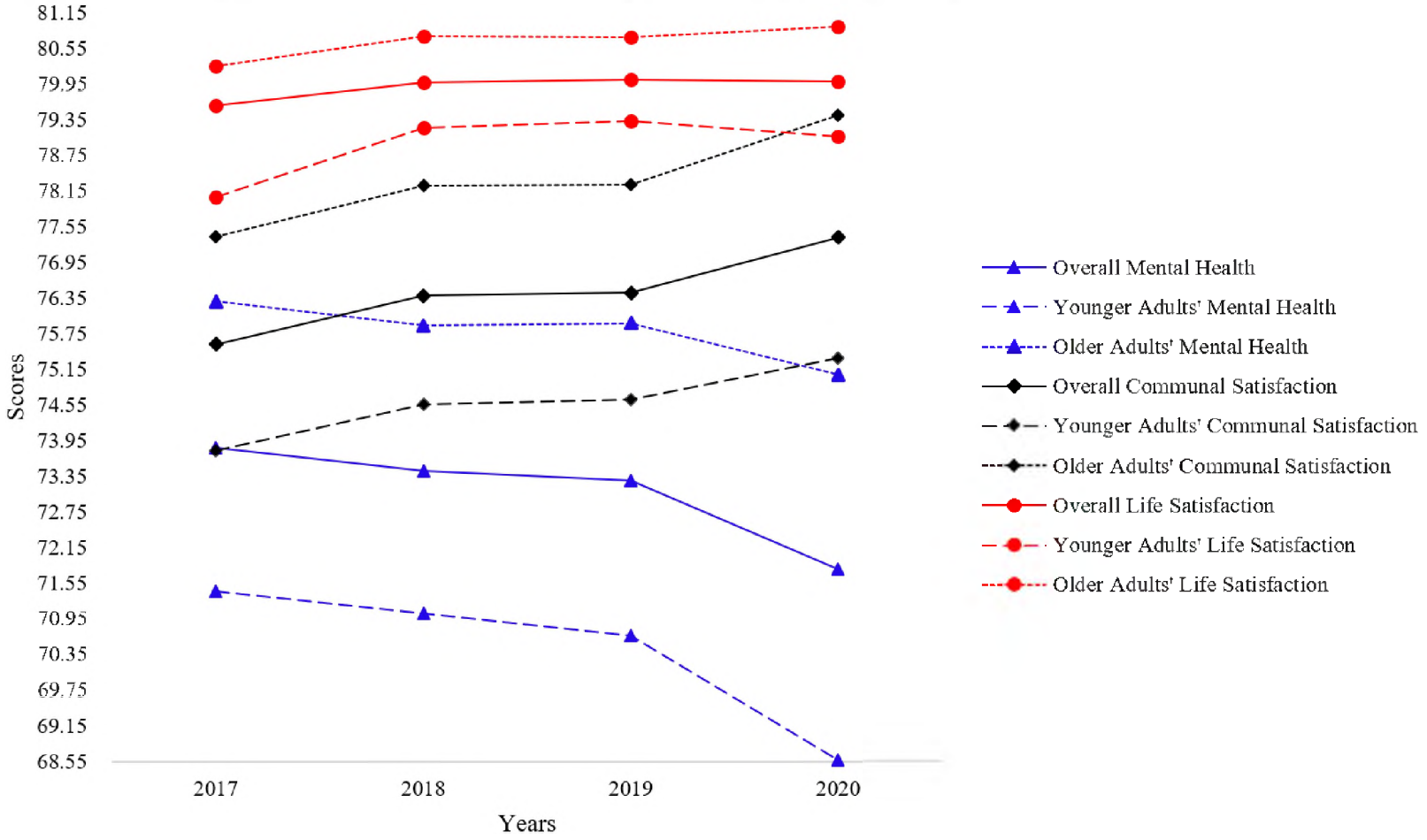

Figure 4

Cross-lagged Model of Reciprocal Associations among Mental Health, Communal Satisfaction and Life Satisfaction from 2017 to 2020