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Original quantitative research

Reciprocal associations between positive emotions and resilience predict flourishing among adolescents

Jenna D. Gilchrist, PhD (1); Mahmood R. Gohari, PhD (1); Lizbeth Benson, PhD (2); Karen A. Patte, PhD (3); Scott T. Leatherdale, PhD (1)

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Abstract

Introduction: The broaden and build theory of positive emotions maintains that positive emotions serve to broaden individuals' thoughts and behaviours, resulting in the accrual of resources (e.g. resilience) that catalyze upward spirals of well-being. However, there is a relative dearth of research examining the upward spiral hypothesis in the context of adolescence.

Methods: Adolescents (n = 4064) in participating Canadian high schools were surveyed annually for three years as part of the COMPASS study. Reciprocal associations between positive emotions and resilience were examined as predictors of flourishing.

Results: Adolescents who experienced positive emotions more frequently than usual reported higher levels of resilience one year later. Similarly, adolescents who had higher levels of resilience than usual reported more positive emotions the following year. Higher than usual levels of resilience and positive emotions positively predicted flourishing.

Conclusion: Positive emotions result in a cascade of beneficial outcomes including increased resilience and enhanced well-being, catalyzing an upward spiral towards flourishing. Opportunities to enhance positive emotions early on in adolescence may help build resources that can set students on the path towards increased well-being.

Keywords: *random-intercept cross-lagged panel model, RI-CLPM, emotions, broaden and build theory, flourishing, well-being*

Highlights

- Positive emotions are associated with increased resilience one year later, and these increases in resilience result in subsequent increases in positive emotions.
- These experiences catalyze an upward spiral towards greater flourishing.
- Positive emotions, although fleeting, result in a more resilient version of the self that subsequently contributes to enhanced well-being over time.
- Opportunities to enhance positive emotions early on in adolescence may help build resources that can set students on the path towards increased well-being.

Introduction

Psychological well-being in adolescence often carries into adulthood, marking adolescence as a developmentally important period for establishing optimal functioning. Psychological well-being during adolescence confers a host of benefits including decreased depressive symptoms and conduct problems and better psychosocial outcomes, interpersonal relationships and school experiences as well as better overall health and fewer risky health behaviours in adulthood.[1,2] Of concern is that estimates of psychological well-being among youth are low and tend to decrease from early to late adolescence.[2]

Positive emotions are integral to the promotion of well-being. Positive emotions are multicomponent response tendencies that arise in response to favourable appraisals of a person's circumstances.[3] One theory that provides insight into how positive emotions promote greater well-being is the broaden and build theory.[4] Positive emotions broaden individuals' momentary thought-action repertoires, prompting them to pursue a variety of thoughts and behaviours, including exploring and learning, being creative and playful, etc.[4,5] Over time, this broadened perspective builds enduring physical (e.g. physical literacy), social (e.g. social connectedness), cognitive (e.g. self-efficacy) and psychological (e.g. resilience) resources that are themselves not emotional in nature.[6] In this way, positive emotions are valuable because their effects outlast the transient experience of the emotion. The resources built through positive emotions help individuals function more effectively in daily life, leading to enhanced well-being. Moreover, the resources accrued from experiencing positive emotions also increase the odds of experiencing subsequent positive emotions, thus creating a mutually reinforcing upward spiral of enhanced well-being.[3]

Author affiliations:

1. School of Public Health Sciences, University of Waterloo, Waterloo, Ontario, Canada
2. Department of Human Development and Family Studies, Pennsylvania State University, Pennsylvania, United States of America
3. Department of Health Sciences, Brock University, St. Catharines, Ontario, Canada

Correspondence: Jenna D. Gilchrist, School of Public Health Sciences, University of Waterloo, Waterloo, ON N2L 3G1; Email: jenna.gilchrist@uwaterloo.ca

The broaden and build theory has often been used as a framework for examining resilience as a resource that both accrues from, and leads to, positive emotions and enhanced well-being.[3,7,8] Both prospective observational studies and experimental designs have demonstrated support for associations between positive emotions and resilience in the enhancement of well-being.[6,9] For example, among undergraduate students, daily experiences of positive emotions over one month predicted increases in resilience, and changes in resilience were associated with increases in life satisfaction.[9] In an experimental test of the broaden and build theory, Fredrickson et al.[10] assigned working adults to a nine-week intervention designed to increase positive emotions. Increases in positive emotions across the duration of the intervention predicted increases in resilience, but the change in resilience from baseline to the end of the intervention did not predict changes in life satisfaction. It is possible that nine weeks was too short a time to observe significant changes for resilience, as other resources did significantly predict improved life satisfaction at the end of the intervention.[6] Taken together, these studies provide evidence of a central assertion within the broaden and build theory, namely that positive emotions result in the accrual of resources (i.e. resilience), and provide some evidence to suggest that this accrual of resources in turn promotes enhanced well-being.[6,10]

Support for the opposite pattern of effects has also been documented.[11] Individuals higher in resilience experienced more frequent positive emotions in the weeks following the September 11 terrorist attacks in the United States, and individuals reporting more frequent experiences of positive emotions following the attacks reported better mental health than those who experienced positive emotions less frequently.[11]

Although these studies provide support for central tenets of the broaden and build theory, empirical evidence of the upward spiral towards increased well-being is lacking.

The upward spiral outlined in the broaden and build theory reflects reciprocal relations between positive emotions and resilience that accumulate and compound over time, subsequently resulting in increased well-being. Tests of the upward spiral dynamic require study designs that allow for repeated assessments of positive emotions and resilience across multiple occasions and enough time for resources (i.e. resilience) to accrue. Reciprocal relationships between positive emotions and other resources have been noted across several studies.[12-15] However, the upward spiral dynamic between positive emotions and resilience has not been investigated. Furthermore, with few exceptions, researchers have not captured how these mutually reinforcing relationships between positive emotions and resources predict subsequent well-being.

The purpose of the present study was to examine (1) within-person reciprocal relationships between positive emotions and resilience, and (2) how these relationships predict well-being as a test of the upward spiral outlined in the broaden and build theory. We defined well-being as flourishing—a state of optimal human functioning.[2] We hypothesized that positive emotions would be associated with greater subsequent resilience; that resilience would be positively associated with subsequent positive emotions; and that both positive emotions and resilience would predict flourishing.

Methods

Procedure

We used data from a longitudinal sample of adolescents participating in the COMPASS (Cannabis, Obesity, Mental health, Physical activity, Alcohol, Smoking, Sedentary behaviour) study. COMPASS is a prospective cohort study (2012–2021) that collects data from full school samples of students (i.e. all students in the school are eligible to participate) in Grades 9 through 12 (Secondaire I–V in the province of Quebec) attending participating secondary schools across Canada. The data are collected annually during the school year via a self-reported paper-based questionnaire covering multiple content domains. COMPASS uses purposeful sampling based on the active-information, passive-consent parental permission protocols with active student assent. A full description of the COMPASS host study methods is available in print[16] or online (http://www.compass.uwaterloo.ca/). All procedures were approved by the University of Waterloo Office of Research Ethics (ORE 30118), and appropriate school board committees.

Participants

As of 2017, questions about students' mental health were integrated into the COMPASS questionnaire. Because of the longitudinal nature of the study, only students in Grades 9 or 10 (corresponding to Secondaire III and IV in Quebec schools) in 2017 were included in the analyses to allow for three years of data (i.e. 2017/18, 2018/19 and 2019/20 school years). At Wave 1 (2017/18), 32 023 students in Grades 9 and 10 participated in the study, while 33 141 Grade 10 and 11 students participated in Wave 2 (2018/19) and 10 294 Grade 11 and 12 students participated in Wave 3 (2019). For Wave 3, only those participants who completed the questionnaire in the first half of the school year (October–December 2019) were included. The final sample comprised 4064 students in Grades 9 and 10 in British Columbia (7 schools), Alberta (5 schools) and Ontario (37 schools) or Secondaire III and IV in Quebec (20 schools) who participated in all three waves.

Data were linked between consecutive years based on responses from participants to six questions; these responses were used to create a unique code for each student. The linkage algorithm could not match 6230 individuals. Respondents were missing across the three years primarily because of inability to follow-up during school closures in effect during the COVID-19 pandemic as well as scheduled spares or absenteeism during data collection or unmatched unique codes across waves of data collection.

Measures

Descriptive statistics

Study participants provided self-reported information specific to sex (male/female), school grade, province, ethnicity (White, Black, Asian, Latin American/Hispanic, Other/Mixed) and weekly spending money (used as a proxy for socioeconomic status).

Positive emotions

Two items assessing hope and happiness were used to measure the presence of positive emotions at each wave. Participants indicated on how many days in the past week they felt hopeful about the future and on how many days in the past week they were happy. Response options were 1 ("None or less than 1 day"), 2 ("1–2 days"), 3 ("3–4 days") and 4 ("5–7 days"). A composite score was created by

summing responses to the two items and calculating an average score at each wave. Higher scores represented more frequent experiences of positive emotions. The Spearman–Brown internal consistency estimate for the two items was .74.

Resilience

We adapted a single-item measure of resilience from the Brief Resilience Scale[17] to use in all three waves of data collection. Response options to the item, "I generally recover from setbacks quickly," ranged from 1 ("Strongly agree") to 5 ("Strongly disagree"). Scores were reverse-scored to aid in interpretation such that higher values indicate greater resilience.

Flourishing

The Flourishing Scale[18] consists of eight items designed to assess dimensions of psychological well-being, which include positive relationships, competence and meaning in life (e.g. "I am competent and capable in the activities that are important to me"). To accommodate inclusion in the COMPASS survey, we modified the original scaling of responses from a 7-point to a 5-point Likert scale, from 1 ("Strongly agree") to 5 ("Strongly disagree"). Scores were reverse-scored to aid interpretation. A single score was derived by summing participant responses across the eight items. Possible scores ranged from 8 to 40 with higher scores indicating greater flourishing. Support for the construct validity of test scores and estimates of score reliability have been reported in adolescents, including adolescents in the COMPASS study.[19-21] Cronbach alpha for scores in this sample was .90.

Data analysis

To test the research questions, we analysed scores for positive emotions and resilience at each of the three waves of data collection and the flourishing scores from Wave 3 (2019). We calculated descriptive statistics and correlations with corresponding confidence intervals between study variables. Confidence intervals that do not include zero are indicative of significant correlations. We calculated intraclass correlations (ICCs) for positive emotions and resilience across each of the three waves to determine the proportion of variance attributable to differences between people relative to variance attributable to variation in people over time.

We also calculated intraclass correlations for positive emotions, resilience and flourishing at the school level to determine the proportion of variance attributable to clustering at this level. Given the longitudinal nature of the design, measurement invariance of positive emotions was assessed across the three waves of data collection.

Finally, we used a random-intercept cross-lagged panel model (RI-CLPM)[22] to characterize reciprocal relations between positive emotions and resilience. These models are appropriate for examining within-person reciprocal effects while accounting for stable between-person differences.[23] The RI-CLPM is an extension of traditional cross-lagged panel model (CLPM) that separates variances due to changes within persons (within-person variability) from differences between persons (between-person variability). The model simultaneously examines (1) the autoregressive effects that reflect within-person stability in positive emotion and resilience over time (i.e. greater positive emotion and resilience scores for an individual at one time point predict greater scores at a subsequent time point), and (2) cross-lagged effects that reflect the degree to which changes in positive emotions are predicted by prior deviation from an individual's own score on resilience and vice versa. The model was implemented in a structural equation framework and estimated using full-information maximum likelihood to account for missing data.[24,25]

To confirm if the RI-CLPM was a better fit to the data than the traditionally used CLPM, we estimated both models and compared model fit. Model fit was assessed using the following fit indices: adjusted Bayesian information criterion (aBIC; the lower the value, the better the fit); root mean square error of approximation (RMSEA; optimal values $< .06$); square root mean residual (SRMR; optimal values $\leq .08$); and the comparative fit index (CFI; optimal values $> .95$).[26]

Results

Participant characteristics at baseline (Wave 1) are shown in Table 1. Descriptive statistics and correlations between study variables are presented in Table 2.

The intraclass correlations for positive emotions and resilience across the three waves were .47 and .52, respectively, indicating that approximately half of the variability in positive emotions and resilience is attributable to stable between-person differences and half is attributable to within-person variation. When the clustering of students within schools was taken into account, the intraclass correlations for positive emotions, resilience and flourishing were .04, .03 and .01, respectively, indicating that this clustering contributed little variability in the scores. As such, the clustering of schools was not considered in the analyses.

TABLE 1
Study participant characteristics at Wave 1 (2017/18 school year) (n = 4064)

Characteristic	n	%
Sex		
Male	1706	42.1
Female	2350	57.9
Province		
Alberta	270	6.6
British Columbia	707	17.4
Ontario	2611	64.2
Quebec	476	11.7
School grade		
9	2426	59.7
10	1638	40.3
Ethnicity		
White	2825	69.5
Black	107	2.6
Asian	495	12.2
Latin American/Hispanic	71	1.8
Other/Mixed	566	13.9
Weekly spending money, $		
0	894	22.1
1–20	1366	33.8
21–100	773	19.2
>100	318	7.9
Don't know	685	17.0

Note: Secondaire III and IV in Quebec schools were categorized as Grade 9 and 10, respectively.

Longitudinal measurement invariance of positive emotions was supported. A chi-square test comparing a constrained model in which the factor loadings were identical over time and an unconstrained model in which the factor loadings were free to vary was not significant ($p > 0.05$), suggesting that the latent structure is invariant over time.

Both a CLPM and RI-CLPM were fit to the data to determine that a RI-CLPM was

TABLE 2
Descriptive statistics and bivariate correlations with corresponding confidence intervals between study variables

Variable	Mean (SD)	1. Positive Emotions – Wave 1	2. Positive Emotions – Wave 2	3. Positive Emotions – Wave 3	4. Resilience – Wave 1	5. Resilience – Wave 2	6. Resilience – Wave 3
1. Positive Emotions – Wave 1	2.76 (0.88)	–					
2. Positive Emotions – Wave 2	2.74 (0.87)	0.42 (0.39–0.44)	–				
3. Positive Emotions – Wave 3	2.69 (0.88)	0.35 (0.31–0.38)	0.42 (0.39–0.45)	–			
4. Resilience – Wave 1	3.64 (0.98)	0.26 (0.23–0.29)	0.23 (0.19–0.25)	0.20 (0.16–0.23)	–		
5. Resilience – Wave 2	3.58 (1.00)	0.22 (0.18–0.25)	0.30 (0.27–0.32)	0.24 (0.21–0.28)	0.46 (0.43–0.48)	–	
6. Resilience – Wave 3	3.54 (1.02)	0.17 (0.14–0.21)	0.22 (0.19–0.26)	0.33 (0.29–0.36)	0.39 (0.35–0.42)	0.49 (0.46–0.52)	–
7. Flourishing – Wave 3	33.16 (12.64)	0.09 (0.05–0.13)	0.14 (0.10–0.18)	0.27 (0.24–0.31)	0.18 (0.14–0.21)	0.17 (0.13–0.21)	0.35 (0.32–0.38)

Abbreviation: SD, standard deviation.

Notes: Wave 1 = 2017/18 school year; Wave 2 = 2018/19 school year; Wave 3 = October–December 2019, as only those participants who completed the questionnaire in the first half of the school year were included.

Confidence intervals that do not include zero are indicative of significant correlations.

indeed the most parsimonious model. Inspection of the fit indices provided support for the RI-CLPM (aBIC = 77 090; CFI = .997; RMSEA = .02) being the better fit to the data than the CLPM (aBIC = 77 287; CFI = .948; RMSEA = .08). A model with the autoregressive and cross-lag parameters freely estimated failed to converge. As a result, both the autoregressive and cross-lagged parameters were constrained to be invariant over time. The specified model showed excellent fit to the data ($\chi^2(7) = 18.29$, $p = 0.011$, aBIC = 77090.43; RMSEA = .02; CFI = .99; SRMR = .01).

Standardized estimates of the RI-CLPM are shown in Figure 1.

At the between-person level, positive emotions and resilience were positively associated (β = .44; 95% CI = 0.36–0.53). In other words, on average, people who reported more positive emotions also reported greater resilience. There was a significant within-person contemporaneous association between positive emotions and resilience in 2017/18 (β = .16; 95% CI = 0.10–0.21), 2018/19 (β = .20; 95% CI = 0.15–0.26) and 2019 (β = .26; 95% CI = 0.21–0.31). There were significant within-person autoregressive associations for both positive emotions (β = .11; 95% CI = 0.05–0.17) and resilience (β = .17; 95% CI = 0.10–0.22).

Of primary interest are the cross-lagged relationships. We examined the cross-lagged relationship between adolescents' positive emotions at a given time point and their resilience at the subsequent time point to test the premise that positive emotions function to build resources over time and that greater accrual of personal resources should lead to more positive emotions. The findings supported these suppositions. Greater positive emotions positively predicted resilience at the subsequent wave (β = .07; 95% CI = 0.02–0.12). Cross-lagged associations were also supported from resilience and positive emotions at the subsequent wave (β = .10; 95% CI = 0.05–0.15).

Finally, temporal deviations in both positive emotions (β = .17; 95% CI = 0.11–0.23) and resilience (β = .25; 95% CI = 0.20–0.31) at Wave 3 predicted variation in flourishing at Wave 3. Stable between-person differences in positive emotions (β = .08; 95% CI = 0.02–0.14) and resilience (β = .19; 95% CI = 0.13–0.25) also significantly predicted variation in flourishing. Overall, the model accounted for 17% of the variance in flourishing.

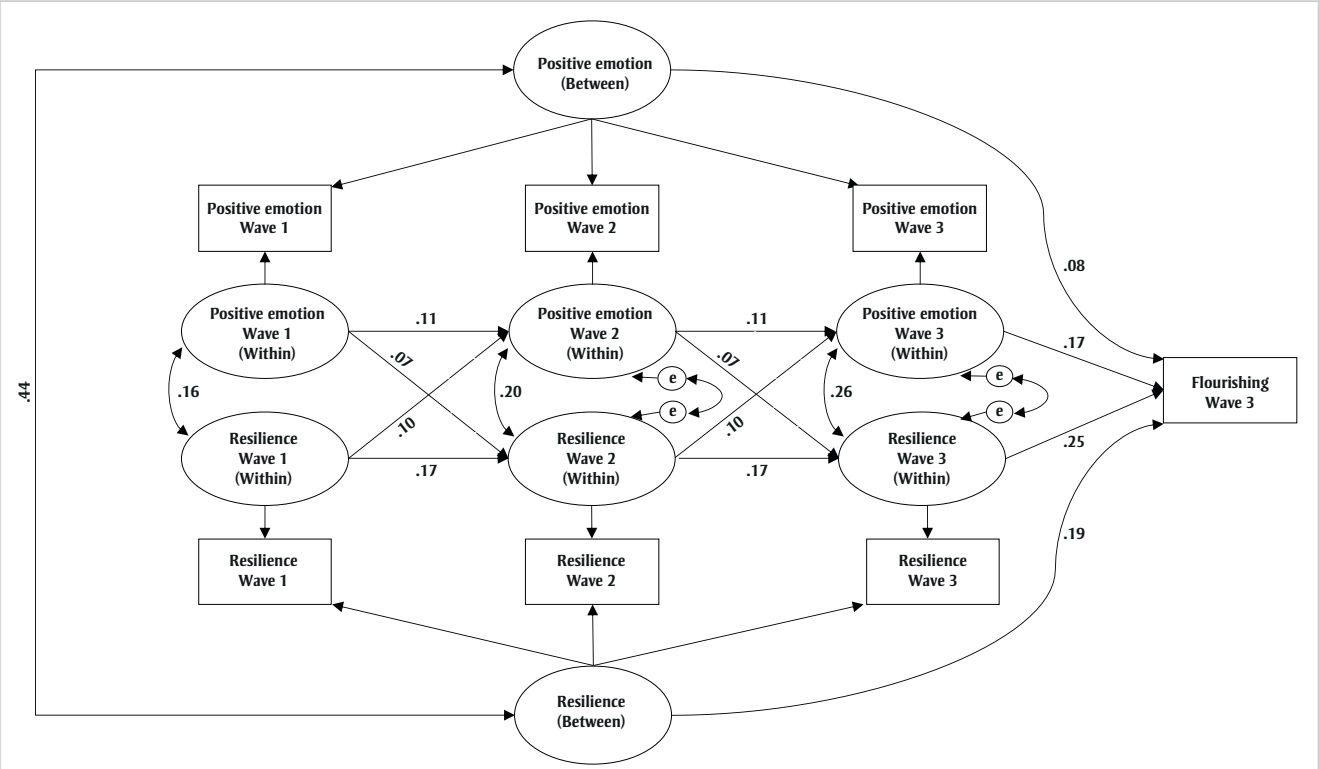
Discussion

Since the broaden and build theory was introduced in 1998, nearly all theoretical tests have examined between-person differences.[3] As a result, the current state of knowledge is limited to an understanding of individual differences in this process. Our aim in this study was to examine the upward spiral towards well-being by examining both between- and within-person associations.

Our findings support our hypothesis. When individuals experienced more positive emotions than they usually do, they experienced an increase in resilience one year later. Similarly, higher levels of resilience were subsequently associated with more frequent experiences of positive emotions. Higher levels of resilience and of positive emotions predicted enhanced flourishing. At the between-person level, both positive emotions and resilience were positively related and predicted greater flourishing.

Our results are consistent with the central premise of the broaden and build theory

FIGURE 1
Standardized results of RI-CLPM between positive emotions and resilience predicting flourishing



Abbreviations: e = measurement error; RI-CLPM, random-intercept cross-lagged panel model.

Note: Wave 1 = 2017/18 school year; Wave 2 = 2018/19 school year; Wave 3 = October–December 2019, as only those participants who completed the questionnaire in the first half of the school year were included.

that experiences of positive emotions, even if fleeting, build enduring psychological resources and trigger upward spirals towards enhanced well-being. By examining within-person associations, the results of the current study provide initial support for the causal process hypothesized in the broaden and build theory of positive emotions. Our results also provide a deeper and more robust understanding of the upward spiral and important theoretical and applied contributions to the study of adolescent well-being.

The upward spiral dynamic towards increased well-being is best captured by prospective, reciprocal associations. Although researchers have previously examined experimental and prospective associations between positive emotions and resilience, this is the first study to examine the upward spiral between positive emotions and resilience. Unlike prospective observational studies, tests of reciprocal relationships can provide stronger evidence of the upward spiral effect by demonstrating that positive emotions and resilience mutually reinforce one another to enhance well-being, and that this is a process that unfolds within individuals over time.

At the between-person level, positive emotions and resilience were moderately positively associated. This finding is consistent with prior studies that also found relationships between positive emotions and resilience of similar magnitudes when assessed at the between-person level.[9-11,28] In the present study, we found smaller associations between positive emotions and resilience when these were assessed both contemporaneously and prospectively at the within-person level. The difference in the magnitude of these relationships is in line with Burns et al.,[27] who found that the CLPM results are overestimated relative to RI-CLPM results. Smaller estimates are expected relative to prior estimates as autoregressive and lagged relationships pertain only to within-person associations in the RI-CLPM, while the CLPM does not separate out between-person differences from the within-person associations.[22]

Although effect sizes are smaller than those reported in previous studies employing between-person designs, dismissing small effect sizes has been cautioned against.[29] Small effect sizes can yield important theoretical advances and hold considerable impact. This is particularly true for effects that accumulate or compound over time, such as the reciprocal nature of the associations we documented in this study.[30]

This study supports not only the broaden and build theory but also the upward spiral dynamic;[4,5] positive emotions were associated with increased resilience one year later, illustrating that positive emotions function to build personal resources (i.e. resilience). Furthermore, experiences of positive emotions and resilience were mutually reinforcing and predicted increased flourishing across three years, illustrating the upward spiral dynamic. These findings are notable given that participants reported their positive emotions over the previous two weeks and resilience was assessed one year later. On

average, participants reported experiencing positive emotions a few times in the previous two weeks. That the meaningful variance was accounted for is notable, particularly in the absence of any intervention and the partitioning of variance into within- and between-person variance, which leaves less variance to predict year-to-year.

Schools are one of the most important developmental contexts in adolescents' lives. Schools afford key opportunities for adolescents to develop the skills and competencies that support their capacity for successful development into adulthood. Coinciding with the rise of positive psychology, many schools have begun shifting from focussing on negative experiences and deficits to prioritizing the implications of positive school experiences on student flourishing.[31,32] Positive psychology interventions implemented in schools have demonstrated promise for promoting both positive emotions and resilience among youth.[33,34] The findings of this study could be integrated into existing positive education programs in schools to promote optimal functioning among youth.

Strengths and limitations

Although we assessed only a limited number of positive emotions, feelings of hope are thought to be the positive emotion most central to resilience processes. Hope is theorized to build resilience, and early empirical research substantiates this claim.[3,35-37]

Another limitation of this study is that resilience was assessed using a single indicator. As a result, the ability to capture the full breadth of the construct is limited. The decision to use a single-item indicator of resilience was made in response to concerns about participant burden, survey space and adequate time to complete the survey in the time provided by the schools.

Only data collected in the fall of 2019 were used in Wave 3. This may result in biased estimates given the noted seasonal differences in mental health and well-being in Canada. The statistical approach used to model the longitudinal data has limitations, including the assumption of linear relationships between time-invariant variables and the inability to capture more complex processes.

Finally, since the schools analyzed in the study were chosen for convenience, the findings cannot be generalized beyond the sample. Nevertheless, by implementing a passive-consent protocol, the study was able to achieve high participation rates and minimize selection bias within schools. Moreover, because of the large sample size, the conclusions drawn from this research are likely to be applicable to a considerable number of high school students in Canada.

Several strengths of the current study should also be considered. This is the first study to examine the upward spiral towards enhanced well-being in a sample of adolescents. The longitudinal design allowed for the investigation of reciprocal relationships and for the disaggregation in variance at the between and within-person levels as well as sufficient time for resources to accrue and affect well-being. This allowed for a more accurate test of the broaden and build theory, and responds to a recent call for researchers to employ more advanced statistical modelling when evaluating the broaden and build theory to allow for disaggregation in within- and between-person variance.[23]

Conclusion

Much of the research on adolescent mental health has adopted a pathological approach, investigating mental illness at the expense of understanding factors that lead to optimal psychological functioning. Estimates indicate that flourishing decreases across adolescence.[2] Strategies that can mitigate this decline need to be identified. The findings from this study provide evidence that even fleeting experiences of positive emotions are associated with increases in resilience one year later, which subsequently result in further increases in positive emotions. These experiences catalyze an upward spiral towards flourishing. Opportunities to enhance emotions early on in adolescence may help build resources that can set students on the path towards increased well-being.

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Authors' contributions and statement

JG: Conceptualization, Methodology, Writing – Original draft, Writing – Review & Editing.

MG: Data curation, Formal analysis, Visualization.

LB: Conceptualization, Writing – Review & editing.

KP: Funding acquisition, Investigation, Project administration, Resources, Writing – Review & Editing.

SL: Funding acquisition, Project administration, Resources, Supervision, Writing – Review & Editing.

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Conflicts of interest

None.

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