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ORIGINAL PAPER

Longitudinal Associations Between Resilience, Emotion Regulation and Mental Health in Adolescents

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Abstract
The adolescent phase, which is already challenging, has been exacerbated by the psychological impact and social restrictions imposed by the COVID-19 pandemic, leading to the onset of psychiatric disorders. Strengthening psychological resilience (PR) and emotion regulation (ER) during challenging periods is vital to foster protective factors and cultivating effective coping strategies. This study aimed to longitudinally examine the association between ER and PR in Turkish adolescents while considering mental health as a control variable. Data collection took place twice, with an interval of three months, from December 2021 to March 2022, involving 929 students, comprising 465 girls and 464 boys, all aged between 10 and 15 years ($M=12$, $SE=0.92$). The data were analyzed using SPSS 26.00 and MPlus 8.7. We performed an autoregressive cross-lagged analysis to investigate the association between ER and PR. Our findings indicated that higher levels of PR were positively associated with internal functional ER (ER-IF) and negatively associated with internal dysfunctional ER (ER-ID) both at T1 and T2 cross-sectionally. Longitudinally, baseline PR was positively associated with ER-IF three months later, without significant gender differences. No longitudinal association was observed between PR and ER-ID. Moreover, greater mental health problems at T1 were positively associated with T2 ER-ID among women. Overall, our findings suggest that mental health professionals, teachers, and others working with adolescents should incorporate practices that strengthen psychological resilience to improve their well-being and quality of life.

Keywords Adolescence · COVID-19 · Longitudinal · Emotion regulation · Mental health · Psychological resilience

Introduction

Adolescence is a critical developmental period marked by profound psychological and physical changes, often making individuals vulnerable to mental health challenges [1]. Environmental stressors, such as the COVID-19 pandemic, have further exacerbated these challenges, significantly impacting adolescents' mental health [2–4]. During this time, rates

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of depression, anxiety, eating disorders, and suicidal ideation increased among youth [5], underscoring the urgent need to strengthen protective psychological resources.

Psychological resilience (PR) and emotion regulation (ER) are two key protective factors that can buffer individuals from the adverse effects of stressful life events [6]. For instance, individuals with low resilience among young individuals during the COVID-19 pandemic have exhibited less effective coping mechanisms [7]. Additionally, during the COVID-19 pandemic, ER skills such as cognitive reappraisal, humor, acceptance, and awareness have been identified as protective factors [8, 9].

While resilience is broadly defined as the capacity to adapt positively in the face of adversity [10], it is increasingly viewed as a dynamic process shaped by personal and environmental factors [11, 12]. Given its evolving nature, it is also crucial to examine the factors that contribute to psychological resilience during adolescence, a period characterized by frequent emotional fluctuations and considerable susceptibility to mental health problems [13, 14]. Similarly, ER refers to the processes through which individuals manage their emotional experiences and expressions [15]. Adaptive ER strategies—such as cognitive reappraisal—promote psychological well-being, while maladaptive ones—such as suppression—are linked to mental health problems [16, 17].

During adolescence, ER skills undergo notable changes. While the use of adaptive strategies typically increases with age, adolescents also experience heightened emotional intensity, which can make regulation more difficult [18, 19]. Difficulties in ER during this stage are associated with an increased risk for psychopathology [20, 21]. Understanding how ER and PR interact is therefore essential, especially since both play a pivotal role in adolescent mental health.

The literature suggests a strong link between ER and PR [22–28] yet the directionality of this relationship remains unclear. Some studies indicate that effective ER enhances resilience [29] while others propose that those with greater PR use more adaptive ER strategies than those with lower PR individuals [30–32]. For instance, PR may enhance ER skills through its interaction with various strengthening sources such as self-esteem and social support [33].

In recent years, theoretical models have been proposed to elucidate the nature of this relationship. In Troy et al.'s (2023) [34] integrative affect-regulation framework, affect regulation is viewed as a crucial precursor for resilience. According to this model, affect regulation processes contribute to strengthening PR through the positive outcomes they produce in the short term. A one key point here is that PR does not emerge immediately after using affect regulation strategies; rather, it develops over time through the short-term outcomes and the interaction with contextual factors [34]. The Broaden-and-Build Theory also contributes to our understanding of the relationship between ER and psychological resilience PR by explaining the interaction between emotions and resilience. According to this theory, psychological resilience and positive emotions are involved in a reciprocal causal relationship [35]. Strategies commonly used by highly resilient individuals, such as humor [8] and optimism [36] help elicit positive emotions [35]. Furthermore, resilient individuals are known to be more effective in utilizing the undo effect of positive emotions [37]. In other words, according to this theory, psychologically resilient individuals are more likely to possess the skills necessary to generate positive emotions. Therefore, they find it easier to engage in functional emotion regulation and are more effective in utilizing positive emotions as a means of coping with adversity. In summary, these theoretical frameworks

emphasize that PR and ER mutually influence each other over time. However, studies in the literature examining the relationship between ER and PR have predominantly focused on unidirectional associations and have been conducted using cross-sectional designs [26, 31, 38]. On the other hand, some longitudinal studies have examined the relationship between ER and PR through the mediator or moderator role of these variables [39]. Polizzi and Lynn (2021) [40], in their review of studies directly investigating ER–PR links, reported only one longitudinal study that followed adolescents. This study [41] investigated unidirectional associations and concluded that ER predicts PR, but it did not provide longitudinal evidence regarding the effect of PR on ER.

To sum up, although there is growing literature on the ER–PR relationship, there is a clear need for more longitudinal studies—especially among children and adolescents—that investigate bidirectional associations. As Polizzi and Lynn (2021) [40] also indicated, further longitudinal research is needed to confirm this bidirectional relationship. Moreover, the dynamic nature of PR necessitates longitudinal investigation to fully understand its development and reciprocal influences over time. This study aims to address this gap by examining the bidirectional relationship between PR and ER in Turkish adolescents over time. The context of the research is particularly relevant, as it was conducted during the 2021–2022 academic year—a period marked by ongoing psychological effects of the COVID-19 pandemic in Türkiye. Restrictions had only recently eased, yet adolescents were still grappling with emotional adjustment difficulties and the lingering impacts of social isolation [42].

In this study, we focused specifically on internal ER strategies, given their strong associations with mental health outcomes [43, 44]. Additionally, mental health was included as a control variable due to its reciprocal association with both PR and ER [45, 46]. In this context, the hypothesis of the research was determined as after controlling for mental health, the bidirectional cross-lagged associations between psychological resilience and emotion regulation remain statistically significant over the three-month follow-up period. In order to address the limitations of cross-sectional research, the study was conducted using a three-month longitudinal design. By exploring the longitudinal interplay between ER and PR, this study seeks to clarify their developmental relationship and inform preventive interventions aimed at strengthening adolescent mental health.

Materials and Methods

Participants

Participants were middle school students attending two schools in Gaziantep, Turkey. A total of 929 Turkish students between the ages of 10 and 15 ($M = 12$; $SE = 0.927$) participated in the study, 465 girls and 464 boys. Eight participants did not indicate their gender. Refugee students who speak Turkish as a second language were not included in the study because it was believed that the questions would not be as clear for Turkish students and might pressure them.

Measures

Emotion Regulation: Emotion Regulation Scale for Adolescents

This scale was developed by Phillips and Power (2007) [44] and adapted into Turkish by Duy and Yıldız (2014) [47]. An exploratory factor analysis conducted using this scale revealed factor loadings ranging from.57 to.83. It assesses adolescents' emotion regulation across four subdimensions: internal functional emotion regulation, internal dysfunctional emotion regulation, external functional emotion regulation, and external dysfunctional emotion regulation. The scale uses a five-point Likert-type rating from "Never (1)" to "Always (5) and consists of 18 items. The highest score in a sub-dimension indicates the adolescents' most frequently used emotion regulation strategies. In this study, internal functional and dysfunctional emotion regulation strategies were used. The internal functional strategies consist of positive reappraisal, goal reappraisal, making plans, putting into perspective, and paying attention, while the internal dysfunctional strategies consist of self-harm, rumination suppression, negative social comparison, and derealization. The Cronbach's alpha values of the internal functional emotion regulation (ER-IF) strategies were.70 for T1 and.78 for T2. The Cronbach's alpha value of the internal dysfunctional emotion regulation (ER-ID) strategies was.73 for T1 and.74 for T2.

Psychological Resilience: Child and Youth Resilience Measure (CYRM-28)

The 28-item version of the child and youth resilience measure (CYRM-28) was developed by Liebenberg et al., (2012) [48]. This scale was developed based on a socio-ecological perspective and utilized both quantitative and qualitative methods. Data were collected across 11 countries, and the results were based on information gathered from these countries. The original 28-item form consists of three subscales and eight sub-dimensions (48]. The scale on which resilience is assessed is based on a five-point Likert scale, ranging from 5 to 1 "Describes me completely (5)" to "Does not describe me at all (1), with a higher score indicating a higher level of resilience. The validity and reliability of the Turkish version of the CYRM-28 were evaluated by Arslan (2015] [49]. The overall internal consistency coefficient of the scale was.92. The internal consistency coefficients for the subscales range between.80 and.82. In this study, only the scale's total score is calculated. Cronbach's alpha value for the total scale was.90 for T1 and.92 for T2.

Mental Health: Revised Child Anxiety and Depression Scale (RCADS)

The revised Child Anxiety and Depression Scale (RCADS) is a 47-item self-report scale designed to assess symptoms related to DSM-4-based anxiety disorders and depression in children and adolescents by Chorpita et al., (2000) [50] Participants rate each item on a scale from 0 to 3 (0 = never, to 3 = always). The assessment tool comprises an overall measure of anxiety and depression, along with subscale scores for particular conditions, including separation anxiety disorder, generalized anxiety disorder, social anxiety, panic disorder, obsessive-compulsive disorder, and depression. The validity and reliability of the Turkish version were evaluated by Gormez et al. (2017) [51], showing appropriate congruence with existing anxiety and depression scales. The Cronbach's α for the total RCADS scale in the

Turkish version was 0.95. In this study, the total anxiety and depression score of the scale was used and referred to as mental health problems throughout the study. Cronbach's alpha value of the total scale was 0.95 for T1 and 0.94 for T2.

Procedure

The XXXX Ethics Committee approved the present study (Ethics approval number: XXXXX). Accordingly, written permission was obtained from the XXXX to collect data from schools. Ten schools were requested permission to collect data to ensure sample diversity, but only two agreed to participate. Therefore, the research data is collected from those state schools having similar sample profiles. Furthermore, a parental consent form was requested from the students' families. All individuals involved in the study provided informed consent, and psychological counselors communicated with the participants' parents to obtain their approval for the research. The scales were administered in a classroom setting in paper-and-pencil format by the first and second authors after obtaining the necessary permissions. Data were collected twice, three months apart, between December 2021 and March 2022. Almost all students volunteered to participate in the study during the first data collection process. However, in the second wave, 8th-grade students did not volunteer to participate because the high school preparatory exam date was approaching. A team also went on a trip during the second wave data collection process. Finally, although the nickname procedure in the first stage was reminded, some students refused to participate in the study because they had changed addresses or could not remember which name they wrote, especially those with two names.

Data Analysis

We computed descriptive statistics, Cronbach's alphas, and correlations using SPSS 26, see Tables 1 and 2. Primary analyses were conducted using MPlus 8.7. The Robust Maximum Likelihood Estimator (MLR) was used to conduct auto-regressive cross-lagged models to investigate the association between ER difficulties and PR. To check the adequacy of the model fit, we used commonly used goodness of fit indices [52], including the Comparative Fit Index. (CFI; ≥0.90 for acceptable; ≥0.95 for excellent), Root-Mean-Square Error of

Table 1 Means and standard deviations of scores on measures according to gender

			Girls			Boys	
		N	*M*	*SD*	*N*	*M*	*SD*
T1	CYRM	349	116.64	17.67	345	115.82	16.81
	RCADS	338	63.50	28.53	289	49.82	25.3
	ER-IF	455	16.05	2.88	453	15.76	2.79
	ER-ID	458	14.54	4.81	452	13.34	4.47
T2	CYRM	173	105.83	19.82	154	108.51	18.02
	RCADS	161	65.96	26.82	141	54.97	27.11
	ER-IF	203	15.22	3.46	190	15.46	3.12
	ER-ID	204	16.86	4.9	188	15.1	4.68

CYRM: Child and Youth Resilience Measure; RCADS: Revised Children Anxiety and Depression Scale; ER-IF: Internal Functional Emotion Regulation; ER-ID: Internal Dysfunctional Emotion Regulation

Table 2 Descriptive and correlational analysis results for T1 and T2

		N	*M*	*SD*	T1				*N*	*M*	*SD*	T2			
					1	2	3	4				1	2	3	4
T1	1. CYRM	700	116.22	17.33	-	−0.37**	0.41**	−0.46**							
	2. RCADS	631	57.206	27.98		-	−0.10**	0.64**							
	3. ER-IF	916	15.9	2.8			-								
	4. ER-ID	918	13.94	4.6				-							
T2	1. CYRM								328	107	19.06	-	−0.29**	0.39**	−0.32**
	2. RCADS								304	60.87	27.39		-	−0.003	0.41**
	3. ER-IF								395	15.32	3.3			-	
	4. ER-ID								394	16.03	4.8				-

CYRM: Child and Youth Resilience Measure; RCADS: Revised Children Anxiety and Depression Scale; ER-IF: Internal Functional Emotion Regulation; ER-ID: Internal Dysfunctional Emotion Regulation. T1 represents the first data collection wave and T2 represents the second data collection wave, *$p<.05$, **$p<.01$

Approximation (RMSEA; ≤0.06 for good, ≤0.08 for acceptable), and Tucker Lewis Index (TLI; ≥0.95 for good, ≥0.90 for acceptable) [52].

The final weighted sample included 938 participants among them, we included 929 participants, as they were the only individuals who could be matched across both data collection waves. At Time 1, our sample consisted of 935 individuals, while at Time 2, 394 individuals completed our questionnaire, indicating a 58% attrition rate between Time 1 and Time 2. Furthermore, we examined whether significant differences existed between participants with missing versus completed data across T1 and T2. Boys who did not attend T2 scored higher on T1 CYRM and ERIF, but lower on T1 ERID and RCADS compared to completers; however, these differences were not statistically significant. These findings indicates that attrition was unlikely to introduce systematic bias into the study results (Sample sizes for each missing variable are provided in Table 2). Furthermore, prior study [54] has emphasized that traditional missing data techniques such as listwise or pairwise deletion are inappropriate to handle missing data when missingness is 10% or more. Thus, traditional techniques may introduce bias, and it has been suggested that Full Information Maximum Likelihood (FIML) is a more appropriate method, as it performs better than traditional approaches such as listwise or pairwise. To do FIML first, we performed Little's Missing Completely at Random (MCAR) test in overall sample and after we performed MCAR for girls and boys separately. Test results for overall sample was non-significant, ($\chi^2 = 82371$; $df = 105815$; $p = 1.000$) when it comes to gender differences for girls ($\chi^2 = 27433$; $df = 46598$; $p = 1.000$) and for boys ($\chi^2 = 32874$; $df = 46828$; $p = 1.000$) it was also non-significant indicating missing data occurred randomly. Therefore, we replaced the missing values with 999 to compensate for the missing values in our dataset for further analysis on MPlus 8.7 using the FIML [53, 54]. First, we examined the association between ER and PR with a saturated model in the total sample (Model A). Next, we included the control variable MHP (Mental health problems) into the model (B). Given that mental health was included as a control variable, and that analyzing depression and anxiety separately would excessively expand the scope of the study, a total score of RCADS was used. Subsequently, we included gender grouping variables (i.e., boys and girls) into our model. We used a multi-group analysis to assess group differences across gender (i.e., boys vs. girls) (Model C). Following this, we tested the path coefficients between ER and PR and constrained them to be the same across groups (Model D). Finally, we compared the differences between Model C and D (i.e., unconstrained and constrained models) for gender differences to examine whether there were any differences across genders by examining changes in chi-square, CFI, TLI, and RMSEA values.

Results

All models (i.e., ERIF and ERID) showed an excellent fit to the data due to being fully saturated models (see Tables 3 and 4 for further details). To interpret our findings, we relied on the effect size criteria outlined by Orth et al. (2024) [55]. This framework was particularly instrumental in evaluating the magnitude of the cross-lagged effects between our key variables. Moreover, as seen in Table 2 cross-sectional results shows that higher levels of T1 PR were associated with higher levels of T1 ER-IF with a large effect ($r = .41$, 95%CI [0.34, 0.48], $p < .001$). Higher levels of T1 PR were associated with lower levels of T1 MHP with a

Table 3 Examination of the relationship between ERID and PR

Models	χ^2 (df)	CFI	TLI	RMSEA	RMSEA (90% CI)
Model A: Fully saturated model, (total sample)	0.000 (0)	1.000	1.000	0.000	0.000–0.000
Model B: Model with control variable (total sample)	0.000 (0)	1.000	1.000	0.000	0.000–0.000
Model C: Fully saturated model, grouping by gender	0.000 (0)	1.000	1.000	0.000	0.000–0.000
Model D: Same as Model C, parameters constrained to be equal between groups	29.482 (15)	0.964	0.943	0.046	0.020–0.070

χ2 = Chi-square test; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-square error of approximation; 90% CI = 90% confidence interval of RMSEA

Table 4 Examination of the relationship between ER-IF and PR

Models	χ^2 (df)	CFI	TLI	RMSEA	RMSEA (90% CI)
Model A: Fully saturated model, (total sample)	0.000 (0)	1.000	1.000	0.000	0.000–0.000
Model B: Model with control variable (total sample)	0.000 (0)	1.000	1.000	0.000	0.000–0.000

χ2 = Chi-square test; df = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis Index; RMSEA = root-mean-square error of approximation; 90% CI = 90% confidence interval of RMSEA

large effect (r = −.37, 95% CI [-0.44, −0.29], p <.001). Higher levels of T1 ER-IF were associated with lower levels of T1 MHP with a medium to large effect (r = −.10, 95% CI [-0.18, −0.03], p =.007). T2 ER-IF was not significantly associated with T2 MHP (r = - < 0.001, 95% CI [-0.14, 0.14], p =.971). Higher levels of T2 ER-IF were associated with higher levels of T2 PR with a large effect (r =.39, 95% CI [0.28, 0.49], p <.001). Higher levels of T1 PR were associated with lower levels of T1 ER-ID with a large effect (r = −.46, 95% CI [0.52, 0.39], p <.001). Higher levels of T1 MHP were associated with lower levels of T1 ER-ID with a large effect (r = −.64, 95% CI [0.58, 0.69], p <.001). Higher levels of T2 PR were associated with lower levels of T2 ER-ID with a large effect (r = −.32, 95% CI-0.44, -0.19], p <.001). Higher levels of T2 MHP were associated with higher levels of T2 ER-ID with a large effect (r = −.41, 95% CI [0.30, 0.53], p <.001).

Cross-Sectional and Longitudinal Associations Between ER-ID and PR

We examined gender differences (i.e., boys and girls), on the association between ER-ID and PR comparing unconstrained model (Model C) to the constrained model (Model D). (ΔCFI = 0.036; ΔTLI = 0.057; ΔRMSEA = -0.046). According to our findings, the corrected chi-square difference test result was significant (Δχ2 = 29.482, p =.013). The findings revealed that the association between ER-ID and PR differed significantly across gender. Regarding COVID-19 status, to examine whether the association between ER-ID and PR significantly differed across individuals diagnosed with COVID-19, we compared the unconstrained (Model E) to the constrained model (Model F). (ΔCFI = 0.012; ΔTLI = 0.02; ΔRMSEA = -0.029), the corrected chi-square difference test result was insignificant (Δχ2 = 20.674; p =.1475). The association between ER-ID and PR did not differ consider-

ably between individuals who were diagnosed and not diagnosed with Covid 19. Therefore the findings of Models B and C are reported in Figs. 1 and 2, and 3, as explained below.

Cross-sectionally higher levels of T1 ER-ID were associated with lower levels of T1 PR with a large effect (r=−.46, 95% CI [-0.52, −0.39], p<.001). Higher levels of T1 ER-ID were associated with higher levels of T1 MHP with a large effect (r=.64, 95% CI [0.58,0.69], p<.001). Higher levels of T1 MHP were associated with lower levels of T1 PR (r=−.36, 95% CI [-0.43, −0.28], p<.001). Higher levels of T2 ER-ID were associated with lower levels of T2 PR with a large effect (r=−.32, 95% CI [-0.44, −0.19], p<.001). Higher levels of T2 ER-ID were associated with higher levels of T2 MHP with a large effect (r=.41, 95% CI [0.30, 0.53]; p<.001). Higher levels of T2 MHP were associated with higher levels of T2 PR with a large effect (r=.28, 95% CI [-0.41, −0.53], p=.018).

Longitudinally, higher levels of T1 ER-ID significantly predicted higher levels of T2 ER-ID, with a large effect (β=0.39, 95% CI [0.25, 0.53], p<.001). T1 PR did not significantly predict T2 ER-ID. (β = −0.08, 95% CI [-0.19, 0.02], p=.131). Higher levels of T1 significantly predicted higher levels T2 ER-ID with a large effect (β=0.24, 95% CI [0.12, 0.36], p<.001). T1 ER-ID did not significantly predict T2 MHP (β=0.54, 95% CI [-0.06, 0.17], p=.372). Higher levels of T1 MHP significantly predicted higher levels T2 MHP with a large effect (β=0.64, 95% CI [0.54, 0.74], p<.001). T1 PR did not significantly predict T2 MHP (β = −0.98, 95% CI [-0.20, −0.00], p=.06). Higher levels of T1 PR significantly predicted higher levels of T2 PR with a large effect (β=0.54, 95% CI [0.41, 0.66], p<.001). T1 ER-ID did not significantly predict T2 PR (β = −0.11, 95% CI [-0.27, 0.03], p=.126). T1 MHP did not significantly predict T2 PR (β=0.10, 95% CI [-0.04, 0.25], p=.164).

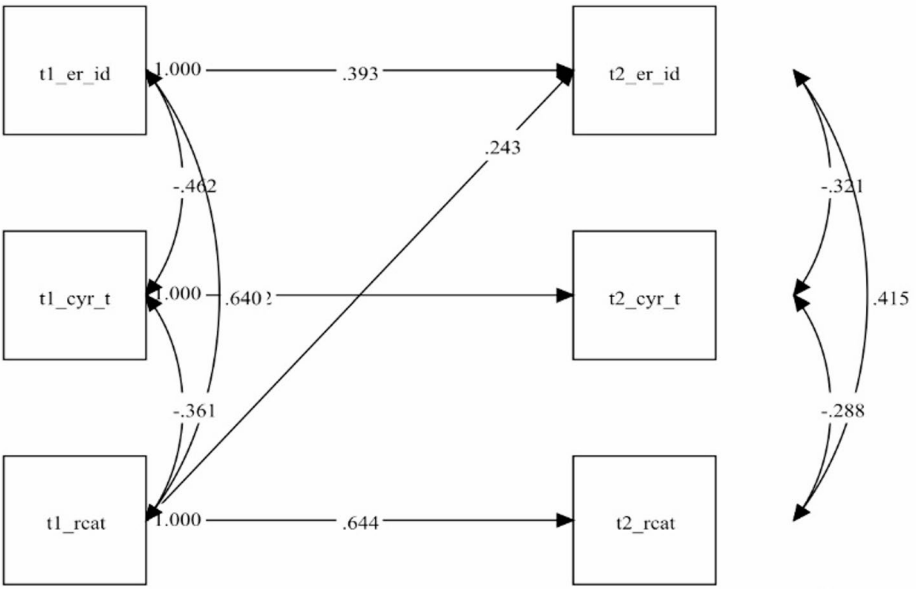

Fig. 1 Association Between ER-ID and PR. ER_ID: Internal Dysfunctional Emotion Regulation; RCADS: Revised Children's Anxiety and Depression Scale; CYRM: Child and Youth Resilience Measure. Only significant associations between T1 and T2 ER-ID, PR and MHP are presented for the sake of clarity. Coefficients are standardized regression coefficients. T1 represents the first data collection wave and T2 represents the second data collection wave, *p<.05, **p<.01

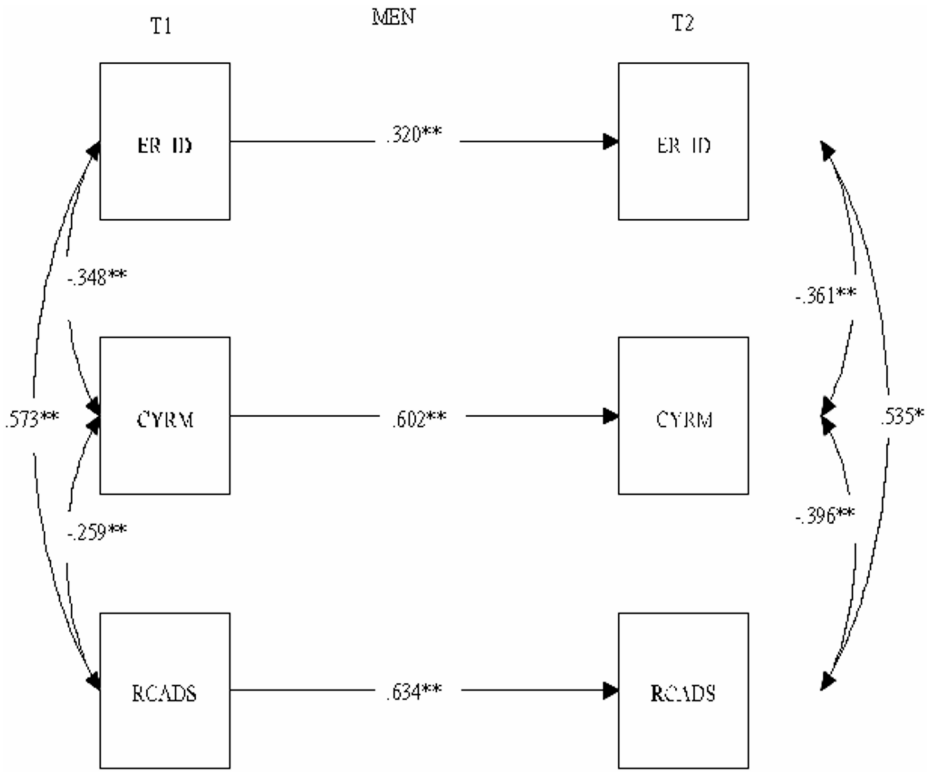

Fig. 2 Association Between ER-ID and PR among men. ER_ID: Internal Dysfunctional Emotion Regulation; RCADS: Revised Children's Anxiety and Depression Scale; CYRM: Child and Youth Resilience Measure. Only significant associations between T1 and T2 ER-ID, PR and MHP are presented for the sake of clarity. Coefficients are standardized regression coefficients. T1 represents the first data collection wave and T2 represents the second data collection wave, *$p<.05$, **$p<.01$

Cross-sectionally, among boys, higher levels of T1 ER-ID were associated with lower levels of T1 PR with a large effect ($r=-.34$, 95% CI [-0.45, −0.23], $p<.001$). Higher levels of T1 ER-ID were associated with higher levels of T1 MHP with a large effect ($r=.57$, 95% CI [0.47,0.67], $p<.001$). Higher levels of T1 PR were associated with lower levels of T1 MHP with a large effect ($r=-.25$, 95% CI [-0.37, −0.14], $p<.001$). Higher levels of T2 ER-ID were associated with lower levels of T2 PR with a large effect ($r=-.36$, 95% = [0.52, −0.19], $p<.001$). Higher levels of T2 ER-ID were associated with higher levels of T2 MHP with a large effect ($r=.53$, 95% CI [0.39, 0.65]; $p<.001$). Higher levels of T2 MHP were associated with lower levels of T2 PR with a large effect ($r=.39$, 95% CI [-0.56, −0.22], $p<.001$).

Longitudinally, higher levels of T1 ER-ID significantly predicted higher levels of T2 ER-ID with a large effect ($\beta=0.32$, 95% CI [0.10, 0.53], $p=.003$). T1 PR did not significantly predict T2 ER-ID ($\beta=-0.11$, 95% CI [-0.27, 0.04], $p=.165$). T1 MHP did not significantly predict T2 ER-ID ($\beta=0.17$, 95% CI [-0.01, 0.35], $p=.068$). T1 ER-ID did not significantly predict T2 MHP ($\beta=0.68$, 95% CI [-0.08, 0.30], $p=.259$). Higher levels of T1 MHP predicted higher levels of T2 MHP with a large effect ($\beta=0.63$, 95% CI [0.48, 0.78], $p<.001$).

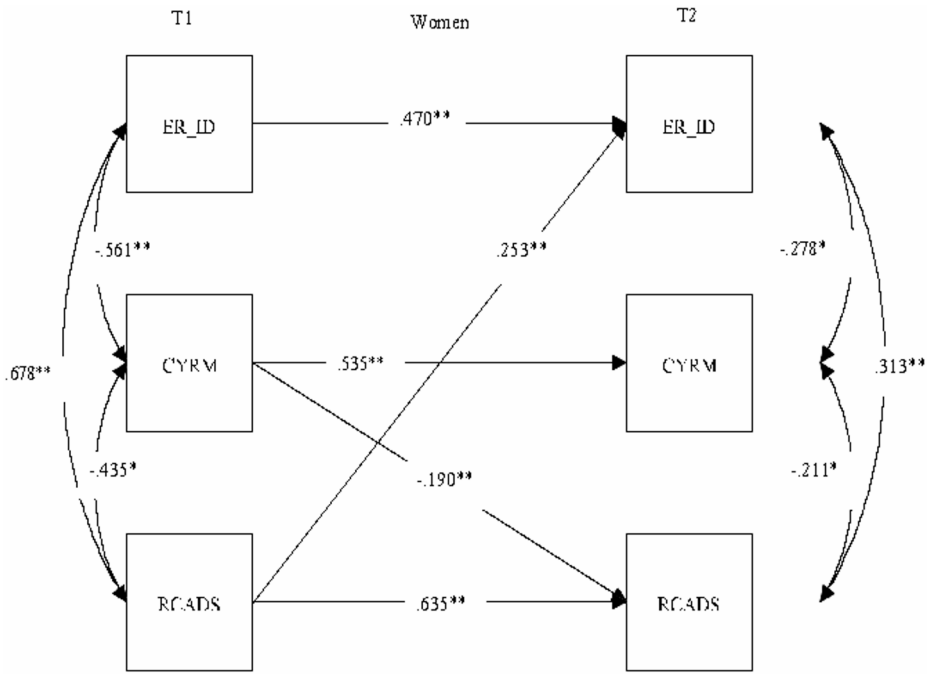

Fig. 3 Association between ER-ID and PR among women. ER_ID: Internal Dysfunctional Emotion Regulation; RCADS: Revised Children's Anxiety and Depression Scale; CYRM: Child and Youth Resilience Measure. Only significant associations between T1 and T2 internal dysfunctional emotion regulation, psychological resilience, and poor mental health are presented for the sake of clarity. Coefficients are standardized regression coefficients. T1 represents the first data collection wave and T2 represents the second data collection wave, *p<.05, **p<.01

T1 PR did not significantly predict T2 MHP (β = −0.00, 95% CI [-0.13, 0.13], p=.989). T1 ER-ID did not significantly predict T2 PR (β = −0.03, 95% CI [-0.08,0.30], p=.760). T1 MHP did not significantly predict T2 PR (β=0.06, 95% CI [-0.16, 0.27], p=.601). Higher levels of T1 PR significantly predicted higher levels of T2 PR with a large effect (β=0.60, 95% CI [0.45, 0.74], p<.001).

Among girls, higher levels of T1 ER-ID were associated with lower levels of T1 PR with a large effect (r=−.56, 95% CI [-0.63 −0.49], p<.001). Higher levels of T1 ER-ID were associated with higher levels of T1 MHP with a large effect (r=.67, 95% CI [0.61, 0.74], p<.001). Higher levels of T1 MHP were associated with lower levels of T1 PR with a large effect (r=−.43, 95% CI [-0.52, −0.34], p<.001). Higher levels of T2 ER-ID were associated with lower levels of T2 PR with a large effect (r=−.27, 95% CI [-0.44, −0.10], p<.001). Higher levels of T2 ER-ID were associated with higher levels of T2 MHP with a large effect (r=.31, 95% CI [0.15, 0.46], p<.001). Higher levels of T2 MHP were associated with lower levels of T2 PR with a large effect (r=−.21, 95% CI [-0.38, −0.03], p=.018). Longitudinally, higher levels of T1 ER-ID significantly predicted higher levels of T2 ER-ID with a large effect (β=0.47, 95% CI [0.30, 0.63], p<.001). T1 PR did not significantly predict T2 ER-ID (β = −0.07, 95% CI [-0.20, 0.06], p=.313). Higher levels of T1 MHP significantly predicted higher levels of T2 ER-ID with a large effect (β=0.25, 95% CI [0.10, 0.40], p=.001). T1 ER-ID did not significantly predict T2 MHP (β=0.00, 95% CI [-0.13,

0.14], p=.935). Higher levels of T1 MHP significantly predicted higher levels of T2 MHP with a large effect (β=0.63, 95% CI [0.49, 0.77], p<.001). Higher levels of T1 PR significantly predicted higher levels of T2 MHP with a large effect (β = −0.19, 95% CI [-0.33, −0.04], p=.009). Higher levels of T1 PR significantly predicted higher levels of T2 PR with a large effect (β=0.53, 95% CI [0.35, 0.71], p<.001). T1 ER-ID did not significantly predict T2 PR (β = −0.17, 95% CI [-0.39, 0.04], p=.124). T1 MHP did not significantly predict T2 PR (β=0.13, 95% CI [-0.07, 0.35], p=.208). Significant longitudinal paths are presented in Table 5.

Cross-Sectional and Longitudinal Associations Between ER-IF and PR

Similarly to ERID and ERIF we also examined whether the association between ER-IF and PR differed significantly across genders (i.e., adolescents), therefore we compared the unconstrained model (Model C) to the constrained model (Model D). (ΔCFI=0.016; ΔTLI=0.025; ΔRMSEA = -0.028). Moreover, the corrected chi-square difference test result was insignificant ($\Delta\chi2$=20.493, p=.1538). In contrast to ERID and PR association between ER-IF and PR did not differ considerably across genders. Regarding the COVID-19 status, to examine whether the association between ER-IF and PR significantly differed across individuals diagnosed or not diagnosed with COVID-19, we compared the unconstrained (Model E) to the constrained model (Model F). (ΔCFI=0.014; ΔTLI=0.023; ΔRMSEA = -0.029), the corrected chi-square difference test result was insignificant ($\Delta\chi2$=20.676; p=.1475). The association between ER-IF and PR did not differ considerably between individuals who were diagnosed and those who were not diagnosed with Covid 19. Therefore, the findings of Model B are reported in Fig. 4 and are explained below.

Cross-sectionally, higher levels of T1 ER-IF were associated with higher levels of T1 PR with a large effect (r=.41, 95%CI= [0.34, 0.48], p<.001). Higher levels of T1 ER-IF were associated with lower levels of T1 MHP with a medium to large effect (r=−.10, 95%CI= [-0.18, −0.03], p=.007). Higher levels of T1 MHP were associated with lower levels of T1 PR with a large effect (r=−.37, 95%CI= [-0.44, −0.29], p<.001). T2 ER-IF was not significantly associated with T2 MHP (r = -<0.001, 95%CI= [-0.14, 0.14], p=.971). Higher

Table 5 Longitudinal associations between ER-ID and PR controlling for MHP

Association	β	95% CI	*P*-value
Overall			
T1 ER-ID → T2 ER-ID	0.39	[0.25, 0.53]	<0.001
T1 MHP → T2 ER-ID	0.24	[0.12, 0.36]	<0.001
T1 MHP → T2 MHP	0.64	[0.54, 0.74]	<0.001
T1 PR → T2 PR	0.54	[0.41, 0.66]	<0.001
Boys			
T1 ER-ID → T2 ER-ID	0.32	[0.10, 0.53]	0.003
T1 MHP → T2 MHP	0.63	[0.48, 0.78]	<0.001
T1 PR → T2 PR	0.60	[0.45, 0.74]	<0.001
Girls			
T1 ER-ID → T2 ER-ID	0.47	[0.30, 0.63]	<0.001
T1 MHP → T2 ER-ID	0.25	[0.10, 0.40]	<0.001
T1 MHP → T2 MHP	0.63	[0.49, 0.77]	<0.001
T1 PR → T2 MHP	−0.19	[-0.33, −0.04]	0.009
T1 PR → T2 PR	0.53	[0.35, 0.71]	<0.001

CYRM: Child and Youth Resilience Measure; ER-ID: Internal Dysfunctional Emotion Regulation; MHP: Mental health problems; PR: Psychological Resilience; β: Standardized regression coefficient. This table includes only significant longitudinal paths (p<.05) for clarity. Full details of all tested models, including nonsignificant results, are presented in the main text

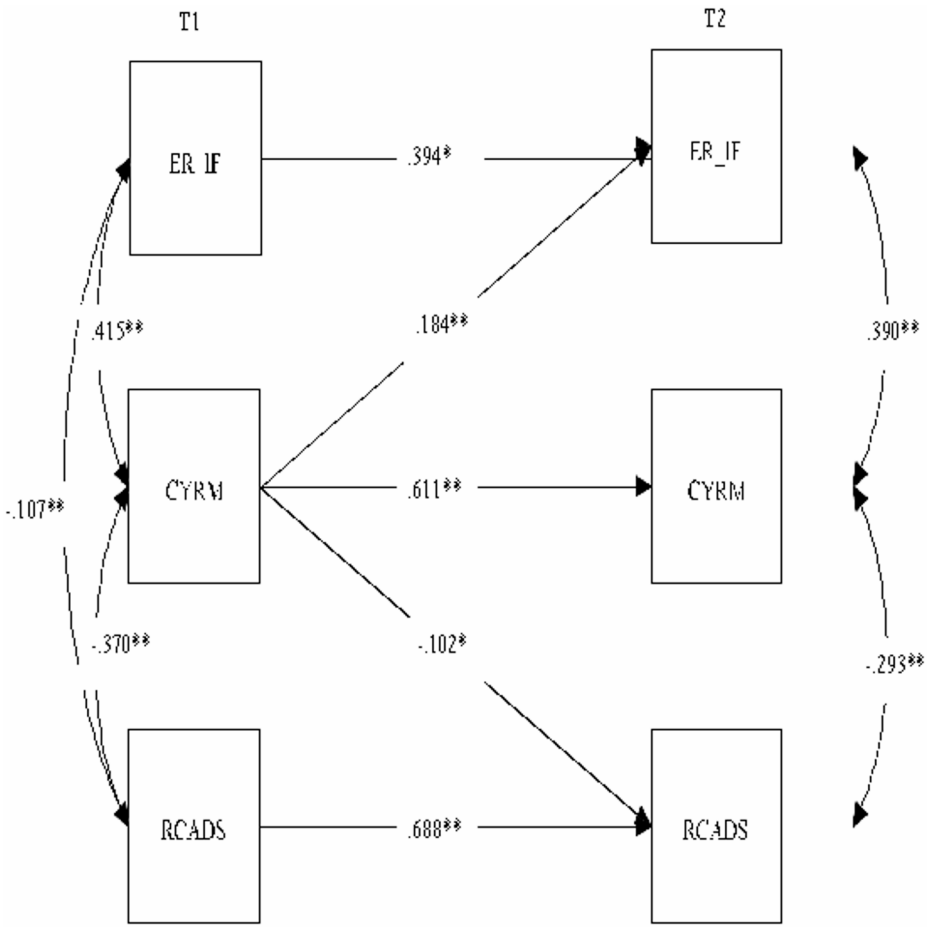

Fig. 4 Association Between ER-IF and PR. RCADS: Revised Children's Anxiety and Depression Scale; CYRM: Child and Youth Resilience Measure; ER-IF: Internal Functional Emotion Regulation. Only significant associations between T1 and T2 *internal functional emotion regulation*, psychological resilience, and poor mental health are presented for the sake of clarity. Coefficients are standardized regression coefficients. T1 represents the first data collection wave and T2 represents the second data collection wave, $*p<.05$, $**p<.01$

levels of T2 ER-IF were associated with higher levels of T2 PR with a large effect ($r=.39$, 95%CI= [0.28, 0.49], $p<.001$). Longitudinally, higher levels of T1 ER-IF significantly predicted higher levels of T2 ER-IF with a large effect ($\beta=0.39$, 95%CI= [0.27, 0.50], $p<.001$). Higher levels of T1 PR significantly predicted higher levels of T2 ER-IF with a large effect ($\beta=0.18$, 95%CI= [0.04, 0.32], $p=.011$). T1 MHP did not significantly predict T2 ER-IF (β = <0.001, 95%CI= [-0.11,0.11], $p=.991$). T1 ER-IF did not significantly predict T2 MHP (β = <0.00, 95%CI= [-0.09, 0.10], $p=.925$). Higher levels of T1 MHP significantly predicted higher levels of T2 MHP with a large effect ($\beta=0.68$, 95%CI= [0.61, 0.76], $p<.001$). Higher levels of T1 PR significantly predicted lower levels of T2 MHP with a medium to large effect ($\beta = -0.10$, 95%CI = [-0.19, −0.00], $p=.038$). Higher levels of T1 PR significantly predicted higher levels of T2 PR with a large effect ($\beta=0.61$, 95%CI= [0.49, 0.72], $p<.001$).

Table 6 Longitudinal associations between ER-IF and PR controlling for MHP for overall sample

Association	β	95% CI	*P*-value
T1 ER-IF → T2 ER-IF	0.39	[0.27, 0.50]	<0.001
T1 PR → T2 ER-IF	0.18	[0.04, 0.32]	0.011
T1 MHP → T2 MHP	0.68	[0.61, 0.76]	<0.001
T1 PR → T2 MHP	−0.10	[-0.19, −0.00]	0.038
T1 PR → T2 PR	0.61	[0.49, 0.72]	<0.001

ER-IF: Internal Functional Emotion Regulation; MHP: Mental health problems; PR: Psychological Resilience; *β*: Standardized regression coefficient. This table includes only significant longitudinal paths ($p<.05$) for clarity. Full details of all tested models, including nonsignificant results, are presented in the main text

T1 ER-IF did not significantly predict T2 PR ($\beta = -0.10$, 95%CI= [-0.21, 0.01], $p=080$). T1 MHP did not significantly predict T2 PR ($\beta = <0.001$, 95%CI= [-0.10, 0.12], $p=.878$). Significant longitudinal paths are presented in Table 6.

Discussion

Main Findings: Psychological Resilience and Emotion Regulation

The primary aim of this study was to examine the longitudinal association between PR and ER, with mental health as a control variable. Cross-sectionally, PR was positively correlated with functional ER strategies and negatively correlated with dysfunctional ER strategies at T1 and T2. This aligns with existing literature [6, 8, 23, 25, 26, 28]. However, cross-lagged panel analyses revealed a unidirectional association between these two variables: higher PR at T1 was positively predicted using internal functional ER strategies at T2. This finding is consistent with studies showing that psychologically resilient adolescents use more adaptive cognitive emotion regulation strategies [24] and face fewer difficulties in accessing these strategies [27]. On the other hand, certain characteristics of individuals with high psychological resilience may help them experience more positive emotions [35], thereby facilitating emotion regulation processes. T1 internal functional ER was not predicted PR at T2. This finding is also consistent with Troy et al. (2023)'s [34] theory, which suggests that ER strategies influence PR through other variables such as social processes, affective experiences, and cognitive engagement.

Psychologically resilient adolescents possess both internal and external resources, such as self-esteem [56], social support, hope [57, 58], optimism [36], coping strategies [59, 60], and positive affect [61]. These resources are likely to facilitate the use of adaptive ER strategies. Future research should investigate the factors that contribute to the influence of PR on internal functional ER. Considering that adaptive strategies are associated with fewer psychopathological and emotional problems [62–65], individuals with high psychological resilience may experience positive emotions more frequently [66] and show fewer mental health problems during challenging times, such as the COVID-19 pandemic [67, 68], because of their success in employing internal functional strategies.

However, high psychological resilience at T1 did not predict internal dysfunctional strategies at T2. Resilience appears to predicted the use of effective internal strategies rather than reduce ineffective ones. This can be explained by the strength-based approach, which

emphasizes coping with resources over weaknesses [69, 70]. Thus, highly resilient individuals are expected to have more robust functional strategies without significantly affecting dysfunctional ones.

These findings suggest that interventions aimed at enhancing PR should focus on strengthening internal functional ER strategies to reduce the risk of mental health problems. Understanding the specific factors that facilitate adaptive ER strategies in resilient individuals can provide valuable insights into the development of mental health interventions for adolescents.

Emotion Regulation and Mental Health

Mental health was considered a control variable in this study. However, the relationship between psychopathology and ER is also noteworthy. Cross-sectionally, although ER-IF was weakly associated with mental health at T1, no significant association was observed between ER-IF and mental health at T2. In contrast, ER-ID was moderately and significantly associated with mental health at both T1 and T2 crossectionally. According to Aldao and Nolen-Hoeksema (2010) [17], maladaptive ER strategies are one more important determinant of psychopathology than adaptive emotion regulation strategies. Therefore, internal dysfunctional ER is expected to be associated with psychopathology, regardless of whether adaptive strategies are utilized.

Longitudinal analyses conducted on the association between internal dysfunctional ER and mental health yielded intriguing findings. It appears that the association between mental health and ER was unidirectional. T1 internal functional and dysfunctional ER did not predict T2 psychopathology. In contrast, high T1 psychopathology predicted T2 ER-ID, which comprises self-harm, rumination, suppression, negative social comparison, and distancing from reality. This finding indicates that maladaptive ER skills emerge as a result of psychopathology rather than as a cause. This can be explained by the fact that adolescents turn to internal maladaptive ER strategies to cope with the emotional difficulties and symptoms resulting from psychopathology. For instance, from the perspective of acceptance and commitment therapy, desire to avoid challenging emotions, thoughts, and bodily sensations accompanying psychopathology may lead individuals to turn to maladaptive ER strategies that provide short-term relief, resulting in more frequent use of these strategies [71]. Furthermore, our findings indicated that ER-IF alone does not have a protective effect on mental health. This aligns with the findings of Aldao and Nolen-Hoeksema (2010) [17], who suggested that adaptive ER strategies do not contribute to psychopathology.

Various studies have suggested that maladaptive ER strategies predicts psychopathology [63, 72]. A meta-analysis conducted by Cavicchioli et al. (2023) [45] supports our findings, stating that maladaptive ER negatively affects mental health. Our findings suggest that the association between ER and psychopathology is unidirectional, and further research in this area is warranted to explore the potential influence of moderator or mediator variables.

Moreover, this effect varied by gender. T1 MHP predicted T2 ER-ID only in girls throughout adolescence. In our study girls are reported greater ER-ID and mental health problems score both T1 and T2 than boys. Girls are more likely to use ER strategies than boys in response to feelings such as sadness, anxiety, or anger [73]. According to Krause et al. (2018) [74], depression predicts rumination in both boys and girls, but rumination is recognized as both a symptom and a risk factor only in girls. Moreover, studies have revealed

that girls use both adaptive and maladaptive ER strategies more frequently than boys across various life stages, including adolescence, adulthood, and old age [75]. Mental health problems contributes to the frequency of experiencing emotions such as anxiety and sadness, which leads girls to rely more frequently on ER strategies than boys to cope with these emotions. This explains the finding that T1 mental health problems predicted T2 dysfunctional ER in our longitudinal analysis.

Adolescence is a critical stage marked by heightened cognitive and emotional development, significantly influenced by the social environment [76]. The social challenges and uncertainties brought about by the COVID-19 pandemic have tested adolescents' psychological resilience and negatively affected their mental health [4]. Current literature indicates that adolescent girls are more likely than boys to use maladaptive emotion regulation strategies in stressful situations and are more vulnerable to psychological issues [77]. The pronounced effect of mental health issues on emotion regulation in our female participants aligns with these findings. The consistent relationship between psychological resilience and emotion regulation capacity suggests that adolescents can cultivate healthier coping strategies by enhancing protective factors during stressful times [78]. This underscores the need to prioritize the development of psychological resilience in mental health interventions. Thus, mental health programs should focus on reducing maladaptive emotion regulation strategies, particularly in female adolescents, while taking gender-specific differences into account. Furthermore, initiatives aimed at boosting psychological resilience could effectively improve overall adolescent health.

Resilience and Mental Health

Cross-sectional analysis indicated that a higher level of PR was linked to a lower level of MH problems at both T1 and T2. Longitudinally, higher levels of T1 PR were associated with lower levels of T2 MHP. These results confirm the protective role of PR on mental health, aligning with earlier studies [6, 79]. However, some studies have suggested that the predictive effect of resilience on mental health can vary over time [80]. This highlights the need for longer-term follow-up studies to thoroughly explore the reciprocal relationship between PR and mental health. In this study, T1 MHP did not longitudinally predict T2 PR. Although some studies have suggested that mental health can predict PR, these findings are limited [81]. Our findings indicated that different mediating or moderating factors may play a role in the impact of MHP on PR.

Study Limitations, Strengths and Future Research

The present study holds considerable importance in exploring the longitudinal association between subset of ER and PR controlling mental health In the present study, controlling for mental health was a crucial objective, as it sought to eliminate the potential confounding influence of mental health on the association between PR and ER. Conducting the study during a stressful period such as COVID-19 [3, 4] is a strength, as it could have led to the use of greater resilience and emotion regulation techniques.

Despite these strengths, the study has several limitations. First, the study did not identify which individuals experienced higher levels of COVID-19-related stress. Future research should measure specific environmental stressors such as economic hardship, social iso-

lation, or familial stress and statistically control their effects. Second, mental health was assessed using a general total score. Future studies should examine specific psychopathologies, including depression and anxiety, to understand how their associations with PR and ER vary over time [81]. Third, although functional and dysfunctional ER strategies were analyzed separately, the measurement tool assessed multiple ER techniques within each subscale, preventing the identification of which specific strategies longitudinally relate to PR or mental health. Future studies should evaluate individual ER strategies (e.g., cognitive reappraisal, rumination, problem-solving) longitudinally to clarify their differential impacts. Fourth, potential moderators such as peer support, family environment, and school climate were not examined. Future studies should incorporate these moderators to understand under which conditions PR and ER are most effective. Fifth, reliance on self-report measures may introduce social desirability bias and comprehension difficulties among younger participants (Mage = 12, SE = 0.93). Sixth, although the longitudinal design supports temporal associations, causal inferences cannot be drawn. Seventh, the three-month interval between assessments was shorter than the initially planned six months due to practical constraints, as the sixth month coincided with the school closure period, thereby limiting the examination of longer-term effects. Eighth, although the missingness was at random, the high attrition rate at the second data collection point may limit the interpretability of our findings. Moreover, the narrow sampling context may limit the generalizability of the results to broader populations. Ninth, data were collected from only two schools instead of the planned 10 restricting generalizability. Lastly, to enable data matching, participants created a nickname based on elements of their name and apartment number. However, this method may have compromised anonymity and poses a risk of re-identification. Therefore, we recommend using numbers to increase the anonymity in future studies. Overall, future research should adopt more detailed measurement of ER strategies and mental health dimensions, include environmental stressors and potential moderators, and extend longitudinal follow-ups to better elucidate the dynamic interplay between ER, PR, and adolescent mental health during adverse conditions.

Conclusion

Adolescence is a phase characterized by significant emotional and developmental challenges, which often coincide with increased susceptibility to psychiatric disorders. To mitigate these risks, mental health experts should identify protective factors that can provide emotional support for adolescents. Our findings suggest that higher PR is associated with fewer psychiatric problems and adaptive ER strategies over time. Adaptive ER strategies are vital for adolescents' psychological well-being [82]. These results highlight the importance of enhancing PR among adolescents.

Mental health professionals, teachers, and others working with youth should incorporate practices that strengthen PR to improve adolescents' well-being and quality of life. Additionally, identifying and mitigating factors that reduce PR can be beneficial. This may involve individual, group, or family interventions to support adolescents.

The predictive role of mental health problems on maladaptive strategies such as rumination and suppression highlights the importance of closely monitoring these dysfunctional emotion regulation strategies when working with adolescents experiencing psychological

difficulties. Mental health professionals should consider these strategies in their assessment and treatment goals. Strengthening PR while teaching adaptive ER strategies can be particularly effective.

Furthermore, this study underscores the potential presence of mediating and moderating variables in the relationship between emotion regulation, resilience, and mental health. These findings reiterate the importance of bolstering resilience as a protective factor for adolescents. Enhancing PR contributes to reducing psychiatric problems and promoting adaptive ER strategies, ultimately supporting adolescents' mental health and overall development.

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Data Availability The data sets used in the study can be provided upon request to the corresponding author.

Declarations

Ethical Approval This study was performed in line with the principles of the Declaration of Helsinki. The present study was approved by the Hasan Kalyoncu University Graduate Education Institute Ethics Committee (Ethics approval number::E-97105791-050.01.01-2347).

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

Financial Interests The authors declare they have no financial interests.

Conflict of Interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

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