RESEARCH

Social support predicted subsequent subjective well-being during the COVID-19 pandemic: a prospective study

Yanhui Mao[1,2], Junpeng Chen[3], Xinqi Liu[1], Junhua Dang[4,5,6*] and Helgi B. Schiöth[6]

Abstract

Background Subjective well-being (SWB) is associated with social support in cross-sectional studies. However, it remains unclear whether and how social support predicts SWB longitudinally, especially during the COVID-19 contingency.

Methods By adopting a prospective design, the current work addressed this research question in a sample of 594 participants from the U.K. The data were collected via the online platform, Prolific, at two time points (June, 2020 and August, 2021) with a 14-month interval. Descriptive analysis and a moderated mediation model were conducted to test the proposed hypotheses.

Results Baseline social support was a significant predictor of subjective well-being (SWB) 14 months later, even after controlling for baseline SWB and other covariates such as personality traits. Additionally, affect balance (i.e., the affective component of SWB) fully mediated the link between baseline social support and subsequent life satisfaction (i.e., the cognitive component of SWB). Moreover, household income moderated this relationship, indicating a stronger mediation for individuals with lower monthly household income.

Conclusion The present work sheds light on the underlying mechanism and boundary condition of the association between social support and different components of SWB during the COVID-19 pandemic.

Keywords Social support, Affect balance, Life satisfaction, Subjective well-being

Background

The COVID-19 pandemic has had a significant impact on people's lives and mental health, leading to post-traumatic stress symptoms, confusion, financial loss, and increased rates of depression and anxiety disorders [1, 2]. To address these issues, recent studies have emphasized the importance of social support in mitigating the negative psychological effects caused by the quarantine [1], such as alleviated stress [3–5], lower loneliness [6–7], reduced anxiety [8, 9], and less depression [10]. The current paper focuses on the relationship between social support and subjective well-being (SWB) during the COVID-19 pandemic. Although studies have revealed

*Correspondence:
Junhua Dang
dangjunhua@gmail.com
[1]Institute of Applied Psychology, Psychological Research and Counseling Center, Southwest Jiaotong University, Chengdu, China
[2]Department of Psychology and Behavioral Sciences, Zhejiang University, Hangzhou, China
[3]School of Social and Behavioral Sciences, Nanjing University, Nanjing, China
[4]School of Education, Huaibei Normal University, Anhui, China
[5]Anhui Engineering Research Center for Intelligent Computing and Application on Cognitive Behavior (ICACB), Anhui, China
[6]Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

Mao *et al. BMC Public Health*   (2024) 24:943

Page 2 of 9

a positive association between social support and SWB after the outbreak of the pandemic [11, 12], their limitations warrant attention. Firstly, these studies adopted cross-sectional designs, which provide very limited information for causal interpretations. Secondly, these works failed to consider the underlying mechanisms through which social support predicts SWB. Lastly, the boundary conditions of the relationship between social support and SWB have rarely been investigated.

Therefore, in this paper, we adopted a prospective design to investigate the predictive effect of social support on subsequent SWB during the COVID-19 pandemic. Specifically, in a sample of citizens living in the U.K., we tested the underlying mechanism of how perceived social support longitudinally predicted the cognitive component of SWB (i.e., life satisfaction) through the affective component of SWB (i.e., affect balance), after controlling for the baseline measure of SWB and other confounding factors such as personality traits. We also tested the boundary condition of when social support could predict future life satisfaction via affect balance by considering people's household income.

Social support

Social support has been studied enormously in past decades considering its significance in coping with disasters or crises [13]. Social support includes a variety of social interactions between friends, family members, neighbours, and others [14], and is usually defined as the existence or availability of those people on whom we can rely, and of those who let us know that they care about, value, and love us [15]. Social support is also believed to be supplied by the community, social networks, and confiding partners [16].

In terms of its conceptualization, social support can be defined by both a main effect model and a buffering effect model [17]. The main effect model conceptualizes social support as the extent to which a person is integrated in a large social network, whereas the buffering effect model conceptualizes social support as the availability of interpersonal resources that are responsive to the needs elicited by stressful events. Embeddedness in a social network is conducive to well-being because it precludes negative feelings resulting from social isolation and induces positive feelings of stability, predictability, and self-worth. However, the mere existence of a social network may not be necessarily beneficial in the face of stress. Instead, coping with stress requires the social network to provide relevant means and resources. Considering the stressful pandemic during which our study was conducted, we conceptualized social support based on the buffering effect model.

In general, the availability of interpersonal resources can be measured in two ways: One is the available assistance perceived by individuals, while the other is what they actually receive. It has been found that the former had greater influence on people's mental well-being [18]. Similarly, compared with received social support, perceived social support also has a more substantial effect on various physical health outcomes such as cardiovascular disease and mortality [19]. Therefore, although social support can be gained from multiple sources and providers, what really matters is how people perceive the support they have received. In this paper, we aim to investigate how perceived social support is associated with different components of SWB.

SWB

SWB encompasses both cognitive and affective aspects to measure an individual's level of well-being [20]. The cognitive component of SWB, often referred to as life satisfaction, represents an individual's overall evaluation of their life based on their personal values, priorities, and what the person deems important [21–23]. The affective component of SWB consists of both positive affect and negative affect. Positive affect includes a person's desirable or pleasant emotions, such as enjoyment, gratitude, and contentment, whereas negative affect contains unwanted or unpleasant emotions, such as anger, sadness, and worry [24]. The coexistence of positive affect and negative affect is referred to as affect balance, which is distinct from but correlated with life satisfaction [25, 26].

Importantly, affect balance is often considered as an important information source of life satisfaction, with substantial studies reporting the mediation role played by affect balance in the relationship between various measures and life satisfaction [27, 28]. When people judge life satisfaction, they need to consider various aspects of their lives. According to the affect-as-information hypothesis [29], people typically rely on their affect balance (i.e., the extent to which they feel good or bad) to evaluate their life satisfaction (i.e., the extent to which they are satisfied with their lives). That is, affect balance is one of the most critical inputs of life satisfaction judgment. In line with this reasoning, it has been found that affect balance could mediate the effects of many predictors on life satisfaction, such as emotional intelligence [30, 31], self-esteem [32], social capital [33], and positive life attitudes [34]. However, these results were mainly based on cross-sectional studies. It remains unknown whether affect balance could mediate social support's predictive effect on life satisfaction, especially in a prospective design.

Social support and SWB

The idea that social support has a positive effect on health and well-being is widely accepted. When it comes to SWB, it has been consistently found that social support

is associated with better affect balance and higher life satisfaction, both before the COVID-19 pandemic [30, 35], and during the pandemic [11]. However, the designs adopted in these studies are cross-sectional, which limits causal inferences. Therefore, in the current study, we aim to adopt a prospective design to test whether the baseline measure of social support could predict future affect balance and life satisfaction after controlling for the baseline measures of affect balance and life satisfaction. Considering that people often rely on their affect balance to evaluate their life satisfaction and that affect balance could mediate the effects of many predictors on life satisfaction, we will also test whether future affect balance mediates the relationship between baseline social support and future life satisfaction. We propose the following hypotheses.

Hypothesis 1 Baseline social support predicts subsequent affect balance.

Hypothesis 2 Baseline social support predicts subsequent life satisfaction.

Hypothesis 3 Subsequent affect balance mediates the relationship between baseline social support and subsequent life satisfaction.

Meanwhile, based on conservation of resources theory, the association between perceived social support and SWB might be moderated by household income. According to this theory, in order to protect themselves and cope with the challenges of daily life, individuals have to acquire and safeguard relevant resources, which include material resources such as money and properties, intrapersonal resources such as self-efficacy and growth mindsets, and interpersonal resources such as social support [36, 37]. Importantly, different types of resources can compensate for each other. For example, growth mindsets are particularly helpful in buffering against the deleterious effects of poverty on academic achievement [38, 39]. In our context, coping with stressful events such as the COVID-19 pandemic consumes resources, which in turn negatively affects well-being. However, such effect may vary depending on possessed material resources. Compared with rich people, those with low monthly household income tend to face more difficulties during the pandemic due to their lack of control in many domains of their lives [40–42], which makes them rely more on other types of resources such as social support. Therefore, we propose the following hypotheses.

Hypothesis 4 Household income moderates the mediating effect of affect balance in the relationship between social support and life satisfaction, such that the medi-

ating effect is stronger for people with lower household income.

In order to rule out the confounding effects of demographic and personality factors, we control for age, gender, education, and the Big-Five personality traits when we test this proposed model (both the mediation and the moderated mediation).

Methods
Measures
Social support
The 12-item *Multidimensional Scale of Perceived Social Support* (MSPSS), developed by Zimet et al. [43], was applied in our study. It provides a measure of perceived support across three different dimensions (i.e., family, friends, and significant others), contributing to the understanding of an individual's perceived availability of social support in their life, thus operationalizing functional support due to its focus on the functional aspects of support rather than the structural characteristics of social networks [14]. Sample items were "*My family really tried to help me*" and "*There is a special person who is around when I am in need*". Responses for each item were ranked on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The internal consistency (Cronbach's alpha) was 0.93.

Affect balance
We adopted the 12-item *Scale of Positive and Negative Experience* designed by Diener and colleagues to measure affect balance. This scale was designed to assess subjective feelings of positivity and negativity and has been shown to converge well with other measures of emotions [25]. This scale includes six items to assess positive affect (e.g., pleasant) and six items to assess negative affect (e.g., unpleasant). Respondents were asked to report how often they had experienced each of the twelve feelings measured in the scale over the past two weeks ("1" = "very rarely or never", and "5" = "very often or always"). Cronbach's alpha was 0.93 for positive affect at T_1, 0.90 for negative affect at T_1, 0.95 for positive affect at T_2, and 0.92 for negative affect at T_2 in the present dataset. Affect balance was obtained by subtracting negative affect from positive affect.

Life satisfaction
The 5-item *Satisfaction with Life Scale* [21], which was designed by Diener and colleagues to measure global cognitive judgments of satisfaction with one's life, was adopted in the present work. Participants were asked to indicate their agreement with each of the five statements (e.g., "*In most ways, my life is close to my ideal*"). Responses were anchored on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with

higher scores indicating better satisfaction. Cronbach's alpha was 0.91 and 0.93 for T_1 and T_2, respectively.

Demographics and personality

We measured gender (1=Male, 2=Female), age, educational level (1=Primary school or less, 2=Lower secondary school, 3=Upper secondary school; 4=Junior college, 5=Bachelor, 6=Master, 7=Doctorate), and monthly household income (1 = £1,000 or less, 2 = £1,000 - £2,000, 3 = £2,000 - £3,000, 4 = £3,000 - £4,000, 5 = £4,000 - £5,000, 6 = £5,000 - £6,000, 7 = £6,000 - £7,000, 8 = £7,000 - £8,000, 9 = £8,000 - £9,000, 10 = £9,000 - £10,000, 11 = £10,000 or more). The Big-Five personality dimensions were measured by the Ten-item Personality Inventory (TIPI), a brief self-report questionnaire used to assess Big-Five personality traits: extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience [44]. Each personality was measured by two adjectives. Sample items were "*I see myself as extraverted and/or enthusiastic.*" and "*I see myself as critical, and/or quarrelsome.*". Participants rated themselves on a scale ranging from 1 to 7, indicating their agreement with each statement. It should be noted that the TIPI is designed to provide a quick assessment of personality traits and is often used in research studies where a more comprehensive measure of personality is not feasible or necessary.

Participants and procedures

U.K. residents were recruited on an online platform (https://www.prolific.co/) for two sessions. In June 2020, 813 participants completed the first session (T_1). They fulfilled the measures of affect balance, life satisfaction, social support, personality traits, and demographic factors, including age, gender, education, and household income. They were paid with £2. In August 2021, 594 participants completed the second session (T_2), in which they fulfilled the measures of affect balance and life satisfaction again. They were paid with £1. Informed consent was obtained from all participants. Compared to participants who completed only the first session (lost group), those who completed both sessions (remaining group) were older (M_{lost_group} = 32.86, $M_{remaining\_group}$ = 42.45, t=9.31, $p<0.001$), included more females (M_{lost_group} = 1.53, $M_{remaining\_group}$ = 1.65, t=3.07, p=0.002), and had lower household income (M_{lost_group}=4.85, $M_{remaining\_group}$ = 3.86, t=4.60, $p<0.001$). However, they had comparable education level (M_{lost_group} = 4.60, $M_{remaining\ group}$ = 4.46, t=1.62, p=0.106). The details are shown in Table 1. We also did Little's test to check the data, which showed that the data was not missing completely at random (MCAR), χ^2=142.32, $p<0.001$. Therefore, we replaced the missing values of each variable with the means of each variable, which yielded similar results as the main results we reported below.

Based on data from the 594 participants who finished both sessions, we tested whether social support measured at T_1 would prospectively predict affect balance and life satisfaction measured at T_2 after controlling for affect balance, life satisfaction, personality traits, and demographic factors measured at T_1. The data are publicly accessible (https://osf.io/j2a8t/?view_only=6368555f2f494472bc77a2d841acc930).

Results

Correlational analysis

Descriptive statistics of all measured variables and correlations among these variables are displayed in Tables 2 and 3, respectively. Results showed that social support measured at T_1 was significantly and positively associated with affect balance and life satisfaction in both sessions. Affect balance measured at T_1 had a high correlation with affect balance measured at T_2. Life satisfaction showed a similar pattern. Therefore, it is essential to control for the baseline measures of affect balance and life satisfaction when estimating the longitudinal relationship between social support and future SWB.

Table 1 The differences in demographics between participants who completed both sessions and those who completed only the first session

Demographics		Participants completed T_1 and T_2 (N=594)	Participants completed only T_1 (N=219)
Age	Mean (SD)	42.45 (13.74)	32.86 (10.93)
Gender	Male	207 (34.8%)	102 (46.6%)
	Female	387 (65.2%)	117 (53.4%)
Educational level	Primary school or less	0 (0.0%)	1 (0.5%)
	Lower secondary school	24 (4.0%)	2 (0.9%)
	Upper secondary school	114 (19.2%)	35 (16.0%)
	Junior college	117 (19.3%)	48 (21.9%)
	Bachelor	251 (42.3%)	95 (43.4%)
	Master	78 (13.1%)	35 (16.0%)
	Doctorate	10 (1.7%)	3 (1.4%)
Monthly household income	£1,000 or less	63 (10.6%)	15 (6.8%)
	£1,000 - £2,000	128 (21.5%)	28 (12.8%)
	£2,000 - £3,000	156 (26.3%)	57 (26.0%)
	£3,000 - £4,000	94 (15.8%)	41 (18.7%)
	£4,000 - £5,000	56 (9.4%)	14 (6.4%)
	£5,000 - £6,000	28 (4.7%)	13 (5.9%)
	£6,000 - £7,000	11 (1.9%)	7 (3.2%)
	£7,000 - £8,000	7 (1.2%)	8 (1.8%)
	£8,000 - £9,000	6 (1.0%)	3 (1.4%)
	£9,000 - £10,000,	3 (0.5%)	7 (3.2%)
	£10,000 or more	42 (7.1%)	30 (13.7%)

Mao *et al. BMC Public Health*   (2024) 24:943

Page 5 of 9

Table 2 Descriptive statistics of all measured variables

Variable	Mean	SD	Skewness	Kurtosis
Age	42.45	13.74	0.34	-0.86
Gender	1.65	0.48	-0.64	-1.60
Educational level	4.46	1.11	-0.30	-0.49
Household income	3.86	2.57	1.56	1.93
Extraversion	3.36	1.53	0.41	-0.70
Agreeableness	4.93	1.18	-0.38	-0.03
Conscientiousness	5.32	1.20	-0.71	0.21
Emotional stability	4.38	1.45	-0.11	-0.79
Openness	4.55	1.18	-0.13	-0.45
Social support	61.50	15.32	-0.75	0.23
T_1 Affect balance	4.20	9.14	-0.18	-0.34
T_1 Life satisfaction	20.07	7.17	-0.29	-0.87
T_2 Affect balance	5.19	9.90	-0.28	-0.41
T_2 Life satisfaction	20.65	7.65	-0.32	-0.89

Mediating effect

We ran Model 4 of the PROCESS macro [45] plugged in SPSS to test whether T_2 affect balance mediated the effect of T_1 social support on T_2 life satisfaction, with T_1 affect balance, T_1 life satisfaction, age, gender, education, and the Big-Five personality traits as covariates. First, the second column in Table 4 showed that T_1 social support (i.e., the predictor) significantly predicted T_2 life satisfaction (i.e., the outcome) after controlling for T_1 affect balance, T_1 life satisfaction, and other covariates (parameter *c* in the mediation analysis), $\beta=0.09$, $p=.011$. Second, as shown in the fourth column in Table 4, T_1 social support (i.e., the predictor) significantly predicted T_2 affect balance (i.e., the mediator) after controlling for covariates (parameter *a* in the mediation analysis), $\beta=0.09$, $p=.011$. Finally, as shown in the sixth column in Table 4, when T_1 social support (i.e., the predictor) and T_2 affect balance (i.e., the mediator) was simultaneously entered, T_1 social support was no longer a significant predictor of T_2 life satisfaction (parameter *c'* in the mediation analysis), $\beta=0.04$, $p=0.203$, whereas T_2 affect balance (i.e., the mediator) was still significant (parameter *b* in the mediation analysis), $\beta=0.59$, $p<0.001$. The bootstrap estimation procedure with 5,000 bootstrapping samples showed that the total effect was 0.044. The indirect effect was 0.027 (61.36% of the total effect), SE$=0.010$, 95%CI [0.007, 0.047] and the direct effect was 0.017, SE$=0.014$, 95%CI [-0.010, 0.044], thus suggesting a full mediation. Note in all regressions, the variance inflation factor for each variable was between 1 and 3, thus showing there is no problem of multicollinearity.

Moderated mediation

We ran Model 7 of the PROCESS macro to test whether monthly household income could moderate the relationship between T_1 social support and T_2 affect balance as well as the mediating effect of T_2 affect balance on the

Table 3 Correlations among all measured variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Age	-												
2 Gender	-0.08*	-											
3 Educational level	-0.14**	0.05	-										
4 Household income	-0.27	-0.02	0.03	-									
5 Extraversion	-0.29	0.12**	-0.03	0.06	-								
6 Agreeableness	0.21**	0.09*	-0.03	0.02	0.03	-							
7 Conscientiousness	0.13**	0.00	-0.01	0.06	0.11**	0.29**	-						
8 Emotional stability	0.18**	-0.14**	0.01	0.04	0.21**	0.37**	0.40**	-					
9 Openness	-0.05	-0.01	0.06	-0.03	0.28**	0.19**	0.17**	0.20**	-				
10 Social support	-0.00	0.06	-0.02	0.11**	0.29**	0.27**	0.34**	0.30**	0.15**	-			
11 T_1 Affect balance	0.14**	-0.05	-0.00	0.11**	0.23**	0.31**	0.35**	0.61**	0.15**	0.47**	-		
12 T_1 Life satisfaction	0.01	0.05	0.05	0.11*	0.20**	0.17**	0.28**	0.40**	0.11**	0.53**	0.68**	-	
13 T_2 Affect balance	0.13**	0.03	-0.01	0.05	0.22**	0.32**	0.32**	0.51**	0.09*	0.45**	0.72**	0.56**	-
14 T_2 Life satisfaction	0.03	0.07	0.08*	0.08	0.23**	0.20**	0.28**	0.37**	0.08	0.49**	0.61**	0.74**	0.76**

* $p<0.05$, ** $p<0.01$

Table 4 Regression results of the mediation

Predictor	T_2 life satisfaction β	T_2 life satisfaction t	T_2 affect balance β	T_2 affect balance t	T_2 life satisfaction β	T_2 life satisfaction t
Covariates						
Age	0.00	0.02	0.02	0.79	-0.01	-0.58
Gender	0.03	1.18	0.05	1.59	0.01	0.28
Education	0.06*	2.30	0.00	0.06	0.06**	2.84
Monthly household income	-0.02	-0.67	−0.04	-1.43	0.01	0.24
Extraversion	0.07*	2.20	0.05	1.56	0.04	1.57
Agreeableness	0.02	0.73	0.08*	2.36	-0.02	-0.87
Conscientiousness	0.03	1.08	0.02	0.69	0.02	0.83
Emotion stability	0.01	0.16	0.09*	2.34	-0.05	-1.57
Openness	-0.06	-1.97	-0.06*	-2.06	-0.02	-0.91
T_1 Affect balance	0.17**	3.91	0.54**	12.19	-0.15**	-3.87
T_1 Life satisfaction	0.55**	13.92	0.09*	2.22	0.50**	15.70
Predictors						
T_1 Social support	0.09*	2.58	0.09*	2.60	0.04	1.26
T_2 Affect balance					0.59**	18.25
R^2	0.58		0.56		0.73	
F	67.10***		62.32**		122.98**	

* $p<0.05$, ** $p<0.01$. $β$ is the standardized coefficient

Table 5 Regression results of the moderation

Predictor	T_2 affect balance β	T_2 affect balance t
Covariates		
Age	0.03	0.89
Gender	0.04	1.50
Education	0.00	0.03
Extraversion	0.05	1.53
Agreeableness	0.08*	2.53
Conscientiousness	0.02	0.62
Emotion stability	0.09*	2.34
Openness	-0.06	-1.90
T_1 Affect balance	0.54**	12.28
T_1 Life satisfaction	0.09*	2.15
Predictors		
Monthly household income	0.20	1.77
T_1 Social support	0.17**	3.37
Social support × Income	-0.27*	-2.19
R^2	0.57	
F	58.27**	

* $p<0.05$, ** $p<0.01$. $β$ is the standardized coefficient

relationship between T_1 social support and T_2 life satisfaction, with T_1 affect balance, T_1 life satisfaction, age, gender, education, and the Big-Five personality traits as covariates. As shown in Table 5, the interactional effect of social support and monthly household income on T_2 affect balance was significant, $β = -0.27$, $p=0.029$. Simple slope analysis showed that social support predicted T_2 affect balance when monthly household income was low (1 SD below the mean), $β=0.09$, $t=3.39$, $p<0.001$. However, when monthly household income was high (1 SD above the mean), social support no longer predicted T_2

affect balance, $β=0.02$, $t=0.53$, $p=0.599$. The pattern is depicted in Fig. 1.

The bootstrap estimation procedure with 5,000 bootstrapping samples revealed a significant moderated mediation, Effect = -0.007, SE=0.003, 95%CI [-0.013, -0.001]. Specifically, the mediating effect of T_2 affect balance on the relationship between social support and T_2 life satisfaction was significant when monthly household income was low (1 SD below the mean), Effect=0.043, SE=0.013, 95%CI [0.018, 0.068], but not significant when monthly household income was high (1 SD above the mean), Effect=0.007, SE=0.014, 95%CI [-0.019, 0.035].

Discussion

Prior studies testing the relationship between social support and SWB were mainly based on cross-sectional surveys. Although a few of studies employed a longitudinal design, they only considered social support and life satisfaction and did not separate SWB into its respective affective and cognitive dimensions [46, 47]. The current paper deepens the current understanding of this relationship by adopting a prospective design and investigating its underlying mechanism and boundary condition, particularly during the COVID-19 pandemic. We found that baseline social support could prospectively predict future life satisfaction via affect balance. This mediating effect was further moderated by household income, such that the mediation was stronger for people with lower monthly household income. Below we will discuss these results in a broader context.

First, results of the correlational analysis indicated that perceived social support was significantly correlated with
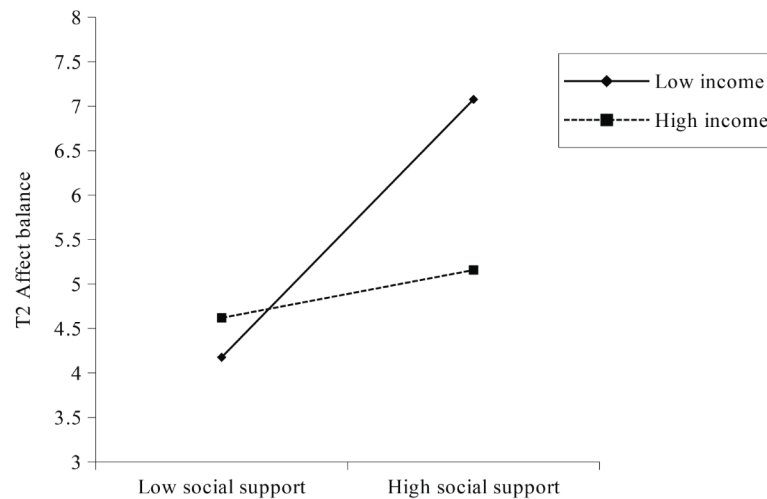
Mao *et al. BMC Public Health*   (2024) 24:943

Page 7 of 9

Fig. 1 The moderating effect of monthly household income on the relationship between T_1 social support and T_2 affect balance after controlling for covariates

affect balance and life satisfaction, both cross-sectionally and longitudinally. This is in accordance with and extends prior cross-sectional studies holding a positive association between social support and SWB [11, 30, 35]. Meanwhile, affect balance and life satisfaction measured at T_1 were strongly correlated with affect balance and life satisfaction measured at T_2, respectively, disclosing that it is necessary to control for the baseline measures of the two components of SWB while estimating the longitudinal relationship between social support and future SWB. Regarding the relationship between income and SWB, previous studies consistently found a positive association at a specific time point (i.e., cross-sectional design) [48]. Similarly, we also found significant correlations between monthly household income (measured at T_1) and the two components of SWB at T_1. However, monthly household income (measured at T_1) was not correlated with the two components of SWB at T_2. These findings align with a recent meta-analysis showing that the longitudinal association between objective socioeconomic status (i.e., income and education) and SWB was smaller than the cross-sectional association between them [48]. Considering the current special period during which the pandemic has dramatically influenced people's lives, the contribution of income to prospective SWB may further decrease, as shown in our results.

Second, taking advantage of the prospective design and data entries collected at two different time points (T_1 & T_2), we tested whether there was a prospective association between social support and SWB (affect balance and life satisfaction). It was found that baseline (T_1) social support significantly predicted future (T_2) affect balance and life satisfaction, and T_2 affect balance fully mediated the relationship between T_1 social support and T_2 life satisfaction, after controlling for the baseline measure

of SWB and other confounding factors such as personality traits. This is a step forward for prior studies that only explored the mediation effect of affect balance on many other life satisfaction predictors (e.g., emotional intelligence, self-esteem) [30–33], but not precisely the link from social support to life satisfaction. This full mediation can be interpreted based on the affect-as-information hypothesis [29], which assumes that people make judgments and decisions concerning life satisfaction according to, for the most part, their own feelings [49]. Although judgments of life satisfaction may also be determined by other parameters in addition to affective feelings, they draw power from social support primarily through the pathway of affective feelings. This is also in line with the buffering effect model of social support, such that the social network needs to provide relevant means and resources to help the receivers of social support cope with the stress. In our situation, such means and resources increased the receivers' positive feelings and alleviated their negative feelings during the pandemic, which in turns promoted their life satisfaction.

Finally, with regard to the boundary condition, results confirmed that the relationship between social support and affect balance was moderated by monthly household income. Notably, the effect of social support on affect balance was significantly stronger for U.K. citizens who reported lower monthly household income. This aligns with the coping strategies adopted by different social classes [50]. It is well documented that both social support and wealth can serve protective functions against the threat [51, 52]. People from the lower class are more likely to rely on others in the social environment because they have fewer material resources. By contrast, upper-class individuals tend to prioritize material wealth since wealth can afford them greater autonomy and

Mao *et al. BMC Public Health*   (2024) 24:943

Page 8 of 9

self-reliance [50]. Therefore, during the current pandemic that poses a great threat to people's social lives, social support could predict subsequent SWB for lower-income individuals because they rely on and value these communal resources to a larger extent. However, higher-income individuals may typically turn to material resources when coping with the pandemic. As a result, social support is not a critical determinant of their SWB.

Limitations

This study has several limitations that can be considered and addressed in future work. First, findings based on the U.K. sample may not imply a fit-for-all solution for people worldwide. Therefore, replications of the findings in other countries or cultures may help to address the robustness and generalizability of our proposed model. Second, although our study overcame the shortcomings of the cross-sectional design by adopting a prospective design, its data were collected from only two waves. Future work applying longitudinal designs with more time intervals will provide more plausible inferences. Third, although we measured SWB twice, we measured social support only once at T_1, which prevents us from testing whether there is a reciprocal relationship between social support and SWB with a more complex model such as the cross-lagged panel model. Finally, our findings are context-dependent, as it was conducted during the special period of the COVID-19 pandemic, a time when the world's economy was severely hit and stagnated, which may make the moderating function of household income different from other periods.

Conclusions

Prior studies have explored and proved the positive association between social support and SWB with cross-sectional evidence, but the causal inference behind it remains elusive. By adopting a prospective design, the present work investigated the underlying mechanism regarding the relationship between social support and different components of SWB in a sample of U.K. citizens during the COVID-19 pandemic. Results indicated that perceived social support prospectively predicted life satisfaction (i.e., cognitive SWB) through a full mediation of affect balance (i.e., affective SWB), and this predictive effect was moderated by people's monthly household income. These findings contribute to the social support, SWB, and affect-as-information literature.

Author contributions
JD developed the conceptual idea and discussed with YM and HS. JD and HS collected data. All authors involved in data analysis. YM and JC wrote the manuscript. JD and HS provided critical feedback.

Declarations

References
1. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. Lancet. 2020;395(10227):912–20. https://doi.org/10.1016/s0140-6736(20)30460-8.
2. Santomauro DF, Mantilla HAM, Shadid J, Zheng P, Ashbaugh C, Pigott DM, et al. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet. 2021;398(10312):1700–12. https://doi.org/10.1016/s0140-6736(21)02143-7.
3. Matvienko-Sikar K, Pope J, Cremin A, Carr H, Leitao S, Olander EK, et al. Differences in levels of stress, social support, health behaviours, and stress-reduction strategies for women pregnant before and during the COVID-19 pandemic, and based on phases of pandemic restrictions, in Ireland. Women Birth. 2021;34(5):447–54. https://doi.org/10.1016/j.wombi.2020.10.010.
4. Szkody E, Stearns M, Stanhope L, McKinney C. Stress-buffering role of social support during COVID-19. Fam Process. 2020;60(3):1002–15. https://doi.org/10.1111/famp.12618.
5. Wang YB, Chung MC, Wang N, Yu XX, Kenardy J. Social support and posttraumatic stress disorder: a meta-analysis of longitudinal studies. Clin Psychol Rev. 2021;85:101998. https://doi.org/10.1016/j.cpr.2021.101998.
6. Gasiorowska W, Sioch M, Zemojtel-Piotrowska MA. Narcissism, social support, and loneliness during the pandemic. Pers Indiv Differ. 2021;181:111002. https://doi.org/10.1016/j.paid.2021.111002.
7. Makiniemi JP, Oksanen A, Makikangas A. Loneliness and well-being during the covid-19 pandemic: the moderating roles of personal, social and organizational resources on perceived stress and exhaustion among Finnish university employees. Int J Environ Res Public Health. 2021;18(13):7146. https://doi.org/10.3390/ijerph18137146.
8. Labrague LJ, De los Santos JA, A. COVID-19 anxiety among front-line nurses: predictive role of organisational support, personal resilience and social support. J Nurs Adm Manag. 2020;28(7):1653–61. https://doi.org/10.1111/jonm.13121.
9. Li Y, Peng J. Does social support matter? The mediating links with coping strategy and anxiety among Chinese college students in a cross-sectional study of COVID-19 pandemic. BMC Public Health. 2021;21(1):1298. https://doi.org/10.1186/s12889-021-11332-4.
10. Rivera NYR, McGuinn L, Osorio-Valencia E, Martinez-Medina S, Schnaas L, Wright RJ, et al. Changes in depressive symptoms, stress and social support in Mexican women during the covid-19 pandemic. Int J Environ Res Public Health. 2021;18(16):e8775. https://doi.org/10.3390/ijerph18168775.
11. Huang L, Zhang T. Perceived social support, psychological capital, and subjective well-being among college students in the context of online learning

during the covid-19 pandemic. Asia-Pacific Educ Researcher. 2022;31:563–74. https://doi.org/10.1007/s40299-021-00608-3.

12. Masciantonio A, Bourguignon D, Bouchat P, Balty M, Rimé B. Don't put all social network sites in one basket: Facebook, Instagram, Twitter, TikTok, and their relations with well-being during the COVID-19 pandemic. PLoS ONE. 2021;16(3):e0248384. https://doi.org/10.1371/journal.pone.0248384.

13. Cacciatore J, Thieleman K, Fretts R, Jackson LB. What is good grief support? Exploring the actors and actions in social support after traumatic grief. PLoS ONE. 2021;16(5):e0252324. https://doi.org/10.1371/journal.pone.0252324.

14. Barrera M, Sandler IN, Ramsay TB. Preliminary development of a scale of social support: studies on college students. Am J Community Psychol. 1981;9(4):435–47. https://doi.org/10.1007/bf00918174.

15. Sarason IG, Levine HM, Basham RB, Sarason BR. Assessing social support: the Social Support Questionnaire. J Personal Soc Psychol. 1983;44(1):127–39. https://doi.org/10.1037/0022-3514.44.1.127.

16. Lin N. (1986). Conceptualizing social support. *Social Support, Life Events, and Depression*, 17–30. Academic Press. https://doi.org/10.1016/B978-0-12-450660-2.50008-2.

17. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychol Bull. 1985;98(2):310–57. https://doi.org/10.1037/0033-2909.98.2.310.

18. Fan X, Lu M. Testing the effect of perceived social support on left-behind children's mental well-being in mainland China: the mediation role of resilience. Child Youth Serv Rev. 2020;109:104695. https://doi.org/10.1016/j.childyouth.2019.104.

19. Uchino BN. Understanding the links between social support and physical health: a life-span perspective with emphasis on the separability of perceived and received support. Perspect Psychol Sci. 2009;4(3):236–55. https://doi.org/10.1111/j.1745-6924.2009.01122.x.

20. Diener E, Oishi S, Lucas RE, Personality, Culture, Subjective Well-Being. Emotional Cogn Evaluations Life. 2003;54(1):403–25. https://doi.org/10.1146/annurev.psych.54.101601.145056.

21. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. J Pers Assess. 1985;49(1):71–5. https://doi.org/10.1207/s15327752jpa4901_13.

22. Andrews FM, Withey SB. Social Indicators of Well-Being: Americans' Perceptions of Life Quality. 1976. Plenum Press. https://doi.org/10.1007/978-1-4684-2253-5.

23. Diener E, Ryan K. Subjective well-being: a general overview. South Afr J Psychol. 2009;39(4):391–406. https://doi.org/10.1177/008124630903900402.

24. Diener E, Heintzelman SJ, Kushlev K, Tay L, Wirtz D, Lutes LD, et al. Findings all psychologists should know from the new science on subjective well-being. Can Psychol. 2016;58(2):87–104. https://doi.org/10.1037/cap0000063.

25. Diener E, Wirtz D, Tov W, Kim-Prieto C, Choi D, Oishi S, et al. New well-being measures: short scales to assess flourishing and positive and negative feelings. Soc Indic Res. 2010;97(2):143–56. https://doi.org/10.1007/s11205-009-9493-y.

26. Kuppens P, Realo A, Diener E. The role of positive and negative emotions in life satisfaction judgment across nations. J Personal Soc Psychol. 2008;95(1):66–75. https://doi.org/10.1037/0022-3514.95.1.66.

27. Liu Y, Wang Z, Lü W. Resilience and affect balance as mediators between trait emotional intelligence and life satisfaction. Pers Indiv Differ. 2013;54(7):850–5. https://doi.org/10.1016/j.paid.2012.12.010.

28. Zhu H. Social support and affect balance mediate the association between forgiveness and life satisfaction. Soc Indic Res. 2015;124(2):671–81. https://doi.org/10.1007/s11205-014-0790-8.

29. Schwarz N, Clore GL. Feelings and phenomenal experiences. In A. Kruglanski, & E. T. Higgins, editors, Social Psychology (2nd ed.). Handbook of Basic Principles. (pp.385–407). The Guilford Press. 2007.

30. Koydemir S, Simsek OF, Schutz A, Tipandjan A. Differences in how trait emotional intelligence predicts life satisfaction: the role of affect balance versus social support in India and Germany. J Happiness Stud. 2013;14(1):51–66. https://doi.org/10.1007/s10902-011-9315-1.

31. Liu Y, Wang ZH, Lu W. Resilience and affect balance as mediators between trait emotional intelligence and life satisfaction. Pers Indiv Differ. 2013;54(7):850–5. https://doi.org/10.1016/j.paid.2012.12.010.

32. Liang DK, Xu DW, Xia LY, Ma XL. Life satisfaction in Chinese rural-to-urban migrants: investigating the roles of self-esteem and affect balance. J Community Psychol. 2020;48(5):1651–9. https://doi.org/10.1002/jcop.22360.

33. Veronese G, Pepe A, Dagdukee J, Yaghi S. Social capital affect balance and personal well-being among teachers in Israel and Palestine. Teachers Teach. 2018;24(8):951–64. https://doi.org/10.1080/13540602.2018.1508431.

34. Sanjuán P. Affect balance as mediating variable between effective psychological functioning and satisfaction with life. J Happiness Stud. 2011;12(3):373–84. https://doi.org/10.1007/s10902-010-9199-5.

35. Lonnqvist JE, Deters FG. Facebook friends, subjective well-being, social support, and personality. Comput Hum Behav. 2016;55:113–20.

36. Hobfoll SE, Tirone V, Holmgreen L, Gerhart J. Conservation of resources theory applied to major stress, In Fink G, editor, Stress: Concepts, cognition, emotion, and behavior. Academic Press. 2016. pp. 65–71 https://doi.org/10.1016/B978-0-12-800951-2.00007-8.

37. Hobfoll SE. Conservation of resources: a new attempt at conceptualizing stress. Am Psychol. 1989;44(3):513–24. https://doi.org/10.1037/0003-066X.44.3.513.

38. Claro S, Paunesku D, S Dweck C. Growth mindset tempers the effects of poverty on academic achievement. Proc Natl Acad Sci. 2016;113(31):8664–8. https://doi.org/10.1073/pnas.1608207113.

39. Yeager DS, Dweck CS. What can be learned from growth mindset controversies? Am Psychol. 2020;75(9):1269–84. https://doi.org/10.1037/amp0000794.

40. Kraus MW, Piff PK, Keltner D. Social class, sense of control, and social explanation. J Personal Soc Psychol. 2009;97(6):992–1004. https://doi.org/10.1037/a0016357.

41. Paloma V, Escobar-Ballesta M, Galvan-Vega B, Diaz-Bautista JD, Benitez I. Determinants of life satisfaction of economic migrants coming from developing countries to countries with very high human development: a systematic review. Appl Res Qual Life. 2021;16(1):435–55. https://doi.org/10.1007/s11482-020-09832-3.

42. Sainz M, Martinez R, Moya M, Rodriguez-Bailon R, Vaes J. Lacking socio-economic status reduces subjective well-being through perceptions of meta-dehumanization. Br J Soc Psychol. 2020;60(2):470–89. https://doi.org/10.1111/bjso.12412.

43. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess. 1988;52(1):30–41. https://doi.org/10.1207/s15327752jpa5201_2.

44. Gosling SD, Rentfrow PJ, Swann WB. A very brief measure of the big-five personality domains. J Res Pers. 2003;37(6):504–28. https://doi.org/10.1016/s0092-6566(03)00046-1.

45. Hayes AF. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling.

46. Hu S, Cai D, Zhang XC, Margraf J. Relationship between social support and positive mental health: a three-wave longitudinal study on college students. Curr Psychol. 2022;41(10):6712–21.

47. Lucas RE, Chopik J. Testing the buffering effect of social relationships in a prospective study of disability onset. Social Psychol Personality Sci. 2021;12(7):1307–15.

48. Tan JJ, Kraus MW, Carpenter NC, Adler NE. The association between objective and subjective socioeconomic status and subjective well-being: a meta-analytic review. Psychol Bull. 2020;146(11):970–1020. https://doi.org/10.1037/bul0000258.

49. Gohm CL, Clore GL. Affect as information: an individual differences approach. In: Barrett LF, Salovey P, editors. The Wisdom in feeling: psychological processes in Emotional Intelligence. The Guilford; 2002. pp. 89–113.

50. Piff PK, Stancato DM, Martinez AG, Kraus MW, Keltner D. Class, chaos, and the construction of community. J Personal Soc Psychol. 2012;103(6):949–62. https://doi.org/10.1037/a0029673.

51. Taylor SE. Social support. In: Friedman HS, Silver RC, editors. Foundations of health psychology. Oxford University Press; 2007. pp. 145–71.

52. Zhou X, Vohs KD, Baumeister RF. The symbolic power of money: reminders of money alter social distress and physical pain. Psychol Sci. 2009;20(6):700–6. https://doi.org/10.1111/j.1467-9280.2009.02353.x.

Publisher's Note