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A longitudinal study of the trajectory of life satisfaction before, during and after the outbreak of the COVID-19 pandemic, and its associations with sociodemographic characteristics, psychological distress, and stressors during the pandemic

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Abstract

Background There has been a paucity of literature on the long-term changes in well-being since the outbreak of COVID-19 pandemic. We explored a 12-year change in life satisfaction (LS) in Canada before and after COVID-19 and identified sociodemographic, psychological, and stressors during the pandemic associated with LS in 2024.

Methods Data were drawn from a community-based longitudinal population cohort established in 2007. Multivariate logistic regression was used to examine LS trajectories across four data collections: T3 (2012–2013), T4 (2014–2015), T7 (2022–2023), and T8 (2024), and LS in 2024 and their related correlates.

Results Compared to pre-pandemic, participants at T7 (Adjusted Odds Ratio (AOR) = 0.71; 95% CI: 0.55–0.91) and T8 (AOR = 0.66; 95% CI: 0.51–0.85) reported having lower odds of high LS. Singles, middle-aged adults, and those with higher psychological distress were less likely to report high LS. Income-related stressors at T8 and financial hardship at T7 were also associated with lower odds of high LS at T8.

Conclusion Compared to pre-pandemic, LS declined during the pandemic (T7) and remained lower in 2024 (T8), with no evidence of recovery. Certain population subgroups were at even elevated risk of experiencing a decline in LS and of reporting low LS in 2024, which underscores the importance of financial support for individuals experiencing income instability and psychological distress.

Keywords Life Satisfaction, Subjective Well-being, Psychological Distress, Stressors, COVID-19, Sociodemographic Factors

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Background

Life satisfaction (LS) subjectively evaluates one's life across multiple domains of life, including emotional health, social relationships, and career achievements [1, 2]. It has been used as a benchmark for cross-country comparisons [3]. Higher rating of LS was linked to reduced risk of mortality and depression, greater physical functioning, and reduced risk of chronic pain [3]. Additionally, better psychological well-being, such as having higher optimism, positive affect, mastery, purpose in life, as well as lower negative affect, lower perceived constraint, and lower loneliness is linked to higher LS [3–5]. LS is also important for those with chronic illnesses, as longitudinal studies have shown a decline in both health and well-being after diagnosis [6, 7].

The COVID-19 pandemic has accompanied with health concerns, economic instability, and social isolation, thereby affecting daily life and causing substantive challenges for LS [8–11]. Before COVID-19, countries, like Canada, Ireland, Finland, and Colombia reported higher LS scores (> 8), whereas Turkey, Korea, Lithuania, and Greece consistently reported scores below 6.5 [12]. During the acute phase of COVID-19, most studies reported a significant decrease in LS [13]. Canada experienced one of the steepest drops in LS, falling sharply to 6.7 from 8.1 on a 0 to 10 response scale [14]. As COVID-19 continued and its control measures were lifted, some regions documented a gradual recovery in LS [15]. It suggests that LS could recover over time; and it is influenced by multiple factors, including economic stability, government policies, and demographic factors. However, existing research on LS during the pandemic was often limited by small or unrepresentative samples and cross-sectional designs, which restricted the ability to capture changes in LS over time [16–18]. Although some longitudinal studies have provided insights into declining LS since the outbreak of the pandemic, the latest available data is only up to 2022 [19–21]. Overall, changes in LS have been inconclusive, and there is a lack of long-term studies to explore the trend of LS in the long run.

Many social determinants of health are associated with LS, although findings have been less conclusive [14]. Married or partnered individuals consistently report higher levels of LS than singles, widowed, or divorced individuals [14, 22], and immigrants generally report lower LS than natives, both pre-pandemic and during the pandemic [14, 23]. Similarly, during the pandemic, men and women in Canada and across Organisation for Economic Co-operation and Development (OECD) countries reported comparable LS levels [12, 14]. Findings on the relationships between other social determinants and LS have been inconsistent. Pre-pandemic research showed a U-shaped curve regarding the relationship between age and LS, with adolescents and older

adults reporting higher LS than middle-aged adults [24]. However, in the era of COVID-19, younger individuals experienced sharper declines [14, 25]. Ethnicity also shows mixed results: minorities (such as Bangladeshi, Black African, Caribbean, etc.) generally reported lower LS pre-pandemic [26], but these differences were not observed during the pandemic [14, 27, 28]. Studies on education also yielded inconsistent results, with research indicating a positive effect on LS, while others find negative or no significant associations [8, 13, 14, 29]. The relationship between speaking a minority versus majority language and LS was mixed before the pandemic, with findings often being context dependent. Anglophone minorities in predominantly Francophone regions of Canada reported lower LS than Francophone majorities, although the opposite trend was observed in some cases [30]. During the pandemic, however, studies from Australia and the UK found no significant associations between language background and LS [14, 27, 28]. Regarding employment, pre-pandemic research highlighted variability across occupational sectors, but during the pandemic, full-time employment consistently was associated with higher LS, emphasizing the potential importance of having steady work [13]. Overall, the experience of COVID-19 may have a disproportional impact on the relationships between social determinants and LS. The long-term impact of the pandemic on the relationships between social determinants associated with LS warrants further study.

Furthermore, little is known about how stressors during the pandemic interact with sociodemographic and psychological factors to influence LS over time [21]. Psychological distress (PD) is a critical factor associated with LS during the pandemic. PD, defined as a state of emotional suffering characterized by non-specific psychological or somatic symptoms [31], is consistently linked to lower LS. For example, people who had depression, anxiety, or stress during the first two waves of the pandemic (June 2020 to May 2021) reported significantly lower LS [32].

It is notable that LS may also be influenced by broader macroeconomic conditions, including inflation, housing instability, and geopolitical uncertainty. Within this evolving context, stressors during the pandemic remain relevant as proximal and measurable experiences linked to the pandemic. In this study, these stressors were not intended to capture all sources of societal disruption but rather to broadly assess exposures during the pandemic that may continue to shape well-being over time. Thus, findings should be interpreted within the broader context of concurrent economic and social changes.

This study aimed to investigate the trajectories of individuals' LS across pre- and post-pandemic periods, using data from a community-based longitudinal population

cohort. We also explored how sociodemographic factors and PD were associated with changes in LS across these periods and examined the associations between stressors during the pandemic and the most recent LS (T8). According to the set-point theory, individuals tend to return toward a “typical state” of well-being following major life disruptions, as well as prior research on post-disaster psychological recovery showing gradual adaptation over time, it is reasonable to postulate that LS would be lower at T7 (2022–2023) compared to pre-pandemic levels (e.g., T3 and T4), with somewhat recovery expected at T8 (2024) [33, 34]. Certain sociodemographic groups and those with higher PD were expected to be more likely to report lower LS. Finally, individuals with stressors during the pandemic—such as job loss, financial hardship, health concerns, a positive COVID-19 diagnosis, or family or friends who contracted the virus—were expected to have lower LS.

Methods

Population and setting

Data analyzed were from the Montreal South-West Longitudinal Catchment Area Study—Zone d'Épidémiologie Psychiatrique du Sud-Ouest de Montréal (ZEPSOM), a longitudinal project established in 2007. Residents of the Montreal south-west aged 15 years or older were randomly selected. Since then, ZEPSOM has conducted eight waves of data collection, with assessments conducted every two years. This study specifically utilized data collected between January 2012 and July 2013 (T3), January 2014 and April 2015 (T4), July 2022 and April 2023 (T7), and March 2024 and July 2024 (T8). Data from intermediate waves (T5 and T6) were not included, as LS and other variables were not measured during these two periods. Data were collected via self-reports in both English and French, allowing participants to choose. Informed consent was obtained from all participants. Participants with complete LS data across all four waves were included in the main analysis. To test whether missingness in LS and stressors during the pandemic would affect the robustness of the results, the selection criteria were relaxed to include at least three waves of data on LS and incomplete data on stressors during the pandemic. A total of 893 participants were included in the longitudinal LS trend analysis, whereas 1159 participants were retained for analyses after relaxing the inclusion criteria. Comparisons between two selection criteria of the study cohorts revealed no significant differences ($p > 0.05$) across all sociodemographic variables.

Measurements

LS served as the dependent variable in our analysis. From 2012 to 2015 (T3 and T4), sociodemographic and psychological factors were examined as independent

variables. From 2022 to 2024 (T7 and T8), stressors during the pandemic were included as additional independent variables.

LS

LS has been frequently measured by a single-item, which is also widely endorsed by many population studies for its simplicity, reliability, and validity [35, 36], and it performs similarly to the multiple-item Satisfaction with Life Scale [37]. LS in this study was also measured using the validated single-item scale recommended by the OECD for its reliability and validity [35]. Participants responded to the question, “How do you feel about your life as a whole right now (0 = “very dissatisfied” to 10 = “very satisfied”)”? Scores were dichotomized as “high” (≥ 8) and “low” (< 8) LS based on established thresholds [38]. Although dichotomization may reduce variability, this approach was chosen to facilitate interpretation and comparability with prior population-based studies, and to align with the objective of identifying factors associated with reporting high LS.

Sociodemographic characteristics

Sociodemographic variables included sex (male, female), age groups (14–39, 40–59, 60+), language (English/French vs. other mother tongues), ethnicity (White, non-White), immigration status (non-immigrant, immigrant), educational level (no post-secondary diploma/certificate, trade school diploma/apprenticeship, community college/university certificate, university degree), marital status (single, married/common-law, widowed, divorced or separated), and occupation (professional/managers, services/labor, technical/administrative work). Age was categorized into life stages (i.e., adolescence/young adulthood, middle age, and older adulthood) to ensure balanced representation across waves [39]. Notably, no post-secondary diploma/certificate refers to individuals who did not complete any education beyond high school, while a trade school diploma/apprenticeship includes certifications in trades such as plumbing, carpentry, etc. Occupation was only collected at T7.

Psychological distress

Psychological distress (PD) was assessed using the Kessler Psychological Distress Scale (K10), a validated instrument measuring distress over a 30-day period. The internal consistency of the K10 has been reported as $\alpha = 0.88$ in previous studies [40]. Responses ranged from 0 (“none of the time”) to 4 (“all of the time”). Total Scores from T3, T4, T7, and T8 were standardized to a 40-point scale to ensure comparability across waves. A total score of ≥ 9 was used to indicate high PD, consistent with established thresholds for mental disorders [40, 41]. The

Cronbach's alpha of the K10 in this study ranged from 0.87 to 0.89, indicating good reliability across all waves.

Stressors during the pandemic

Stressors were measured using the exposure scale, with assessments at T7 and T8. Participants responded to a series of questions reflecting their experiences during the pandemic. Appendix 1 lists the detailed questions to evaluate the stressors. At T7, participants answered five binary “yes” or “no” questions about their COVID-19 experiences. They were asked whether they had received a positive COVID-19 diagnosis (Stressor-1 T7); whether anyone in their household had tested positive (Stressor-2 T7); whether they knew family members or friends who had tested positive (Stressor-3 T7); whether they had lost a loved one to COVID-19 (Stressor-4 T7); and, whether they experienced difficulties meeting basic needs (such as food, money, or shelter) due to the pandemic (Stressor-5 T7). At T8, the questions became more nuanced and focused on financial and employment impacts, requiring transformation to binary outcomes (“no improvement” or “yes”) for analysis. Participants were asked: whether their financial hardship had worsened in the past 12 months (Stressor-1 T8); whether they currently faced financial hardship (Stressor-2 T8), if their income had changed over the past 12 months (Stressor-3 T8); whether their employment situation had changed (Stressor-4 T8); and, whether COVID-19 had affected their health (Stressor-5 T8).

Statistical analysis

Data analysis was performed using R Core Team (2024), version 4.4.0. The Wilcoxon rank-sum test and Chi-square test were used to test for group differences in the following sociodemographic characteristics: age, sex, language, ethnicity, marital status, education, and occupation. To examine the longitudinal relationships between changes in LS and sociodemographic characteristics, mixed-effects logistic regression analyses were conducted. Given the extended interval between T4 (2014–2015) and T7 (2022–2023), time was modelled as a categorical variable (T3, T4, T7, and T8) in our models, rather than as a continuous variable (to avoid linearity assumptions). This allows for non-linear changes in LS across waves without assuming a constant rate of change over time. Mixed-effects models with random intercepts for participants were also used to account for within-individual correlations across repeated measures. Additionally, both time-varying covariates (e.g., age, marital status) and time-invariant characteristics (e.g., ethnicity) were included to account for changes related to aging and life course transitions. As such, differences observed at T7 reflect cumulative changes since T4 and should not be interpreted as just due to the COVID-19 pandemic.

Missing data were minimal across predictor variables, with the highest proportion in education (<16% in all analyses). For other sociodemographic variables, PD, and stressors during the pandemic, the missing rate was <5%. Multiple imputations with 10 iterations were used to address the missingness in sociodemographic characteristics. The Missing at Random (MAR) assumption prior to multiple imputation was checked, and chi-squared tests supported it. Therefore, multiple imputation was appropriate for addressing missing values in those variables. The imputed datasets were then used for further analyses. We conducted sensitivity analyses by broadening the selection criteria to include participants with at least 3 valid responses for LS across all waves, enabling a comparison between the complete ($n=893$) dataset and the dataset with at least 3 time points of LS information ($n=1,159$).

To explore whether stressors during the pandemic influence LS at T8, a multivariate logistic analysis was conducted, controlling for LS at T7 and sociodemographic characteristics. Given the low proportion of missing data across predictors included in the analysis (<5%), including key variables such as PD, listwise deletion was used. A sensitivity analysis for this subset was conducted using multiple imputation with 10 iterations, allowing comparison of findings from listwise deletion and imputed datasets. We also tested the MAR assumption again prior to multiple imputation by conducting chi-squared tests to evaluate the relationship between missingness in education and LS. Missingness in education was not significantly associated with LS ($\chi^2=0.23$, $p=0.63$), supporting the MAR assumption.

For all the above-mentioned analyses, univariate logistic regression was first performed. Variables with p -values < 0.2 were included in the initial multivariate model building process. The selection of interaction terms was based on the literature and the critical roles of variables in our objectives [42, 43], and we identified one for the association between stressors during the pandemic and LS in 2024 (T8). Multicollinearity was assessed using the variance inflation factor (VIF) and generalized variance inflation factor (GVIF), with $GVIF^{1/(2 \times df)} \leq 5$ indicating acceptable non-collinearity [44]. Backward stepwise regression was applied to derive the final adjusted model, and model fit was evaluated using the likelihood ratio test.

Results

Characteristics of the study cohort

A total of 893 participants with four waves data of LS were included in the main analysis, and 747 in the recent LS at T8 (Fig. 1). For longitudinal LS trends, 59.2% of participants were classified as having high LS at T3. The cohort had a median age of 48 years at T3. Age

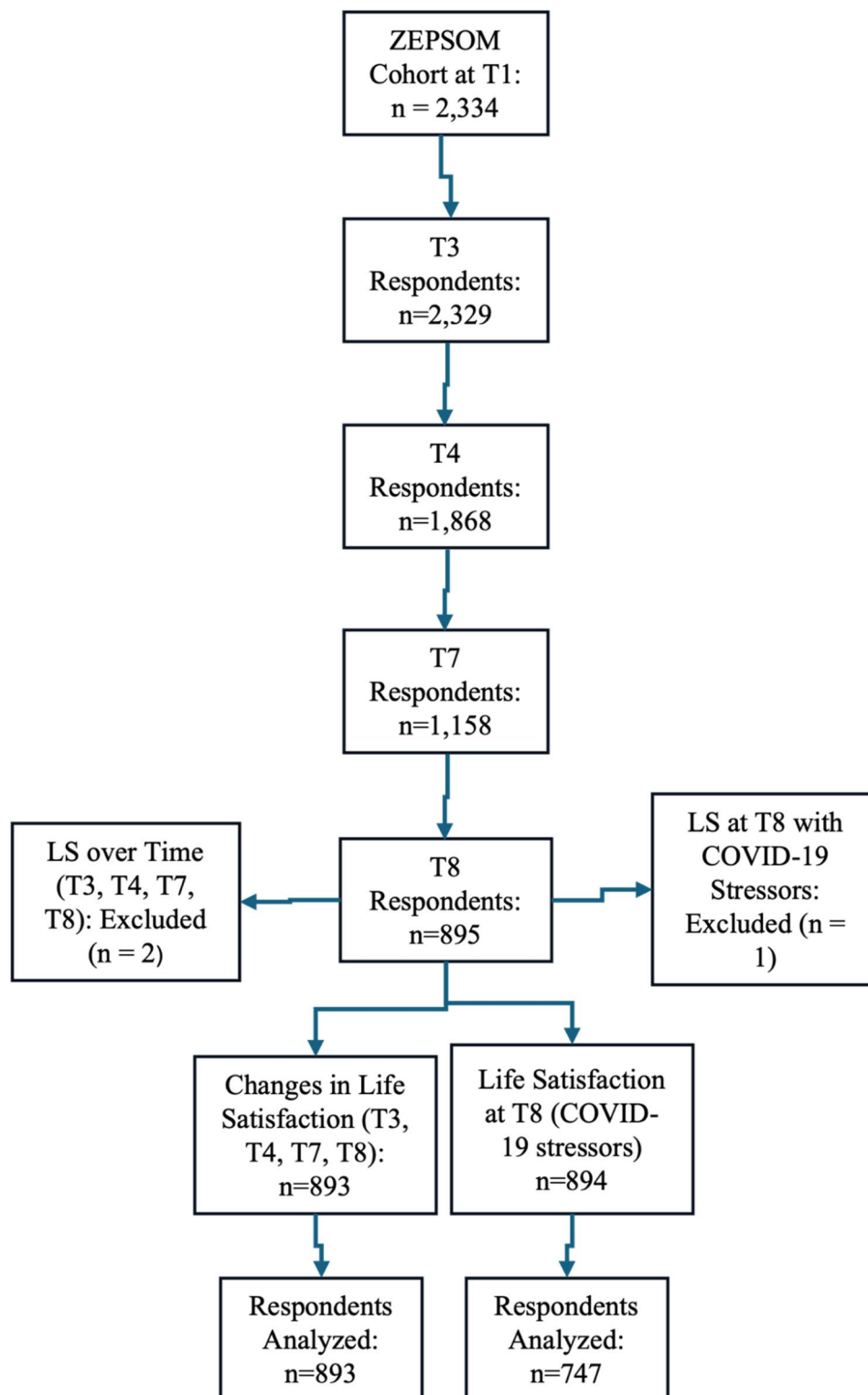


Fig. 1 Flowchart of participant selection across waves; missing LS includes “don’t know,” “refusal,” “not stated”

Table 1 Sociodemographic characteristics of study cohort on the longitudinal trend of LS

Variable	Count or Mean or Median	Percentage (%)
Age at T3	mean (46.2); median (48)	
14-39	285	31.9
40-59	439	49.2
60+	169	18.9
Age at T7	mean (56.9); median (58)	
14-39	107	12.0
40-59	363	40.6
60+	423	47.4
Sex		
Female	560	62.7
Male	333	37.3
Language		
English/French	793	88.8
Others	100	11.2
Immigration status		
Immigrant	143	16.0
Non-immigrant	750	84.0
Occupation at T7		
Professional/Managers	214	24.0
Services/Labour	553	61.9
Technical/Administrative Work	126	14.1
Ethnicity		
White	801	89.7
Non-White	92	10.3
Education level at T3		
No post-secondary diploma/certificate	68	7.6
Community college/University certificate	290	32.5
Trade school diploma/apprenticeship	132	14.8
University Degree	403	45.1
Marital status at T3		
Single	277	31.0
Couple	449	50.3
WDS ^a	167	18.7
Marital status at T7		
Single	241	27.0
Couple	454	50.8
WDS ^a	198	22.2
PD ^b at T3		
T3 High Distress	311	34.8
T3 Low Distress	582	65.2

N = 893

^aWDS: Widowed/divorced/separated^bPD: Psychological Distress

distribution was relatively balanced, with the largest proportion in the 40–59 age group at T3 (49.2%) and the 60+ group at T7 (47.4%). About half of the cohort (45.1%) held a university degree, were married or in common-law

Table 2 Multivariate Associations of Life Satisfaction Changes with Time, Sociodemographic Factors, and Psychological Distress

	AOR ^c	95% CI ^d	p-value
Age, years			
14-39	1.00		
40-59	0.73	0.55 – 0.96	0.026*
60+	1.12	0.80 – 1.57	0.517
Marital Status			
Married	1.00		
Single	0.40	0.31 – 0.52	<0.001***
WDS ^a	0.56	0.42 – 0.75	<0.001***
PD ^b			
Low	1.00		
High	0.14	0.12 – 0.18	<0.001***
Data collections			
T3	1.00		
T4	1.12	0.88 – 1.42	0.360
T7	0.71	0.55 – 0.91	0.008**
T8	0.66	0.51 – 0.85	0.001**

N = 893

^aWDS: Widowed/divorced/separated^bPD: Psychological Distress^cAOR: Adjusted Odds Ratio^dCI: Confidence Interval

(50.3%), and one-third (34.8%) reported high PD at T3. Table 1 details all the sociodemographic characteristics and PD of this study cohort. Appendix 2 provides the sociodemographic characteristics of the study cohort on the most recent LS in 2024.

Longitudinal trends of LS and its associated sociodemographic characteristics before and after the outbreak of the pandemic

The longitudinal trend of LS showed a significant decline during COVID-19 compared to pre-pandemic levels. Participants at T7 were less likely to report high LS compared to those at T3 (pre-pandemic) (adjusted odds ratio [AOR]: 0.71, 95% CI: 0.55–0.91, $p < 0.01$) (Table 2). At T8 (12 months later), participants also had lower odds of reporting high LS compared to T3 (AOR: 0.66, 95% CI: 0.51–0.85, $p = 0.001$). Notably, there was no significant difference in LS was observed between T3 and T4 (AOR: 1.12, 95% CI: 0.88–1.42, $p = 0.360$), indicating a stable pre-pandemic baseline. Age, marital status, and PD were associated with changes in LS (all p -value < 0.05). Middle-aged participants were less likely to report high LS compared to younger participants (AOR: 0.73, 95% CI: 0.55–0.96, $p < 0.05$). Both singles (AOR: 0.40, 95% CI: 0.31–0.52, $p < 0.001$) and those who were widowed/divorced/separated (AOR: 0.56, 95% CI: 0.42–0.75, $p < 0.001$) had lower odds of reporting high LS compared to their counterparts. Participants with high PD were less likely to report high LS compared to those with low PD (AOR: 0.14, 95% CI: 0.12–0.18, $p < 0.001$).

Sensitivity analyses on different sample selection criteria generally yielded consistent findings, with two different findings (Appendix 3). In the sample framework of having at least three waves of data on LS, participants with a university degree were found to have significantly higher LS than those without a post-secondary diploma/certificate, with an odds ratio (OR) of 1.77 (95% CI: 1.15–2.74, $p=0.01$). T7 was not associated with LS compared to T3, with an AOR of 0.81(95% CI: 0.66–1.01, $p=0.062$).

Associations between stressors during the pandemic and the most recent LS in 2024

LS in 2024 was significantly associated with stressors during the pandemic in 2023/2024, even after adjusting for marital status, PD, and prior LS at T7 (detailed in Table 3). Among these stressors, participants with a change in income over the past 12 months were less likely to report a higher level of LS (AOR: 0.57, 95% CI: 0.34–0.97, $p=0.036$). We also tested interactions between these stressors, sociodemographic factors, and PD. While no significant interactions with sociodemographic factors emerged, a significant interaction between stressors and PD was found at T8. Participants with high PD who were currently facing financial hardship were less likely to report higher levels of LS (AOR: 0.17, 95% CI: 0.05–0.49, $p=0.002$). Overall, findings for the most recent LS were largely consistent between the complete-case analysis and the sensitivity analysis that included participants with incomplete stressor data. One inconsistent finding is that in the sensitivity analysis (Appendix 4), financial hardship was not significantly associated with LS (AOR: 0.69, 95% CI: 0.43–1.09, $p=0.114$), suggesting caution in interpreting this result.

Discussion

The present study provided one of the first pieces of evidence on the changes in LS over a 12-year period in a longitudinal community-based population cohort. The availability of data as late as 2024 offers a unique opportunity to explore the long-term changes and address critical gaps in the literature on the trends of LS. Certain sociodemographic factors, PD, and stressors during the pandemic were associated with changes in LS over time and the most recent LS in 2024. Lower levels of LS were observed at T7 and T8 compared to pre-pandemic levels. These lower levels persisted at T8, with no evidence of recovery to pre-pandemic levels, which may be tied to financial struggles. Among sociodemographic factors, marital status was one of the key predictors for changes in LS, with singles and those with high PD being less likely to report higher LS. Sensitivity analyses using relaxed inclusion criteria ($N=1159$), generally yielded consistent results with the primary analysis ($N=893$), with similar directions and magnitudes of associations

Table 3 Associations between Stressors during the pandemic and life satisfaction in 2024 (T8)

	OR ^h	95% CI ⁱ	p-value
<i>Final Model (n=747)</i>			
Life Satisfaction T7			
Low	1.00		
High	3.70	2.57-5.33	<0.001***
Marital status			
Married	1.00		
Single	0.58	0.38-0.88	0.011*
WDS ^a	0.86	0.55-1.34	0.498
PD ^b			
Low	1.00		
High at T7	0.61	0.41-0.92	0.017*
High at T8	0.58	0.38-0.88	0.009**
Stressors at T8			
Stressor-1 T8 ^c	0.71	0.44-1.16	0.170
Stressor-2 T8 ^d	1.08	0.53-2.24	0.843
Stressor-3 T8 ^e	0.57	0.34-0.97	0.036*
Stressor-4 T8 ^f	0.69	0.39-1.22	0.206
Stressor-5 T8 ^g	0.80	0.54-1.18	0.268
High PD at T8 ^j			
Stressor-2 T8 ^k	0.17	0.05-0.49	0.002**

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^aWDS = Widowed/divorced/separated (but still married)

^bPD: Psychological Distress

^cStressor-1 T8: How has your financial Hardship Changed during the past 12 months?

^dStressor-2 T8: Do you currently face any financial hardship?

^eStressor-3 T8: How has your income changed during the past 12 months?

^fStressor-4 T8: How has your overall employment changed during the past 12 months?

^gStressor-5 T8: How has COVID-19 affected your own Health?

^hOR: Odds Ratio

ⁱCI: Confidence Interval

^j*: Notation for interaction

^k: $n=85$ for this specific interaction cell

across key variables, including age, marital status, PD, and time points. For example, middle-aged participants (40–59 years), single individuals, and those with high PD consistently showed lower odds of higher LS across both analyses. A notable difference was observed for education, which reached statistical significance only in the sensitivity cohort. Overall, these findings suggest that the retained sample remained broadly comparable to the larger cohort and that the results are robust in the face of potential selection bias due to attrition. Regarding the association between stressors during the pandemic and LS at T8, participants who experienced income changes over the last 12 months at T8 and those with high PD who currently faced financial hardship at T8 were less likely to have higher LS.

A longitudinal trend of LS

Compared to pre-pandemic levels, LS was lower at T7 and remained lower at T8. No recovery to pre-pandemic levels was observed by 2024. Notably, the absence of a significant difference between T3 and T4 suggests that LS remained relatively stable during the pre-pandemic period. The subsequent decline observed at T7 and T8 suggests a decline from previously stable levels, although this should be interpreted with caution given the extended interval between T4 and T7. These findings are in line with Pan et al. [9], who found similar declines in LS in China, and Ammar et al. [44], who reported a global decrease in LS during early pandemic confinement. The lack of partial recovery may be explained using set-point theory, which suggests that LS is generally stable but may temporarily decline following major life events before returning toward “typical states” [33]. In the present study, LS did not return to pre-pandemic levels by T8, which may reflect the extended or long-term fluctuations caused by adverse conditions that prevent back to their “typical states,” rather than a permanent shift. Notably, no other study has examined LS trajectories as late as T8 (July 2023–April 2024), limiting direct comparison. In 2020, a German study found stable LS after an initial decline [45], and concluded that the stability in lower LS may persist for several years post-onset of COVID-19. One possible contextual factor related to lower observed LS in 2024 is the shifting financial landscape in Canada. In 2024, 32.8% of Canadians reported facing financial difficulties, a substantial increase from 18.6% in 2021 [46]. Notably, unemployment does not appear to be a key driver of this decline, as total employment had fully recovered by January 2023, with a net gain of approximately 800,000 full-time jobs surpassing pre-pandemic levels [47]. By spring 2024, nearly 45% of Canadians reported that rising prices were significantly straining their finances, a 12% increase from spring 2022 [37]. These patterns may reflect broader economic conditions in Canada, such as inflation and rising cost of living; however, these factors were not directly measured in this study and should therefore be interpreted as contextual considerations rather than direct explanations for the observed associations with LS.

Associations between changes in LS and sociodemographic and psychological factors

The study's findings on middle-aged adults are consistent with existing literature, where they often face significant life stressors, such as employment challenges, marriage, child-rearing, and midlife crises (e.g., divorce, death of parents, job loss, etc.), all of which are linked to reduced LS [48–50]. The findings on marital status also align with longstanding research showing that married individuals reported higher level of LS than singles [14, 51–53],

likely due to married individuals having stronger and more supportive social connections [54, 55]. In terms of PD, the findings aligned with several studies reporting a global rise in distress from pre-pandemic levels to the first wave of COVID-19 [56, 57]. A meta-analysis with pooled adjusted estimates found an inverse relationship between PD and LS, with similar direction and effect sizes in binary outcomes [58]. Our findings indicate that this inverse association persisted over the long term and was observed through April 2024. High PD can continuously affect LS, as prolonged emotional distress can strain well-being, hinder resilience, and reduce one's capacity to manage stressors effectively [59]. We found mixed results on the relationship between education and changes in LS. It was not a significant predictor for LS in the complete dataset, but in the large cohort with more relaxing selection criteria. Specifically, university-educated participants were more likely to report a higher level of LS, consistent with previous Canadian findings that individuals with a university degree report the highest LS compared to those with only a high school diploma or less, both before and during the pandemic [14, 60]. This may be due to higher educational attainment fostering greater self-control over one's environment, higher self-esteem, and a more optimistic outlook on the future [60]. Individuals with higher levels of education tend to have more robust social networks, which can enhance their ability to manage negative emotions, such as loneliness, through stronger social support [60]. Lastly, occupation and immigration status may not influence LS as strongly as hypothesized.

Associations between LS in 2024 and the stressors during the pandemic

We found that a lower level of LS in 2024 was more likely to be reported by participants facing financial challenges, particularly those experiencing changes in income over the past 12 months and individuals with high PD who were also facing financial hardship during 2023–2024. These findings suggest that low LS may be less directly attributable to the virus itself and more closely linked to its secondary impacts on a broader socioeconomic consequence (e.g., financial hardship, inflation, cost of living, etc.). The critical role of financial stability in LS has been well documented in the literature, regardless of crisis context [61, 62]. According to Maslow's hierarchy of needs, financial stability is integral to satisfying safety needs, the second tier of the hierarchy following the fulfillment of basic physiological needs. Financial satisfaction, which encompasses income stability, has consistently been identified as one of the strongest predictors of LS [63]. However, in our study, given that PD and LS were assessed concurrently at T8, it is notable that these associations may reflect bidirectional aspects of well-being

rather than strictly unidirectional effects. Nonetheless, this interaction indicates that the negative association between financial hardship and LS at T8 was more pronounced among individuals with high PD (compared to those with low PD), suggesting that PD may amplify the impact of financial stress on well-being, aligning with prior research linking financial worries with higher PD [64, 65]. Financial stressors may also influence well-being across multiple domains, compounding the adverse effects of PD. Notably, COVID-19 stressors at T7 were not associated with LS at T8 after controlling for other covariates. This can be explained in part by the financial landscape not being as bad in 2021, when 18.6% of Canadians experienced financial hardship, compared with 32.8% in 2024 [46]. In addition, 8.9 million Canadians mitigated pandemic-related financial impacts through reduced household spending and substantial fiscal support programs, such as the Canada Emergency Response Benefit and Employment Insurance. Consequently, household savings increased during that period, may have mitigated some of the negative impacts of COVID-19 on LS [66, 67]. The extra savings from households, may have delayed the association between pandemic-related stressors at T7 and lower LS observed at T8, with inflation now having a greater impact [37, 47]. While the change in employment status at T8 was not statistically significant in either analysis, its proximity to the significance threshold in the sensitivity cohort (Table 3 in the appendix) suggests that employment stability during the pandemic may be associated with LS. Pandemic-related employment changes could interact with other stressors or sociodemographic factors in ways not fully captured in the main model. Future studies could explore this interaction more flexibly, treating occupation as a variable that evolves over time rather than as a fixed factor, to gain deeper insights. Notably, our findings diverge from studies in China, where infected individuals or those who infected friends or family reported lower levels of LS [9]. This discrepancy may be related to differences in public health control measures and socio-cultural factors [68]. Additionally, individuals with higher LS at T7 were more likely to maintain higher LS at T8, reflecting the general stability of LS over time [33, 45].

Strengths and limitations

The study analyzed a unique longitudinal cohort that has been repeatedly measured at four time points over 12 years and assessed how LS has changed over this period, including the period across pre- and post-pandemic time points. It included measuring LS during the late COVID-19 pandemic. Importantly, this study also addressed gaps in existing research by identifying specific stressors—namely, financial hardship—which were associated with LS in 2024.

However, there are several limitations to note. First, although LS has been repeatedly measured over time, the latest collection of the study's pre-pandemic data was completed by April 2015 (T4). No data was collected immediately before the outbreak, and pandemic-phase data collection began relatively late in mid-2022 (T7). Thus, the observed differences in LS before- and after-the outbreak of pandemic cannot be solely attributed to the COVID-19 pandemic, since other societal or economic also had changed between 2015 and 2022. In addition, restricting the primary analysis to participants with complete LS data across all waves ($n=893$) may introduce attrition bias, as individuals lost to follow-up over the 12-year period may differ systematically from those retained. Although sensitivity analyses using a broader sample yielded consistent results and suggested minimal impact on the main findings, the possibility of loss-to-follow-up bias cannot be fully excluded. Thirdly, LS was assessed using a single-item measure and dichotomized using a cut-off of ≥ 8 , consistent with OECD recommendations. While this approach allows for interpretation and comparability with prior studies, single-item measures may not fully capture the multidimensional nature of LS, and dichotomization may result in loss of information and reduced statistical power compared to modeling LS as a continuous or ordinal variable. Future studies may benefit from using more comprehensive measures and alternative modelling approaches to capture nuanced variations in LS. Fourth, the study relied on self-reported measures for most variables, including stressors during the pandemic, which may be subject to recall and reporting bias. In addition, these stressors were assessed using non-validated measures that differed between two waves, reflecting variations in survey design and evolving pandemic conditions. Although these measures were intended to capture similar domains of stress during the pandemic (e.g., financial and material hardship), the lack of standardization may limit direct comparability across time points and complicate interpretation of longitudinal associations. Therefore, findings should be interpreted as reflecting broader stress rather than specific stressor items. Fifth, PD and LS may have a bidirectional relationship, as both constructs capture related aspects of well-being. Although PD was modeled as a predictor of LS, it was also assessed concurrently with LS at T8, raising the possibility of reverse causation. This limits the causal interpretation of these associations. Future studies using longitudinal designs may help clarify the directionality of these relationships. Lastly, the study cohort was derived from a population-based cohort, which may limit the generalizability of the research findings to other population settings, as pandemic experiences vary globally. Future studies would benefit from more geographically

diverse samples to consolidate the findings on LS in pandemic and post-pandemic contexts.

Implications

The findings of this study highlight the need to develop sustained public health and mental health interventions, particularly during prolonged crises. While financial intervention programs may have helped mitigate some of the immediate impacts of the pandemic, the broader psychological and economic consequences may not be entirely resolved but may re-emerge over time. This may require continued public health efforts to support well-being beyond the acute phase. Policies should target identified stressors (e.g., financial hardship) and vulnerable groups (e.g., middle-aged individuals, singles, or those with PD) to ensure long-term resilience and recovery.

Conclusion

Overall, LS was lower in the pandemic and post-pandemic periods compared to pre-pandemic levels. Factors, including marital status, age, and having a PD were associated with the changes in LS over time. Certain stressors during the pandemic were associated with lower LS in 2024, highlighting the continued relevance of these stressors in relation to LS. Importantly, the findings suggest that the negative association between financial hardship and LS was more pronounced among those with higher PD, underscoring the importance of an integrated approach that address financial hardship alongside PD, specifically among those already experienced elevated distress. The findings of the study deepen our understanding of long-term changes in LS and the factors associated with well-being during prolonged crises, and suggests more attention to vulnerable populations, particularly individuals facing psychological distress.

Future research is encouraged to apply longitudinal cohort designs with longer follow-up to further clarify these associations. While causal inferences cannot be established, the observed associations point to the potential importance of an integrated approach that address both financial and psychological stressors. A multi-sectoral approach, including initiatives to enhance social connection, improve access to mental health services, and provide financial support, may be beneficial.

Abbreviations

AOR	Adjusted odds ratio
CI	Confidence Interval
GVIF	Generalized Variance Inflation Factor
K10	Kessler Psychological Distress Scale
LS	Life Satisfaction
MAR	Missing At Random
OECD	Organisation for Economic Co-operation and Development
OR	Odds ratio
PD	Psychological Distress
T3	Third wave of data collection (2012–2013)
T4	Fourth wave of data collection (2014–2015)
T7	Seventh wave of data collection (2022–2023)

T8	Eighth wave of data collection (2024)
WDS	Widowed/divorced/separated
ZEPSOM	Zone d'Épidémiologie Psychiatrique du Sud-Ouest de Montréal

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-026-27735-0>.

Supplementary Material 1: Appendix 1. Self-Developed Exposures During the Pandemic Scale. Appendix 2. Sociodemographic characteristics of the study cohort on the recent LS in 2024. Appendix 3. Sensitivity Analysis of Life Satisfaction Over Time Adjusting for Sociodemographic Factors and Psychological Distress. Appendix 4. Associations Between COVID-19 Stressors and Life Satisfaction at T8 in Participants with Incomplete COVID-19 Data.

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Authors' contributions

XW, YS, MJF, CD, ML, CB, DM, and XM were major contributors to writing the manuscript. Additionally, XW, ML, XM, and SN assisted in analyzing and interpreting participant data. Lastly, JC and XM played a major role in data collection across several waves. All authors read and approved the final manuscript.

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Data availability

The ZEPSOM data is currently not freely available to researchers in general due to ethical and data management requirements. Interested researchers can directly contact the Research Team at: zepsom.coordo@douglas.mcgill.ca.

Declarations

Ethics approval and consent to participate

Ethics approval was granted by the Douglas Mental Health University Institute Ethics Committee. All procedures complied with the ethical standards of the relevant institutional and national research committees and with the 1975 Helsinki Declaration, as revised in 2000. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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