Applied Research in Quality of Life (2022) 17:333–349
https://doi.org/10.1007/s11482-020-09883-6

The Interaction Between Peer Social Support and Stressors Predicts Somatic and Psychological Depressive Symptoms in Chinese Adolescents

Adolescents' Depressive Symptoms

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Received: 24 October 2019 / Accepted: 22 October 2020 / Published online: 6 January 2021

Abstract
The major goal of this study was to investigate the diathesis-stress model in predicting depressive symptoms in Chinese high school students. A total of 613 students from a community-based sample of two high schools completed self-report measures of social support, depressive symptoms, and daily stressors. Over a period of 12 months, the students reported on social support from parents and peers, somatic and psychological depressive symptoms, and the occurrence of daily stressors on five occasions, 3 months apart. The results revealed neither a main effect of parental or peer support nor a significant daily stressor × parent support interaction effect. Nevertheless, a statistically significant daily stressors × peer support effect was revealed in the prediction of both somatic symptoms and psychological symptoms. These findings suggested that low levels of peer support (but not parent support) among Chinese high school students act as a diathesis with respect to the development of both somatic symptoms and psychological symptoms of depression in the face of high frequencies of daily stressors.

Keywords Social support · Stressors · High school students · Depressive symptoms

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Introduction

Depression is a serious problem in adolescents, among whom rates of depressive symptoms range from 20 to 50% around the world (Gordana, Fadbi, & Slagana, 2016; Rawana & Morgan, 2013). Previous research has shown that depressive symptoms in adolescents often lead to the development of a full-blown, clinical depressive disorder and various academic and interpersonal difficulties in the future (Rudolph, Davis, & Monti, 2017; Simeng, Benyu, Tifei, Wendong, & Fushun, 2016). More specifically, depressive symptoms can be grouped into two categories: somatic symptoms and psychological symptoms. Somatic symptoms of depression are mainly manifested in changes in sleep, appetite, fatigue, and other symptoms related to physical behavior, while psychological symptoms of depression are mainly manifested as depressive mood, anhedonia, guilt, and other psychological cognitive symptoms (Nylen, Williamson, O'Hara, Watson, & Engeldinger, 2013; Silverstein et al., 2013; Yen, Robins, & Lin, 2000). Previous studies (Kleinman, 1982; Tseng, 1975) have found that due to differences in cultural backgrounds, personality traits, and emotional expression, some individuals tend to experience more of the physical symptoms of depression, whereas others are inclined to experience more of the psychological symptoms of depression. However, few researchers have addressed the possibility of whether somatic symptoms and psychological symptoms of adolescent depression display different development trends.

Depression is a complicated psychological problem, and its origins are not yet fully understood. Several studies have indicated that environmental conditions, such as stressful life experiences, contribute to the development of depression in adolescents (Assari & Lankarani, 2016; Chatwin et al. 2016; Mazurka, Wynne-Edwards, & Harkness, 2016). Adolescents, such as high school students, are at particularly high risk for experiencing symptoms of depression, such as negative effect, which may be linked with environmental stressors, such as school difficulties, family conflicts, and changing peer relations (Gordana et al., 2016; Yang et al. 2010b). Such stressors are especially salient for Chinese high school students, who may be more susceptible to depression due to extremely high parent and teacher pressures to succeed in college entrance examinations and to honor their families and schools (Li & Prevatt, 2008).

However, not all individuals who have experienced stressful life experiences develop depression; thus, there must be risk factors that operate to facilitate the development of depressive symptoms (Mazure, Bruce, Maciejewski, & Jacobs, 2000). Among the most promising explanations of how a depressive episode forms, the diathesis-stress framework posits that environmental stressors trigger an underlying predisposition, which leads to depressive symptoms (Hankin & Abela, 2005; Ling et al. 2016). The underlying predisposition refers to pre-existing vulnerabilities, including biological (e.g., genes), personality (e.g., perfectionism), and environmental (e.g., insecure parental attachment) factors, all of which contribute to depressive symptoms only when life stressors are present (Auerbach, Bigdapeyton, Eberhart, Webb, & Ho, 2011; Belsky et al., 2009; O'Connor, Rasmussen, & Hawton, 2010; Technow, Hazel, Abela, & Hankin, 2015; Yi et al. 2012).

The diathesis-stress model proposes that the impact of daily stressors is more likely to contribute to depressive symptoms in people when a vulnerability factor is active or in motion prior to the occurrence of the negative stressor(s) and that is capable of

exerting a continuous influence on the depression-prone person's functioning (Dykman & BM, 1998). One such vulnerability factor that has been studied previously is lack of social support. Social support refers to the degree to which individuals perceive that others care for them as individuals, like them the way they are, understand them, listen to them, and generally treat them as people who matter. Most researchers have supported the notion that environmental stressors and social support interact to yield depressive symptoms. However, significant interaction effects have been reported in some of these studies (Freeman & Rees, 2010; Sheffler & Sachs-Ericsson, 2015), but not others (Blom, 2005; De Pallant, 2012; Pearlin & Bierman, 2013). In short, the extant literature (Bilsky et al., 2013; Rhind, Jowett, & Lorimer, 2011; von Weiss et al. 2002) regarding support for the diathesis-stress model shows inconsistent findings, suggesting the need for further research.

Our review of the extant literature revealed three major limitations that warrant consideration in understanding the inconsistencies in the findings and guiding future research. First, previous researchers have employed mainly cross-sectional designs and between-subjects' analyses. Therefore, the majority of the studies have evaluated the relations of social support, in combination with between-subject differences in frequencies of stressors, to predict individual differences in depression. Thus, whether the expression of depression within individuals varies as a function of social support and stressors remains unclear.

Second, most of the prior studies examining stressors × social support interactions in predicting depression did not divide the depressive symptoms into psychological and somatic symptoms. However, this distinction may be crucial because some individuals report more somatic symptoms of depression whereas other individuals report more psychological symptoms. This distinction is likely due to differences in cultural backgrounds, perceptions of cognitive and emotional functioning, and the quality of social relationships (Kung & Lu, 2008; Parker, Chan, Tully, & Eisenbruch, 2005; Wilz & Barskova, 2007). For instance, because mental illness is stigmatized in Chinese societies, Chinese individuals may have a tendency to emphasize the somatic symptoms of depression, with the consequence of delaying mental health treatment (Ryder et al. 2008).

Furthermore, a paucity of research has been conducted to test the effects of possible interactions between stressors and social support on somatic symptoms and psychological symptoms of depression in Chinese adolescent samples. One exception involved a short-term longitudinal study by Yang et al. (2010b) which supported the diathesis-stress model of depression in Chinese high school students. Their study revealed that stressful life experiences interacted with social support from peers in that students who reported lower levels of peer support when encountering frequent stressors were at increased risk for experiencing depressive symptoms. However, Yang et al. employed a sub-clinical sample of students and did not differentiate between their reports of somatic and psychological symptoms, thus limiting the generalizability of their findings.

In addition, past research has demonstrated that Asian individuals are less likely than European individuals to seek social support because they are worried about the possible relational ramifications of seeking support, such as interrupting the harmony of the group, losing face, receiving criticism, or making the situation worse (Taylor et al., 2004). Chinese persons especially tend to adapt to stressors by adopting the patterns of denial, repression, and turning against the self because of the teaching of the traditional Confucian values, which emphasizes self-control (Chiu & Kosinski, 2011; Li &

Prevatt, 2008). Given such cultural differences, it seems plausible that Chinese individuals are less likely to benefit from social support from others than their Western counterparts.

The current study addressed these limitations by using a multi-wave, longitudinal design wherein frequencies of stressors and depressive symptoms were evaluated at multiple time points during the course of a 12-month follow-up interval. The study was thus able to evaluate the relative risk effects of lower levels of social support, in conjunction with within-subject fluctuations in the frequencies of stressors, in predicting within-subject fluctuations in depressive symptoms. More specifically, the design allowed the examination of whether the slopes reflecting the relations between daily stressors and depressive symptoms within individuals differed across individuals reporting differing levels of parental support or peer support. Second, we addressed somatic and psychological symptoms of adolescent depression separately to determine if there were differing trends for the symptoms in Chinese adolescents.

Our review of the extant literature also revealed that it remains unclear whether social support affects Chinese adolescents directly (main effect model) or indirectly by moderating the effect of stressors on depressive symptoms (i.e., diathesis-stress model). Specifically, the main effect model (Dumont & Provost, 1999) proposes that social support would exert an equivalent effect on individuals' depressive symptoms regardless of the level of daily stressors. Consistent with the diathesis-stress model of depression (Colodro-Conde et al. 2017), the level of social support should moderate the relation between the occurrence of daily stressors and depressive symptoms. Specifically, a vulnerability effect should occur such that the magnitude of the relation between the stressors and the frequencies of depressive symptoms should be greater in the absence of strong support.

In this study, we thus addressed the diathesis-stress model of depression further in a community-based sample of Chinese high school students, focusing on social support as a vulnerability factor, which represents one such predictive factor that has been shown to be strongly related to depression across the lifespan (Ling, Yang, Zhang, Yi, & Yao, 2010; Simeng et al. 2016). We thus hypothesized that Chinese students who experience frequent daily stressors will report more depressive symptoms (Brown, Harris, Woods, Buman, & Cox, 2012; Chao, 2011) under conditions of less social support. Our study extended beyond previous studies of Chinese adolescents by evaluating whether the diathesis-stress model applied to parental as well as peer support and whether the model applied to psychological as well as somatic depressive symptoms. To our knowledge, our study was also among the first to test the diathesis-stress model with Chinese high school students to assess the generalizability of findings based on students from other countries.

Method

Participants and Procedure

Participants were drawn from a five-wave longitudinal study of freshman students from two residential high schools in Hunan, mainland China. The parents of all eligible students ($N = 635$) in the participating high schools were asked to provide active consent for their

children to participate in the study. A total of 618 students returned consent forms signed by their guardians/parents along with signed student assent forms to their teachers. The students subsequently filled out questionnaires administered by a trained research assistant in their classrooms without the presence of teachers. The initial assessment was conducted in March, 2016, and follow-up assessments were performed every 3 months across a 12-month time frame, during which participants completed a demographic form and measures of depressive symptoms (Radloff, 1977), social support (Harter, 1985), and daily stressors (Compas, Davis, Forsythe, & Wagner, 1987) on each measurement occasion. Participants took about 20 min to finish the measures on each occasion, which occurred during class time at the respective schools. Adolescents had just started their first year in high school at the time of the first measurement wave, and they were in their second year (if they had progressed with studies at a normative pace) at the time of the final measurement wave. Among the 618 students, only individuals who participated in all of the measurement waves [($n = 613$, 51% female; mean age = 16.03 years, standard deviation (SD) = .61 years) were included in the analyses. Most (98.9%) students were Han, the predominant ethnic group in China while the remainder was from various ethnic minority groups. All participants spoke Mandarin. There was no significant age difference across gender ($p > 0.05$). Ethics committees from Hunan Agriculture University, the Health Department of Hunan provinces, and all eight cities representing the two schools involved with the research approved the research protocol.

Measures

Depressive Symptoms

Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), a 20-item self-report measure. Students were asked to rate the occurrence of each symptom in the past week on a scale ranging from 1 (rarely) to 4 (most of the time). Total scores ranged from 20 to 80, and higher scores reflected higher frequencies of depressive symptomatology.

The CES-D has been shown across numerous studies to display strong test-retest reliability and high correlations with other measures of depressive symptoms (Verhoeven, Sawyer, & Spence, 2013). The Chinese version of the CES-D has exhibited high degrees of reliability and validity as well (Ling, Wei, Yi, Xiao, & Yao, 2008). Moreover, depressive symptoms were divided into somatic and psychological symptoms following the classification of Yen et al. (2000) who analyzed the 20 items with principal axis factor analysis. Visual inspection of the scree plot yielded a three-factor solution, reflecting psychological symptoms, somatic symptoms, and positive emotions. The items that loaded on the Positive Emotions factor were dropped because they were not relevant to our research questions. In the current study, the Cronbach's alphas for the CES-D ranged from 0.89 to 0.90 across the various assessments.

Social Support

Parental support and peer support were measured using the 24-item self-report Social Support Scale for Adolescents (SSSA) (Harter, 1985), which assesses adolescents' perceived social support from significant others in their lives, including parents, teachers,

classmates, and close friends. The SSSA assesses the degree to which adolescents perceive that others care for them as individuals, like them the way they are, understand them, listen to them, and generally treat them as people who matter. Previous studies have identified that early adolescents rely strongly on teachers, with teacher support decreasing significantly with age and with parent support and peer support increasing with age (Aro, Hänninen, & Paronen, 1989; Laet et al. 2014). For the purposes of the present study and taking into account the age level of our sample, we chose to use the items assessing perceived social support from parents, classmates, and close friends (excluding the items assessing teacher support). Furthermore, based on previous research, we combined the subscales of the Classmate Support and Close Friends Support to create one measure of overall peer support (Yang, Sylva, & Lunt, 2010a). The Cronbach alpha coefficient for the merged peer support measure with this sample was 0.91, which was higher than the alphas for the original subscales of Close Friend support (0.83) and Classmate support (0.77) (East, Hess, & Lerner, 1987). Thus, the measures for the Parents Support subscale and the merged Peer Support subscales were retained from the SSSA in this study. Both subscales consisted of six items scored on a four-point scale, with higher scores indicating greater perceived support. The SSSA has exhibited good reliability and validity (East et al. 1987).

Life Events

The Adolescent Life Events Questionnaire (ALEQ-R) (Compas et al., 1987) is a self-report questionnaire that was developed by Compas et al. to assess a broad range of ongoing daily stressors occurring during the past month. Participants were asked to report how often such negative daily stressors occurred on a Likert scale ranging from 1 (never) to 5 (always), with higher scores reflecting a greater frequency of daily stressors. Past research has found that the ALEQ is both reliable and valid (Hankin & Abramson, 2002).

Statistical Analyses

Multilevel modeling was used to examine whether the interaction between social support and daily stressors predicted the frequency of students' depressive symptoms. Analyses were conducted using the SAS (Ray Chaudhury, 2003) MIXED procedure and maximum likelihood estimation. The dependent variables were within-subject fluctuations in the CES-D scores during the follow-up interval. The primary predictors of depression were social support and fluctuations in the ALEQ-R scores during the follow-up interval. Because social support scores were between-subject predictors, they were standardized prior to analyses. Given that daily stressors represented within-subject predictor measures, the scores were centered at each participant's mean prior to analyses. Separate analyses were conducted for parental and peer support. Preliminary analyses suggested that no reported association was moderated by age or gender; analyses are thus provided for the sample as a whole.

While fitting hierarchical linear models, proper mean and covariance structures must be specified. Covariance structures are widely utilized in studies where multiple responses are acquired from the same individual over time and include compound symmetry, first-order autoregressive, heterogeneous autoregressive, and banded Toeplitz structures. To choose a covariance structure for our analyses, we fitted the

models using each structure and selected the best fit based on standard and corrected Akaike information criteria (Akaike, 1987) and the Schwarz Bayesian information criterion (Schwarz, 1978). In all cases, the best fit was an autoregressive heterogeneous (ARH) structure (Zhang, Peng, & Dang, 2004).

After selecting the proper covariance structure, we next tested the random effects component of our model. According to Ziecel's (2015) recommendation to utilize a "saturated" model for mean structure when seeking a proper covariance structure, we selected a mean structure that included social support, daily stressors, and social support × daily stressors interaction terms. Four additional effects were also included in this original mean structure. First, because levels of depressive symptoms may differ among participants experiencing average individual levels of stressors, a random intercept was included in the model. Second, considering that depressive symptoms represented a within-subject predictor effect that was expected to vary among participants, a random effect for slope was included in the model. Third, to control individual distinctions in baseline levels of depressive symptoms, participants' initial depressive symptoms were included in the model. Finally, considering that daily stressors reflected a within-subject predictor, a random slope for daily stressors was also inserted into the model.

Results

Descriptive Statistics

Means and standard deviations for the measures for T1–T5 are presented separately in Table 1. Somatic symptoms and psychological symptoms from the CES-D and ALEQ scores were significantly higher at the initial assessment and significantly lower at the fifth assessment compared to the other time points. Pearson correlations among all Time 1 measures are shown in Table 2. Higher levels of somatic symptoms and psychological symptoms were linked to lower levels of parent and peer support and more frequent occurrences of daily stressors.

Table 1 Observed means and standard deviations of depressive symptoms and stressors

	CES-D Psychological symptoms		CES-D Somatic symptoms		ALEQ	
	Mean	SD	Mean	SD	Mean	SD
Time 1	9.574	3.143	12.149	3.506	111.613	24.454
Time 2	8.996	3.043	11.406	3.720	91.762	22.091
Time 3	8.417	2.812	10.674	3.349	89.725	22.656
Time 4	8.647	3.001	10.754	3.737	86.009	23.079
Time 5	8.251	2.786	10.179	3.399	83.019	21.909

CES-D, Central for Epidemiological Studies Depression Scale; *ALEQ*, Adolescent Life Events Questionnaire

Table 2 Intercorrelations among initial somatic symptoms and psychological symptoms, social support and stressors

	Somatic symptoms	Psychological symptoms	Stressors	Parental support
Psychological symptoms	0.628***			
Stressors	0.394***	0.326***		
Parental support	0.243***	0.163***	0.197***	
Peer support	0.256***	0.298***	0.297***	0.194***

*** $P < 0.001$

Parental Support and Daily Hassles Predicting Somatic Symptoms

To examine the effects of parental support in the diathesis-stress model for somatization symptoms, we utilized multilevel modeling. Analyses were conducted using the SAS (Ray Chaudhury, 2003) MIXED procedure and maximum likelihood estimation. When the random effects component of the "saturated" model was tested, non-significant random effects were deleted from the model before examination of the fixed effects component. The random intercept ($r = 3.23$, $p < 0.001$) and ARH parameter ($r = 6.00$, $p < 0.0001$) were both statistically significant and therefore retained in the model. The random effect slope ($r = 1.43$, $p > 0.05$) was not significant, and therefore it was removed. Table 3 indicates covariance parameter estimates for the final model. The fixed effects component of the model revealed neither a significant main effect of parental support ($\beta = 0.111$, SE = 0.101, F (1,566) = 1.20, $p > 0.05$), nor a significant two way, cross-level interaction between parental support and daily hassles ($\beta = 0.000$, SE = 0.006, F (1,1188) = 0.00, $p > 0.05$).

Peer Support and Daily Stressors Predicting Somatic Symptoms

Similar analyses were carried out to test if peer support showed a significant increase in somatic symptoms following increases in daily stressors. The ARH parameter ($r = 5.91$, $p < 0.0001$) and random intercept ($r = 3{,}28$, $p < 0{,}001$) were both significant and thus retained in the model. However, the random slope effect ($r = 1.44$, $p > 0.05$) was not significant, and thus it was removed. In the first model, the effects of peer support and daily stressors on somatic symptoms were estimated. As shown in Table 4, peer support exhibited no significant main effect on somatic symptoms ($\beta = 0.156$, SE = 0.102, F

Table 3 Estimates of the fixed effects component of the simultaneous model: parental support × stressors → somatic symptoms

Predictor	β	SE	F	df
Initial somatic symptoms	1.382	0.101	187.33****	1, 566
Parental support	0.111	0.101	1.20	1, 566
Stressors	0.039	0.005	50.69****	1, 1188
Parental support × stressors	0.000	0.006	0.00	1, 1188

**** $P < 0.0001$

Table 4 Estimates of the fixed effects component of the simultaneous model: peer support × stressors → somatic symptoms

Predictor	β	SE	F	df
Initial somatic symptoms	1.363	0.103	176.51****	1, 560
Peer support	0.156	0.102	2.34	1, 560
Stressors	0.038	0.005	53.36****	1, 1173
Peer support × stressors	0.011	0.005	4.15*	1, 1173

**** P <0.0001, ** P < 0.05

(1,560) = 2.34, $p > 0.05$); however, a significant two way, cross-level interaction between peer support and daily stressors was observed ($\beta = 0.011$, SE = 0.005, F (1,1173) = 4.15, $p < 0.05$).

To further test the interaction between peer support and daily stressors in predicting the somatic symptoms, we calculated predicted somatic symptoms for individuals who reported high or low levels of peer support (± 1.5 SD). The results showed that individuals who reported low levels of peer support showed higher levels of somatic symptoms (slope = 0.055, t (1173) = 5.72, $p < 0.0001$; Fig. 1) when they were experiencing high frequencies of daily stressors relative to when they were experiencing low frequencies of daily stressors. Equivalent results were observed for high levels of peer support (slope = 0.021, t (1173) = 0.216, $P < 0.05$; Fig. 1). Furthermore, the slope of the relation between daily stressors and somatic symptoms was significantly greater for individuals who reported low levels of support compared to those individuals who reported high levels of peer support ($b = 0.034$, t (1173) = 2.04, $p < 0.05$). These findings thus demonstrated that subsequent to higher frequencies of stressors, somatic symptoms increased significantly more in individuals who reported low levels of peer support than in individuals who reported high levels of peer support.

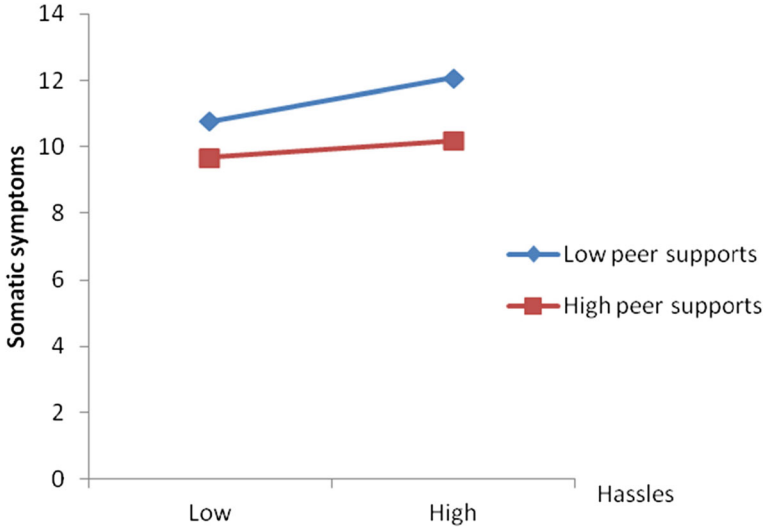

Fig. 1 Peer support and stressors as predictors of somatic symptoms

Parental Support and Daily Stressors Predicting Psychological Symptoms

Similar analyses were carried out to test if parental support was associated with greater increases in psychological symptoms following increases in daily stressors. The ARH parameter ($r = 5.39$, $p < 0.0001$), random intercept ($r = 3.58$, $p < 0.001$), and random slope ($r = 2.41$, $p < 0.01$) were significant. As can be seen in Table 5, the fixed effects component of the model exhibited neither a significant main effect for parental support ($\beta = 0.108$, SE = 0.084, F (1,563) = 1.67, $p > 0.05$), nor a significant two way, cross-level interaction between parental support and daily stressors ($\beta = 0.007$, SE = 0.006, F (1,1195) = 1.79, $p > 0.05$).

Peer Support and Stressors Predicting Psychological Symptoms

Similar analyses were carried out to examine whether peer support showed increases in psychological symptoms following increases in daily stressors. The ARH parameter ($r = 5.44$, $p < 0.0001$), random intercept ($r = 3.72$, $p < 0.001$), and random slope ($r = 2.43$, $p < 0.01$) were significant. Table 6 exhibits covariance parameter estimates for the final model. The fixed effects component of the model showed no significant main effect of peer support ($\beta = 0.102$, SE = 0.087, F (1,556) = 1.35, $p > 0.05$); however, a significant two way, cross-level interaction between peer support and daily stressors was observed ($\beta = 0.014$, SE = 0.005, F (1,1177) = 4.15, $p < 0.01$).

To further test the interaction between peer support and daily stressors in predicting the psychological symptoms, we calculated predicted somatic symptoms for individuals who experienced high or low levels of peer support (± 1.5 SD). Participants who experienced low levels of peer support showed higher levels of psychological symptoms when experiencing high frequencies of daily stressors than when experiencing low frequencies of daily stressors (slope = 0.048, t (1177) = 5.28, $p < 0.0001$; Fig. 2). However, the levels of psychological symptoms did not change as a function of higher levels of peer support (slope = 0.005, t (1177) = 0.52, $p > 0.05$; Fig. 2). Moreover, the slope of the relation between daily stressors and psychological symptoms was significantly greater for the individuals with low levels of peer support relative to those adolescents with high levels of peer support ($b = 0.043$, t (1177) = 2.75, $p < 0.01$). These findings revealed that following increases in daily stressors, psychological symptoms increased significantly more in adolescents with low levels of peer support than in those adolescents with high levels of peer support.

Table 5 Estimates of the fixed effects component of the simultaneous model: parental support × stressors → psychological symptoms

Predictor	β	SE	F	df
Initial psychological symptoms	0.882	0.086	104.26****	1, 563
Parental support	0.108	0.084	1.67	1, 563
Stressors	0.026	0.005	25.15****	1, 1195
Parental support × stressors	0.007	0.006	1.79	1, 1195

**** $P < 0.0001$

Table 6 Estimates of the fixed effects component of the simultaneous model: peer support × stressors → psychological symptoms

Predictor	β	SE	F	df
Initial psychological symptoms	0.895	0.091	97.75****	1, 556
Peer support	0.102	0.087	1.35	1, 556
Stressors	0.026	0.005	26.08****	1, 1177
Peer support × stressors	0.014	0.005	7.55**	1, 1177

**** $P < 0.0001$, ** $P < 0.01$

Discussion

Employing a five-wave longitudinal research design with 3-month follow-up assessments, we focused on the interaction between social supports and daily hassles in the development of somatic symptoms and psychological symptoms among Chinese high school students. Four major findings were observed. First, in line with previous research (Ling et al., 2010; Yang et al. 2010b), the results showed that stress (in the form of daily stressors), somatic depressive symptoms, and psychological depressive symptoms were highest at the initial assessment (time 1), but decreased during the follow-up interval 3 months later (time 2). This result may have occurred because that the students had just begun high school when the initial assessment was conducted. A variety of academic challenges, parental pressures, and peer relationship issues may have been involved in this major transition, yielding unusually high levels of daily stressors and depressive symptoms (Ming, Zhang, Chai, Chen, & Yao, 2013). As the students adjusted to the high school environment, their stress levels and depressive symptoms likely dropped. Moreover, practice effects may have occurred owing to the repeated follow-up assessments.

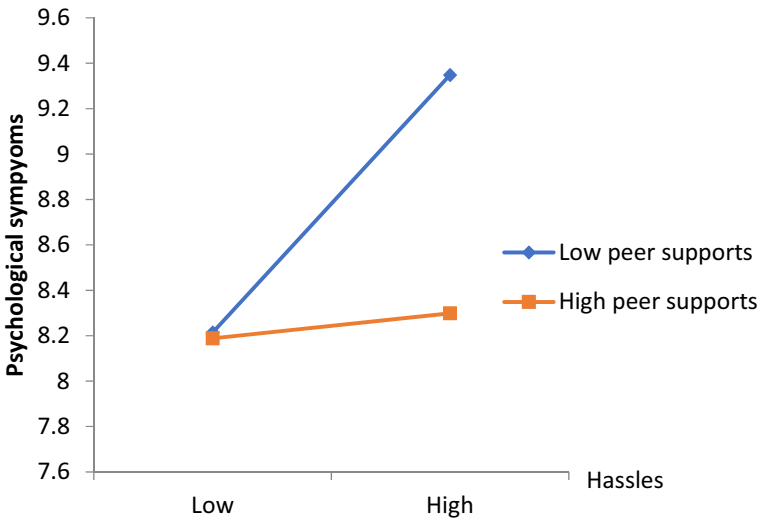

Fig. 2 Peer support and stressors as predictors of psychological symptoms

Second, although neither a significant main effect of parental or peer support nor a significant moderating effect of parental support was observed on students' somatic symptoms or psychological symptoms, a statistically significant moderating effect of peer support (but not parent support) was observed for both students' somatic symptoms and psychological symptoms. Thus, lower levels of social support from peers, in particular, acted as a vulnerability factor in relation to the adverse impact of daily stressors on depressive symptoms. These findings were inconsistent with past research findings (Zhou, Shek, Zhu, & Dou, 2020; Zhu & Shek, 2020) demonstrating that parents play an important role in influencing adolescent depression, especially living with parents was found to be a significant protective factor against depression longitudinally. The reason for the greater contribution of peers rather than parents in this study might be that Chinese high school students spend most of their time with peers rather than parents (Liu et al., 2019). This difference was especially characteristics of our sample because most of the adolescents in our sample were residential students in a high school where they spent only 4 days of vacation time with their parents every month. In this case, peers may likely provide more timely and effective support than parents. In addition, teenagers and their peers are developmentally in the same stage, living and learning in the same environment; thus, they may experience similar daily hassles so that peers can provide more effective support for teenagers than their parents (Ling et al. 2010).

This finding of a moderating effect of peer social support was consistent with the previously mentioned studies of Yang et al. (2010b) with Chinese adolescents of ages 14–18 years and Machmutow et al. (2012) with Swiss adolescents of ages 13–15 years. Nevertheless, this finding contrasted with that of several studies of adolescents that supported a main effects model of social support (Bilsky et al., 2013; Galand & Hospel, 2013). As noted above, these inconsistencies may reflect methodological issues, including differences in the measures of social support used in the studies and differences in the analytic strategies for assessing buffering effects (Aneshensel & Stone, 1982). Nevertheless, our study supports the diathesis-stress model of depression symptoms in a community-based sample of Chinese adolescents.

Furthermore, our results demonstrated that lower levels of peer support occurred along with increases in both somatic symptoms and psychological symptoms in the presence of daily stressors in high school students. This finding underscored that differences in peer support contributed equally to the development of somatic symptoms and psychological symptoms. This finding that lower levels of peer support represented a risk for Chinese students in terms of the development of multiple forms of depressive symptoms in the face of daily stressors is in accordance with Bleuler's conceptualization of the diathesis-stress framework (Bleuler, 1966) and extends beyond the findings of Yang et al. (2015) who did not differentiate between the two forms of depressive symptoms. This finding also suggests that although Chinese youth may emphasize somatic symptoms in reporting depressive symptoms to others, they may nevertheless be at risk for experiencing higher levels of somatic and psychological symptoms when confronted with frequent daily stressors and low peer support.

Our study reflected several noteworthy strengths. The present research increased its statistical power by applying five repeated assessments across a 1-year time interval. A relatively reliable estimate of each adolescent's occurrence of daily stressors was generated to minimize the effects of individual differences in the relevant variables.

Moreover, a general community sample of adolescents was employed, instead of a clinical sample, which would be less relevant to understanding the development of depressive symptoms. Finally, sophisticated statistical tests were applied to test the hypotheses.

However, some limitations of the current study should be noted. First, the data were collected in only one Chinese province, Hunan, which may limit the generalizability of the findings relative to other regions of China. The samples for future studies should be more representative of the general population of Chinese adolescents. Secondly, daily stressors were exclusively assessed by self-report measures, which may not be as domain-specific (e.g., peer experiences, family experiences) nor as objective as contextual stress interviews, which incorporate parent and child reports. Future research would benefit from using domain-based and multi-informant reports of life experiences in multi-wave designs. Finally, our study did not address whether specific daily stressors were particularly relevant to specific depressive symptoms. Therefore, further research should examine whether specific life stressors may differentially predict different symptoms of depression.

Conclusions

Our findings extended beyond those of previous studies by using a multi-wave longitudinal design to demonstrate that the frequency of occurrence of daily stressors predicted higher levels of depressive symptoms, both somatic and psychological, but only among those students experiencing lower levels of peer support. These findings supported the diathesis-stress model for peer support, but not parent support, among Chinese high school students. The finding of the greater influence of peer support than parent support in high school students underscores the importance of promoting optimal levels of peer support for the prevention and amelioration of depressive symptoms among high school students. Pfeiffer et al. (2011) argued that interventions promoting peer support exceed the usual standards of care in decreasing depressive symptoms as support from peers often plays a crucial role as a source of emotional support, affection, intimacy, and nurturance, thereby giving individuals better resources to cope with daily stressors and prevent and decrease depressive symptoms in adolescents.

Funding This research was supported by the Key Program for Research on Women's Theory and Practice of Hunan Province (18ZDB04) awarded to Dr. Yu Ling.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the Educational College of Hunan Agricultural University Institutional Review Board and with the 1964 Helsinki declaration as well as its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

Akaike, H. (1987). Factor analysis and AIC. *Psychometrika, 52*(3), 317–332. https://doi.org/10.1007/BF02294359.

Aneshensel, C. S., & Stone, J. D. (1982). Stress and depression: a test of the buffering model of social support. *Archives of General Psychiatry, 39*(12), 1392–1396. https://doi.org/10.1001/archpsyc.1982.04290120028005.

Aro, H., Hänninen, V., & Paronen, O. (1989). Social support, life events and psychosomatic symptoms among 14–16-year-old adolescents. *Social Science & Medicine, 29*(9), 1051–1056. https://doi.org/10.1016/0277-9536(89)90015-4.

Assari, S., & Lankarani, M. M. (2016). Association between stressful life events and depression; intersection of race and gender. *Journal of Racial and Ethnic Health Disparities, 3*(2), 349–356. https://doi.org/10.1007/s40615-015-0160-5.

Auerbach, R. P., Bigdapeyton, J. S., Eberhart, N. K., Webb, C. A., & Ho, M. H. (2011). Conceptualizing the prospective relationship between social support, stress, and depressive symptoms among adolescents. *Journal of Abnormal Child Psychology, 39*(4), 475–487. https://doi.org/10.1007/s10802-010-9479-x.

Belsky, J., Jonassaint, C., Pluess, M., Stanton, M., Brummett, B., & Williams, R. (2009). Vulnerability genes or plasticity genes? *Molecular Psychiatry, 14*(8), 746–754. https://doi.org/10.1038/mp.2009.44.

Bilsky, S. A., Cole, D. A., Dukewich, T. L., Martin, N. C., Sinclair, K. R., Cong, V. T., et al. (2013). Does supportive parenting mitigate the longitudinal effects of peer victimization on depressive thoughts and symptoms in children? *Journal of Abnormal Psychology, 122*(2), 406. https://doi.org/10.1037/a0032501.

Bleuler, M. (1966). Conception of schizophrenia within the last fifty years and today. *International Journal of Psychiatry, 56*(10), 135–137. https://journals.sagepub.com/doi/pdf/10.1177/003591576305601048.

Blom, M. (2005). Psychosocial risk factors in women with coronary heart disease : stress, social support and a behavioral intervention. *International Journal of Cancer Journal International Du Cancer, 85*(1), 27–34 https://openarchive.ki.se/xmlui/handle/10616/43459.

Brown, J. D., Harris, S. K., Woods, E. R., Buman, M. P., & Cox, J. E. (2012). Longitudinal study of depressive symptoms and social support in adolescent mothers. *Maternal & Child Health Journal, 16*(4), 894–901. https://doi.org/10.1007/s10995-011-0814-9.

Chao, S. F. (2011). Assessing social support and depressive symptoms in older Chinese adults: a longitudinal perspective. *Aging & Mental Health, 15*(6), 765–774. https://doi.org/10.1080/13607863.2011.562182.

Chatwin, S., Porter, D., & Sheldon. (2016). The effectiveness of cognitive behavioral therapy and emotional freedom techniques in reducing depression and anxiety among adults: A pilot study. *Integrative Medicine, 15*(2), 27. https://doi.org/10.1007/s10802-015-0103-y.

Chiu, R. K., & Kosinski, F. A. (2011). Chinese cultural collectivism and work-related stress: implications for employment counselors. *Journal of Employment Counseling, 32*(3), 98–110. https://doi.org/10.1002/j.2161-1920.1995.tb00980.x.

Colodro-Conde, L., Couvy-Duchesne, B., Zhu, G., Coventry, W., Byrne, E., & Martin, N. (2017). A direct test of the diathesis-stress model for depression. *Molecular Psychiatry, 23*(7). https://doi.org/10.1038/mp.2017.130.

Compas, B. E., Davis, G. E., Forsythe, C. J., & Wagner, B. M. (1987). Assessment of major and daily stressful events during adolescence: the Adolescent Perceived Events Scale. *Journal of Consulting & Clinical Psychology, 55*(4), 534–541. https://doi.org/10.1037//0022-006X.55.4.534.

De Pallant, R. (2012). Investigation of the stress-buffering effects of social support on adjustment in youth caring for parents with illness or disability. *Stressors in Yong Primary & Secondary Carers*. http://espace.library.uq.edu.au/view/UQ:307059

Dumont, M., & Provost, M. A. (1999). Resilience in adolescents: protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of Youth & Adolescence, 28*(3), 343–363. https://doi.org/10.1023/A:1021637011732.

Dykman, & BM. (1998). Integrating cognitive and motivational factors in depression: Initial tests of a goal-orientation approach. *Journal of Personality and Social Psychology, 74*(1), 139–158. https://doi.org/10.1037//0022-3514.74.1.139.

East, P. L., Hess, L. E., & Lerner, R. M. (1987). Peer social support and adjustment of early adolescent peer groups. *Journal of Early Adolescence, 7*(2), 153–163. https://doi.org/10.1177/0272431687072003.

Freeman, P., & Rees, T. (2010). Perceived social support from team-mates: direct and stress-buffering effects on self-confidence. *European Journal of Sport Science, 10*(1), 59–67. https://doi.org/10.1177/0272431687072003.

Galand, B., & Hospel, V. (2013). Peer victimization and school disaffection: exploring the moderation effect of social support and the mediation effect of depression. *British Journal of Educational Psychology, 83*(4), 569–590. https://doi.org/10.1111/j.2044-8279.2012.02077.x.

Gordana, S., Fadbi, O., & Slagana, A. (2016). Relationship between stressful life events and anxiety during the period of adolescence. *European Scientific Journal, 12*(11), 332–340. https://doi.org/10.1016/S0006-3223(01)01129-5

Hankin, B. L., & Abela, J. R. Z. (2005). *Development of psychopathology: a vulnerability-stress perspective*: Sage Publications.

Hankin, B. L., & Abramson, L. Y. (2002). Measuring cognitive vulnerability to depression in adolescence: reliability, validity, and gender differences. *Journal of Clinical Child and Adolescent Psychology, 31*(4), 491–504. https://doi.org/10.1207/S15374424JCCP3104_8.

Harter, S. (1985). *Manual for the social support scale for children and adolescents*. University of Denver.

Kleinman, A. (1982). Neurasthenia and depression: a study of somatization and culture in China. *Culture Medicine & Psychiatry, 6*(2), 117–190. https://doi.org/10.1007/BF00051427.

Kung, W. W., & Lu, P.-C. (2008). How symptom manifestations affect help seeking for mental health problems among Chinese Americans. *Journal of Nervous & Mental Disease, 196*(1), 46–54.

Laet, D., & Luc, & Leeuwen, V. (2014). Comparing parent-child and teacher-child relationships in early adolescence: measurement invariance of perceived attachment-related dimensions. *Journal of Psychoeducational Assessment, 32*(6), 521–532. https://doi.org/10.1177/0734282914527408.

Li, H., & Prevatt, F. (2008). Fears and related anxieties in Chinese high school students. *School Psychology International, 29*(1), 89–104.

Ling, Y., He, Y., Wei, Y., Cen, W., Zhou, Q., & Zhong, M. (2016). Intrinsic and extrinsic goals as moderators of stress and depressive symptoms in Chinese undergraduate students: a multi-wave longitudinal study. *BMC Psychiatry, 16*(1), 138. https://doi.org/10.1186/s12888-016-0842-5.

Ling, Y., Wei, Y., Yi, J., Xiao, J., & Yao, S. Q. (2008). Factorial structure of the CES-D scale among Chinese high school students. *Chinese Journal of Clinical Psychology, 43*(3–4), 284–284. https://doi.org/10.1080/00273170701710338.

Ling, Y., Yang, J., Zhang, C. C., Yi, J. Y., & Yao, S. Q. (2010). Social support as a moderator of the effects of adolescent stress and depressive symptoms: a longitudinal study. *Chinese Journal of Clinical Psychology*(05), 70-73. http://www.cnki.com.cn/Article/CJFDTotal-ZLCY201005022.htm

Liu, C., Wei, Y., Ling, Y., Huebner, E. S., Zeng, Y., & Yang, Q. (2019). Identifying trajectories of Chinese high school students' depressive symptoms: an application of latent growth mixture modeling. *Applied Research in Quality of Life, 14*(1), 1–15. https://doi.org/10.1007/s11482-018-9703-3.

Machmutow, K., Perren, S., & Sticca, F. (2012). Peer victimisation and depressive symptoms: can specific coping strategies buffer the negative impact of cybervictimisation? *Emotional & Behavioural Difficulties, 17*(16), 403–420. https://doi.org/10.1080/13632752.2012.704310.

Mazure, C., Bruce, M., Maciejewski, P., & Jacobs, S. (2000). Adverse life events and cognitive-personality characteristics in the prediction of major depression and antidepressant response. *American Journal of Psychiatry, 157*(6), 896–903. https://doi.org/10.1002/anie.200804573.

Mazurka, R., Wynne-Edwards, K. E., & Harkness, K. L. (2016). Stressful life events prior to depression onset and the cortisol response to stress in youth with first onset versus recurrent depression. *Journal of Abnormal Child Psychology, 44*(6), 1173–1184. https://doi.org/10.1007/s10802-015-0103-y.

Ming, Q. S., Zhang, Y., Chai, Q. L., Chen, H. Y., & Yao, S. Q. (2013). Interaction between a serotonin transporter gene promoter region polymorphism and stress predicts depressive symptoms in Chinese adolescents: a multi-wave longitudinal study. *BMC Psychiatry, 13*(1), 142–142. https://doi.org/10.1186/1471-244X-13-142.

Nylen, K., Williamson, A., O'Hara, M., Watson, D., & Engeldinger, J. (2013). Validity of somatic symptoms as indicators of depression in pregnancy. *Archives of Womens Mental Health, 16*(3), 203–210. https://doi.org/10.1007/s00737-013-0334-2.

O'Connor, R. C., Rasmussen, S., & Hawton, K. (2010). Predicting depression, anxiety and self-harm in adolescents: the role of perfectionism and acute life stress. *Behaviour Research and Therapy, 48*(1), 52–59. https://doi.org/10.1016/j.brat.2009.09.008.

Parker, G., Chan, B., Tully, L., & Eisenbruch, M. (2005). Depression in the Chinese: the impact of acculturation. *Psychological Medicine, 35*(10), 1475–1483. https://doi.org/10.1017/S0033291705005623.

Pearlin, L. I., & Bierman, A. (2013). *Current issues and future directions in research into the stress process*: Springer Netherlands.

Pfeiffer, P. N., Heisler, M., Piette, J. D., Rogers, M. A. M., & Valenstein, M. (2011). Efficacy of peer support interventions for depression: a meta-analysis. *General Hospital Psychiatry, 33*(1), 29–36. https://doi.org/10.1016/j.genhosppsych.2010.10.002.

Radloff, L. S. (1977). The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401. abs/https://doi.org/10.1177/014662167700100306.

Rawana, J. S., & Morgan, A. S. (2013). Trajectories of depressive symptoms from adolescence to young adulthood: the role of self-esteem and body-related predictors. *Journal of Youth & Adolescence, 43*(4), 597–611. https://doi.org/10.1007/s10964-013-9995-4.

Ray Chaudhury, A. (2003). SAS users guide: Statistics.

Rhind, D. J. A., Jowett, S., & Lorimer, R. (2011). The impact of social support on student athletes' satisfaction in individual sports. *Journal for the Study of Sports & Athletes in Education, 5*(1), 73–84. https://doi.org/10.1179/ssa.2011.5.1.73.

Rudolph, K. D., Davis, M. M., & Monti, J. D. (2017). Cognition-emotion interaction as a predictor of adolescent depressive symptoms. *Developmental Psychology, 53*(12), 2377–2383. https://doi.org/10.1037/dev0000397.

Ryder, A. G., Yang, J., Zhu, X., Yao, S., Yi, J., Heine, S. J., & Bagby, R. M. (2008). The cultural shaping of depression: somatic symptoms in China, psychological symptoms in North America? *Journal of Abnormal Psychology, 117*(2), 300–313. https://doi.org/10.1037/0021-843x.117.2.300.

Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics, 6*(2), 15-18. euclid.aos/1176344136.

Sheffler, J., & Sachs-Ericsson, N. (2015). Racial differences in the effect of stress on health and the moderating role of perceived social support. *Journal of Aging & Health, 28*(8), 1362–1381. https://doi.org/10.1177/0898264315618923.

Silverstein, B., Edwards, T., Gamma, A., Ajdacic-Gross, V., Rossler, W., & Angst, J. (2013). The role played by depression associated with somatic symptomatology in accounting for the gender difference in the prevalence of depression. *Social Psychiatry & Psychiatric Epidemiology, 48*(2), 257–263. https://doi.org/10.1007/s00127-012-0540-7.

Simeng, G., Benyu, G., Tifei, Y., Wendong, D., & Fushun, W. (2016). Adult attachment,self-esteem and social support as predictors of adolescent depression. *Chinese Journal of Clinical Psychology, 24*(1), 1–7. https://doi.org/10.16128/j.cnki.1005-3611.2016.01.001

Taylor, S. E., Sherman, D. K., Kim, H. S., Jarcho, J., Takagi, K., & Dunagan, M. S. (2004). Culture and social support: who seeks it and why? *Journal of Personality and Social Psychology, 87*(3), 354–362. https://doi.org/10.1037/0022-3514.87.3.354.

Technow, J. R., Hazel, N. A., Abela, J. R. Z., & Hankin, B. L. (2015). Stress sensitivity interacts with depression history to predict depressive symptoms among youth: prospective changes following first depression onset. *Journal of Abnormal Child Psychology, 43*(3), 489–501. https://doi.org/10.1007/s10802-014-9922-5.

Tseng, W. (1975). The nature of somatic complaints among psychiatric patients: the Chinese case. *Comprehensive Psychiatry, 16*(3), 237–245. https://doi.org/10.1016/0010-440X(75)90050-4.

Verhoeven, M., Sawyer, M. G., & Spence, S. H. (2013). The factorial invariance of the CES-D during adolescence: are symptom profiles for depression stable across gender and time? *Journal of Adolescence, 36*(1), 181–190. https://doi.org/10.1016/j.adolescence.2012.10.007.

von Weiss, R. T., Rapoff, M. A., Varni, J. W., Lindsley, C. B., Olson, N. Y., Madson, K. L., & Bernstein, B. H. (2002). Daily hassles and social support as predictors of adjustment in children with pediatric rheumatic disease. *Journal of Pediatric Psychology, 27*(2), 155–165. https://doi.org/10.1093/jpepsy/27.2.155.

Wilz, G., & Barskova, T. (2007). Predictors of psychological and somatic components of poststroke depression: a longitudinal study. *Topics in Stroke Rehabilitation, 14*(3), 25–40. https://doi.org/10.1310/tsr1403-25.

Yang, T. O., Sylva, K., & Lunt, I. (2010a). Parent support, peer support, and peer acceptance in healthy lifestyle for asthma management among early adolescents. *Journal for Specialists in Pediatric Nursing Jspn, 15*(4), 272–281. https://doi.org/10.1111/j.1744-6155.2010.00247.x.

Yang, J., Yao, S., Zhu, X., Zhang, C., Ling, Y., Abela, J. R. Z., et al. (2010b). The impact of stress on depressive symptoms is moderated by social support in Chinese adolescents with subthreshold depression: a multi-wave longitudinal study. *Journal of Affective Disorders, 127*(1), 113–121. https://doi.org/10.1016/j.jad.2010.04.023.

Yang, J., Xia, L. W., & Yao, S. Q. (2015). Interpersonal vulnerability to depressive symptoms in adolescents: a multi-wave longitudinal study. *Chinese Journal of Clinical Psychology, 23*(1), 71-75. https://doi.org/10.16128/j.cnki.1005-3611.2015.01.016.

Yen, S., Robins, C. J., & Lin, N. (2000). A cross-cultural comparison of depressive symptom manifestation: China and the United States. *Journal of Consulting & Clinical Psychology, 68*(6), 993–999. https://doi.org/10.1037//0022-006X.68.6.993.

Yi, J., Zhu, X., Randy, P., & A., Casey K, G., Cai, L., Wang, Y., & Yao, S. (2012). Insecure attachment as a predictor of depressive and anxious symptomology. *Depression & Anxiety, 29*(9), 789–796. https://doi.org/10.1002/da.21953.

Zhang, L., Peng, C., & Dang, Q. (2004). Individual-tree basal area growth models for jack pine and black spruce in northern Ontario. *Forestry Chronicle, 80*(366), 366–374. https://doi.org/10.5558/tfc80366-3.

Zhou, Z., Shek, D. T. L. S., Zhu, X., & Dou, D. (2020). Positive youth development and adolescent depression: a longitudinal study based on mainland Chinese high school students. *Int. J. Environ. Res. Public Health, 17*(12), 4457. https://doi.org/10.3390/ijerph17124457.

Zhu, X., & Shek, D. T. L. (2020). The influence of adolescent problem behaviors on life satisfaction: parent–child subsystem qualities as mediators. *Child Indicators Research, 2020*(13), 1767–1789. https://doi.org/10.1007/s12187-020-09719-7.

Ziecel, E. (2015). Analysis of longitudinal data. *Statistics in Medicine, 37*(3), 356–356. https://doi.org/10.1080/00401706.1995.10484363.

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