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Perceived Parental Control and Mixed-Feature Symptoms in Student Patients with Depressive Episodes: Associations with Depressive Symptoms and Smartphone Addiction in a Multicenter Study

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Article

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Abstract

Background:

Mixed-feature symptoms during depressive episodes are clinically important yet often under-recognized in general-hospital settings. Family-context stressors and maladaptive smartphone-related behaviors may co-occur with mixed features in clinically referred youth.

Methods:

We conducted a multicenter cross-sectional study of 206 clinically referred student patients aged 16–24 years presenting with a current major depressive episode. Participants completed the C-CUDOS-M (mixed features), PHQ-8ex8 (depressive symptoms), SABAS (smartphone addiction), and GAD-7 (anxiety). Perceived parental control (PPC) was indexed using a brief binary item (“overly controlling”: yes/no). A prespecified serial-association model was tested with covariate adjustment (age, sex, anxiety, age at onset, episode type, and pharmacotherapy) using 5,000 bootstrap samples. Robustness checks included additional adjustment for diagnostic group (MDD vs BD) and substitution of PHQ-9 for PHQ-8ex8.

Results:

PPC was positively associated with depressive symptoms, smartphone addiction, and mixed-feature severity. In adjusted path models, PPC related to higher depressive symptoms; depressive symptoms related to higher smartphone addiction; and smartphone addiction related to higher mixed-feature severity. PPC also showed an independent direct association with mixed features. A positive serial indirect association via depressive symptoms and smartphone addiction was supported, but indirect effects were sensitive to alternative specifications.

Conclusions:

In clinically referred youth with depressive episodes, PPC and smartphone addiction were cross-sectional correlates of mixed-feature symptoms, suggesting potentially useful contextual and behavioral signals for assessment in general-hospital psychiatric services. Longitudinal, multi-method studies are needed to clarify temporal dynamics and diagnostic heterogeneity.

1. Introduction

Mixed features in depressive episodes represent a clinically important but often under-recognized presentation, particularly among adolescents and young adults[1,2]. These mixed-feature symptoms—commonly including irritability, psychomotor agitation, and increased energy—have been associated with greater functional impairment, higher risk of diagnostic misclassification, and poorer treatment response[3–5]. Although mixed features occur across both major depressive disorder (MDD) and bipolar disorder (BD), available evidence suggests that they tend to be more prevalent and more pronounced in bipolar-spectrum depression[6,7]. A recent

systematic review and meta-analysis further summarized the prevalence of DSM-5 mixed features across mood episodes, underscoring both the clinical salience and the heterogeneity of operational definitions across studies[8]. Taken together, improving recognition of mixed features in youth may support diagnostic clarification, longitudinal monitoring, and treatment planning[9].

Adolescents and young adults may show a higher expression of mixed-feature symptoms during depressive episodes. This developmental period is characterized by heightened affective reactivity and reward sensitivity alongside still-maturing prefrontal regulatory circuits, features that have been associated with irritability, psychomotor agitation, and increased energy during depressive presentations in some youth samples[10–13]. During the same period, digital engagement is ubiquitous, and smartphone-related dysregulation is commonly observed in youth.

In parallel, youth represent a population with a high prevalence of smartphone addiction, with meta-analytic estimates ranging from 23.3% to 61.44% across definitions and sampling frames[14,15]. Smartphone addiction has been consistently associated with depressive symptoms, impulsivity, and emotional dysregulation[14,16,17], and has also been linked to emotion-regulation difficulties and maladaptive mood-regulation strategies (e.g., distraction or avoidance)[18–20]. These correlates suggest that smartphone addiction and mixed-feature symptoms may co-occur among young people experiencing depressive episodes, yet empirical work directly examining their concurrent associations—especially in clinically referred samples—remains relatively limited.

A growing body of research further indicates that psychosocial stressors and maladaptive behavioral patterns are associated with affective instability in adolescents and young adults[21–24]. Within the family context, perceived parental control (PPC), a form of psychologically controlling parenting, has been associated with heightened emotional distress, impaired self-regulation, and greater vulnerability to depressive and anxiety symptoms in young populations[25–27]. However, evidence remains limited regarding whether PPC and depressive symptoms relate to mixed-feature symptoms alongside smartphone addiction among clinically referred youth with depressive episodes. This question may be particularly salient in student populations, who often report substantial academic pressure and ubiquitous digital engagement, a context in which depressive symptoms, smartphone addiction, and mixed features may co-occur.

Moreover, most existing studies have relied on community or school-based cohorts, whereas evidence from multi-center psychiatric settings—where diagnostic differentiation between bipolar and unipolar depression is particularly consequential—remains limited[28–31]. To address these gaps, the present multi-center, hospital-based study examined the serial associations among PPC, depressive symptoms, smartphone addiction, and mixed features in student patients aged 16–24 years experiencing current depressive episodes in general hospital psychiatric inpatient and outpatient settings. We hypothesized that higher PPC would be associated with greater mixed-feature symptomatology, and that these associations would be statistically consistent with indirect pathways involving depressive symptoms and smartphone addiction, including a serial indirect association from PPC to mixed features through depressive symptoms and smartphone addiction.

2. Methods

2.1. Participants

A total of 206 student patients aged 16–24 years with current major depressive episodes (MDEs) were consecutively recruited between February 2024 and October 2025 from psychiatric outpatient and inpatient services at three general hospitals in China (Shulan (Hangzhou) Hospital, Gansu Provincial Hospital, and Linxia Hui Autonomous Prefecture Hospital of Traditional Chinese Medicine). DSM-5 diagnoses (MDD or BD) were made by attending psychiatrists based on clinical interviews and available medical records. Bipolar disorder subtypes (BD-I vs BD-II) were not systematically ascertained across sites in this routine clinical setting. The age range of 16–24 years in the present study was selected because the Chinese validation study of the C-CUDOS-M established its reliability and construct validity beginning at age 16, and therefore the instrument is only psychometrically supported for use in individuals aged 16 years and above[32].

Data screening

A total of 216 records were collected. Ten cases were excluded: 3 provided only basic demographic information without completing any questionnaires; 4 completed only demographic information and PHQ-9/GAD-7 but did not complete key measures (C-CUDOS-M and/or SABAS) required for complete-case analyses; and 3 were excluded due to suspected invalid responding characterized by extensive straightlining across multiple questionnaires. The final analytic sample comprised 206 participants.

Inclusion criteria

Participants were eligible if they: (1) were 16–24 years old and currently enrolled as students (high school/college/university); (2) met DSM-5 criteria for a current MDE at the time of assessment, occurring in the context of MDD or BD; (3) were recruited from psychiatric outpatient or inpatient services of participating general hospitals; and (4) were able to complete study questionnaires and provided informed consent (with parental/guardian consent when required).

Exclusion criteria

Participants were excluded if they: (1) met DSM-5 criteria for a current manic or hypomanic episode at assessment, to ensure that the index episode was a current MDE when evaluating mixed features; (2) had schizophrenia spectrum disorders or other primary psychotic disorders; (3) had major neurological disorders, severe/unstable physical illnesses, or other medical conditions judged to substantially affect mood or cognition; (4) had intellectual disability or significant cognitive impairment that precluded valid assessment; or (5) had current nicotine use (including e-cigarettes) or regular alcohol consumption, given their potential to influence activation-related symptoms and sleep–wake regulation.

2.2. Measures

2.2.1. General Information Questionnaire

Demographic and clinical characteristics were collected using a structured general information questionnaire. Demographic variables included current age, sex, ethnicity, and current level of education (high school vs. college or above). Parents' educational attainment was recorded separately for fathers and mothers and categorized as primary school or below, junior high school, high school, or college and above. Clinical variables included age of illness onset, DSM-5 diagnosis (MDD or BD), episode type (first depressive episode vs. recurrent episode), and current pharmacotherapy (yes/no).

2.2.2. Perceived parental control

Perceived parental control (PPC) was assessed using a single self-report item: “Do you feel that your parents are overly controlling?” Response options were “yes” or “no”. For analysis, responses were coded as 1 = yes and 0 = no, with higher scores indicating the presence of perceived parental overcontrol. This binary PPC indicator was entered as the independent variable in the mediation model. This item was administered as a brief indicator of youth-perceived parental overcontrol in a time-limited clinical assessment context.

2.2.3. Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale (C-CUDOS-M).

Mixed-feature symptoms were assessed using the Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale (C-CUDOS-M) [32,33]. The scale consists of 13 items rated from 0 (not at all) to 4 (almost always), yielding total scores from 0 to 52, with higher scores indicating more severe mixed-feature symptoms. In the current sample, internal consistency was acceptable (Cronbach’s α = 0.80).

2.2.4. Depressive Symptoms: PHQ-8ex8.

Depressive symptoms were assessed using an adapted eight-item version of the Patient Health Questionnaire (PHQ-8ex8), derived from the widely used PHQ-9. The PHQ-9 is one of the most extensively validated self-report instruments for assessing depressive symptom severity across clinical and community populations[34,35]. In the present study, we excluded item 8 of the PHQ-9 (“psychomotor agitation or retardation”) to minimize direct overlap between depressive-symptom items and the mixed-feature symptoms assessed by the C-CUDOS-M. Including this item may introduce conceptual and measurement contamination when depressive severity is used as a predictor of mixed features.

Prior psychometric work suggests that removing a single heterogeneous item from the PHQ-9 does not meaningfully change its underlying depressive-symptom construct, which is dominated by core affective–cognitive symptoms such as anhedonia, depressed mood, fatigue, and concentration difficulties[36,37]. The resulting PHQ-8ex8 therefore included eight depressive symptoms, each scored from 0 (“not at all”) to 3 (“nearly every day”), yielding a total score of 0–24, with higher scores indicating greater depressive symptom severity. This construct-refined version was used as the index of depressive symptoms in all analyses. In the current sample, internal consistency was α = 0.85.

2.2.5. Generalized Anxiety Disorder Scale-7 (GAD-7).

Anxiety symptoms were evaluated using the Generalized Anxiety Disorder Scale-7 (GAD-7). This instrument contains 7 items, each scored from 0 (not at all) to 3 (nearly every day), with total scores ranging from 0 to 21. Higher scores indicate greater anxiety severity[38]. The GAD-7 has shown high internal consistency and strong convergent validity in Chinese clinical and community samples[39–41]. In the current sample, internal consistency was α = 0.88.

2.2.6. Smartphone Application-Based Addiction Scale (SABAS).

Smartphone addiction was assessed using the Smartphone Application-Based Addiction Scale (SABAS). The scale includes 6 items rated from 1 (strongly disagree) to 6 (strongly agree), yielding a total score between 6 and 36. Higher scores indicate more severe smartphone-related addictive tendencies. SABAS has demonstrated good psychometric properties, including internal consistency and cross-cultural validity in Chinese youth populations[42–44]. In the current sample, internal consistency was α = 0.86.

2.3. Statistical analysis

All analyses were performed using SPSS version 27.0 (IBM Corp., Armonk, NY) and the PROCESS macro (version 4.2) developed by Hayes. Cases with missing data on variables required for the primary model were excluded prior to analysis; therefore, analyses were conducted using complete-case data (listwise deletion). Descriptive statistics were computed to summarize demographic, clinical, and symptom variables; continuous variables were presented as means and standard deviations (SD), and categorical variables as frequencies and percentages. Internal consistency was evaluated using Cronbach's alpha.

Pearson correlation analyses were conducted to examine bivariate associations among perceived parental control (PPC), depressive symptoms (PHQ-8ex8), smartphone addiction (SABAS), mixed-feature symptoms (C-CUDOS-M), and covariates. Multicollinearity was assessed using variance inflation factors (VIF), with VIF < 5 indicating acceptable collinearity.

The hypothesized serial mediation model was tested using PROCESS Model 6, with PPC as the independent variable (X), depressive symptoms (PHQ-8ex8) and smartphone addiction (SABAS) as sequential mediators (M1 and M2), and mixed-feature symptoms (C-CUDOS-M total score) as the outcome (Y). Covariates were selected a priori based on clinical relevance and prior literature (age, sex, anxiety severity [GAD-7], age at illness onset, episode type, and current pharmacotherapy). Indirect effects were estimated using 5,000 bootstrap samples and were considered statistically supported when the 95% bootstrap confidence interval (CI) did not include zero.

Given the clinical relevance of diagnostic heterogeneity in depressive episodes, robustness checks were performed by (1) additionally adjusting for diagnostic group (MDD vs BD) and (2) re-estimating the model using PHQ-9 total score in place of PHQ-8ex8. We also conducted exploratory stratified analyses by diagnostic group, where feasible, to examine whether the directions of key path estimates were broadly consistent across subgroups, acknowledging reduced precision in subgroup models due to smaller sample sizes.

All statistical tests were two-tailed, and $p < 0.05$ was considered statistically significant.

2.4. Ethics statement

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Shulan (Hangzhou) Hospital (Approval No:KY2025174). Gansu Provincial Hospital and Linxia Hui Autonomous Prefecture Hospital of Traditional Chinese Medicine participated as a collaborating recruitment site. Written informed consent was obtained from all participants prior to study enrollment. For participants younger than 18 years, additional written consent was obtained from a parent or legal guardian.

3. Results

3.1. Sample characteristics

A total of 206 student patients aged 16–24 years with current depressive episodes were included in the analyses (mean age = 18.4 years, SD = 2.2). Most participants were female, and the majority were high school students (63.1%). The sample was predominantly diagnosed with bipolar-spectrum depressive episodes (70.9%). A substantial proportion reported recurrent episodes and were currently receiving pharmacotherapy. Detailed sociodemographic and clinical characteristics are presented in Table 1.

Table 1
Demographic and clinical characteristics of young student patients with depressive episodes

Variable	**Mean (SD) / n (%)**
	N = 206
Age (years)	18.4 (2.2)
Sex	
Male	69 (33.5)
Female	137 (66.5)
Han ethnicity	152 (73.8)
Education	
High school	130 (63.1)
college and above	76 (36.9)
Father’s education level	
Primary school or below	85 (41.2)
Junior high school	75 (36.4)
High school	23 (11.2)
College and above	23 (11.2)
Mother’s education level	
Primary school or below	115 (55.8)
Junior high school	46 (22.3)
High school	19 (9.2)
College and above	26 (12.7)
PPC	
No	80 (38.8)
Yes	126 (61.2)
Age of illness onset	14.7 (2.2)
Primary diagnosis	
MDD	60 (29.1)

Note. Values are presented as mean (standard deviation) for continuous variables and n (%) for categorical variables. PPC = Perceived parental control; C-CUDOS-M = Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale; PHQ-9 = Patient Health Questionnaire-9; PHQ-8ex8 = Adapted eight-item version of the Patient Health Questionnaire (PHQ-9 excluding item 8); GAD-7 = Generalized Anxiety Disorder-7; SABAS = Smartphone Application-Based Addiction Scale. Higher scores indicate more severe symptoms for all symptom scales.

Variable	Mean (SD) / n (%)
	N = 206
BD	146 (70.9)
Episode type	
First depressive episode	24 (11.7)
Recurrent episode	182 (88.3)
Current pharmacotherapy	
No	71 (34.5)
Yes	135 (65.5)
C-CUDOS-M	13.1 (7.4)
PHQ-9	17.3 (5.8)
PHQ-8ex8	15.6 (5.4)
GAD-7	13.2 (4.9)
SABAS	21.5 (6.8)

Note. Values are presented as mean (standard deviation) for continuous variables and n (%) for categorical variables. PPC = Perceived parental control; C-CUDOS-M = Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale; PHQ-9 = Patient Health Questionnaire-9; PHQ-8ex8 = Adapted eight-item version of the Patient Health Questionnaire (PHQ-9 excluding item 8); GAD-7 = Generalized Anxiety Disorder-7; SABAS = Smartphone Application-Based Addiction Scale. Higher scores indicate more severe symptoms for all symptom scales.

3.2. Correlations among the main variables

Pearson correlations among the main study variables are summarized in **Table 2**. PPC was positively correlated with depressive symptoms (PHQ-8ex8), smartphone addiction (SABAS), and mixed-feature symptoms (C-CUDOS-M). Depressive symptoms were positively associated with smartphone addiction, but showed a negligible and non-significant bivariate association with mixed-feature symptoms. Smartphone addiction was positively correlated with mixed-feature symptoms. Anxiety symptoms (GAD-7) showed moderate positive correlations with depressive symptoms and a small positive correlation with smartphone addiction, but were negligible and non-significantly associated with mixed-feature symptoms

Table 2. Pearson correlations among main study variables (N = 206)

Variable	1	2	3	4	5	6	7	8	9
1. PPC	1								
2. PHQ-9	0.234**	1							
3. PHQ-8ex8	0.251**	0.978**	1						
4. SABAS	0.203**	0.364**	0.368**	1					
5. C-CUDOS-M	0.240**	-0.002	-0.032	0.168*	1				
6. GAD-7	0.195**	0.693**	0.688**	0.283**	0.041	1			
7. Age	-0.015	-0.008	-0.047	-0.004	-0.069	0.060	1		
8. Age of illness onset	-0.253**	-0.151*	-0.158*	-0.239**	-0.113	-0.216**	-0.018	1	
9. Current pharmacotherapy	0.030	0.065	0.065	0.022	0.027	0.094	0.024	-0.102	1

Note. Values are Pearson's correlation coefficients. PPC = Perceived parental control; C-CUDOS-M = Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale; PHQ-9 = Patient Health Questionnaire-9; PHQ-8ex8 = Adapted eight-item version of the Patient Health Questionnaire (PHQ-9 excluding item 8); GAD-7 = Generalized Anxiety Disorder-7; SABAS = Smartphone Application-Based Addiction Scale. |r| < 0.10 = negligible; 0.10–0.29 = small; 0.30–0.49 = moderate; ≥ 0.50 = strong. * p < 0.05; ** p < 0.01.

3.3. Serial mediation model in the full sample

Table 3 and Fig. 1 summarize the serial mediation model examining whether depressive symptoms (PHQ-8ex8) and smartphone addiction (SABAS) were statistically consistent with pathways linking PPC to mixed-feature symptoms (C-CUDOS-M), after adjustment for age, sex, anxiety symptoms (GAD-7), age at illness onset, episode type, and current pharmacotherapy.

Figure 1. Serial mediation model linking perceived parental control (PPC) to mixed features (C-CUDOS-M) through depressive symptoms (PHQ-8ex8) and smartphone addiction (SABAS). Standardized path coefficients (β) from PROCESS Model 6 are shown along each arrow, adjusted for age, sex, anxiety symptoms (GAD-7), age at illness onset, episode type, and current pharmacotherapy. The serial indirect effect from PPC to C-CUDOS-M via PHQ-8ex8 and SABAS was statistically significant (indirect effect = 0.095, 95% bootstrap CI [0.002, 0.286], based on unstandardized coefficients). **Note.** PPC = perceived parental control; C-CUDOS-M = Chinese version of the Clinically Useful Depression Outcome Scale – Mixed Features Subscale; PHQ-8ex8 = adapted eight-item version of the Patient Health Questionnaire-9 (excluding item 8); GAD-7 = Generalized Anxiety Disorder-7; SABAS = Smartphone Application-Based Addiction Scale. * p < .05, ** p < .01, *** p < .001.

Table 3
Serial mediation analysis

Part A. Regression paths					
Path	B	SE	t	p	β
PPC → PHQ-8ex8	1.347	0.568	2.373	0.019	0.123
PHQ-8ex8 → SABAS	0.376	0.118	3.193	0.002	0.297
SABAS → C-CUDOS-M	0.187	0.081	2.312	0.022	0.172
PHQ-8ex8 → C-CUDOS-M	−0.304	0.137	−2.222	0.027	−0.221
PPC → C-CUDOS-M (direct effect)	3.518	1.086	3.240	0.001	0.232
Part B. Bootstrap indirect effects (5,000 samples)					
Indirect effect pathway		Effect	Boot SE	95% CI (LLCI, ULCI)	
PPC → PHQ-8ex8 → C-CUDOS-M		−0.410	0.255	−0.997 to − 0.012	
PPC → SABAS → C-CUDOS-M		0.208	0.213	−0.122 to 0.712	
PPC → PHQ-8ex8 → SABAS → C-CUDOS-M		0.095	0.077	0.002 to 0.286	

Note. PPC = Perceived parental control; C-CUDOS-M = Chinese version of the Clinically Useful Depression Outcome Scale–Mixed Features Subscale; PHQ-8ex8 = Adapted eight-item version of the Patient Health Questionnaire (PHQ-9 excluding item 8); SABAS = Smartphone Application-Based Addiction Scale. All models controlled for age, sex, GAD-7 score, age of illness onset, episode type, and current pharmacotherapy. Indirect effects were considered statistically significant when the 95% bootstrap CI did not include zero. The model showed a negative indirect association through PHQ-8ex8 alone and a positive serial indirect association through PHQ-8ex8 and SABAS (PPC → PHQ-8ex8 → SABAS → C-CUDOS-M).

3.3.1. Path coefficients

As shown in Table 3, PPC was positively associated with depressive symptoms (PHQ-8ex8) after adjustment for covariates (B = 1.35, p = 0.019). In turn, higher PHQ-8ex8 scores were positively associated with smartphone addiction (SABAS) (B = 0.38, p = 0.002). In the final outcome model, PPC was positively associated with mixed-feature symptoms (C-CUDOS-M) (B = 3.52, p = 0.001), SABAS showed a positive association with mixed-feature symptoms (B = 0.19, p = 0.022), and PHQ-8ex8 showed a negative association with mixed-feature symptoms when PPC, SABAS, and covariates were included simultaneously (B = − 0.30, p = 0.027). Among covariates, episode type was positively associated with mixed-feature symptoms in this model (B = 3.00, p = 0.025), whereas other covariates were not statistically significant.

Taken together, these coefficients are consistent with positive associations of PPC with depressive symptoms, depressive symptoms with smartphone addiction, and smartphone addiction with mixed-feature symptom severity, alongside a significant direct PPC–mixed-feature association. The negative PHQ-8ex8 coefficient in the multivariable outcome model is consistent with a statistical suppression pattern when overlapping variance with PPC and smartphone addiction is accounted for.

3.3.2. Indirect effects

Bootstrap analyses (5,000 samples) indicated a mixed pattern of indirect associations (Table 3). The total indirect effect of PPC on mixed-feature symptoms via depressive symptoms and smartphone addiction combined was not statistically significant (effect = − 0.11, 95% bootstrap CI [− 0.70, 0.54]).

Despite the non-significant total indirect effect, two of the three specific indirect effects were statistically supported. First, a negative simple indirect effect via depressive symptoms alone was observed: PPC → PHQ-8ex8 → C-CUDOS-M (effect = − 0.41, 95% bootstrap CI [− 0.997, − 0.012]). Second, a positive serial indirect effect via depressive symptoms and smartphone addiction was observed: PPC → PHQ-8ex8 → SABAS → C-CUDOS-M (effect = 0.095, 95% bootstrap CI [0.002, 0.286]). In contrast, the simple indirect effect via smartphone addiction alone was not statistically significant: PPC → SABAS → C-CUDOS-M (effect = 0.21, 95% bootstrap CI [− 0.122, 0.712]).

The presence of specific indirect effects in opposite directions is consistent with partial cancellation, which may contribute to the non-significant total indirect effect. The negative indirect effect via depressive symptoms alone is consistent with a suppression pattern in the multivariable model.

3.3.3. Robustness and Diagnostic Heterogeneity

Robustness checks showed that the direct association between PPC and mixed-feature symptoms remained statistically significant when additionally adjusting for diagnostic group (MDD vs BD) and when using PHQ-9 in place of PHQ-8ex8. However, under these alternative specifications, the bootstrap confidence intervals for the serial indirect association via depressive symptoms and smartphone addiction included zero. In exploratory stratified analyses, the BD subgroup showed a statistically supported serial indirect association, whereas the model did not converge in the MDD subgroup due to the smaller sample size and model complexity (**Supplement Table S1**).

4. Discussion

The present multi-center study examined associations among PPC, depressive symptoms, smartphone addiction, and mixed-feature symptoms in student patients aged 16–24 years experiencing current depressive episodes. In the full sample, PPC was positively associated with depressive symptoms and with mixed-feature symptoms, depressive symptoms were positively associated with smartphone addiction, and smartphone addiction showed a positive association with mixed-feature symptoms after adjustment for covariates. Overall, these findings align with prior work suggesting that psychologically controlling parenting is related to emotional distress and maladaptive digital-media use patterns in youth, and that such behavioral dysregulation may co-occur with affective instability[45–47].

A key contribution of the current study is that it integrates family context (PPC), symptom severity, and smartphone addiction within a single serial-association framework in a clinically referred student sample. In the primary model, the serial indirect association (PPC → depressive symptoms → smartphone addiction → mixed-feature symptoms) was statistically supported. The estimated coefficients were consistent with positive associations of PPC with depressive symptoms, depressive symptoms with smartphone addiction, and smartphone addiction with mixed-feature symptom severity. This pattern is broadly consistent with prior evidence linking parental psychological control with greater depressive symptoms and with smartphone-related addictive tendencies in adolescents and college students, as well as reports that smartphone addiction is

associated with depressive/anxiety symptoms in young populations[46,48–51]. At the same time, robustness checks indicated that pathway-level findings were sensitive to diagnostic heterogeneity and depressive-symptom indexing: when additionally adjusting for diagnostic group (MDD vs BD) and when substituting PHQ-9 for PHQ-8ex8, the bootstrap confidence intervals for the serial indirect association included zero (Supplement Table S1). These results support a cautious interpretation in which the serial pathway is reported as a statistically consistent pattern in the primary model rather than definitive evidence of a unitary mediational mechanism in the combined sample.

The diagnostic composition of the sample provides an important context for interpreting pathway-level associations. Mixed-feature symptom severity was strongly related to diagnostic group, and exploratory stratified analyses suggested that the serial indirect association was more clearly supported in the BD subgroup, whereas estimation in the MDD subgroup was unstable due to the smaller sample size and model complexity (Supplement Table S1). One plausible interpretation is that, within bipolar-spectrum depressive presentations—where activation-related symptom expression may be more prominent—smartphone addiction may track mood dysregulation and behavioral activation more tightly, thereby yielding a clearer "symptom–behavior coupling" signal at the pathway level[3,17,47,52]. Importantly, the instability of the MDD subgroup model should not be interpreted as evidence of absence; rather, it underscores the need for larger diagnostically stratified samples to clarify whether pathway-level associations differ between unipolar and bipolar-spectrum depression.

The model also revealed a negative association between depressive symptoms (PHQ-8ex8) and mixed-feature symptoms in the multivariable outcome model, and a corresponding negative simple indirect effect via depressive symptoms alone. This pattern is consistent with statistical suppression in the presence of overlapping constructs and correlated predictors: when PPC and smartphone addiction are included simultaneously, the residual variance of depressive symptoms may reflect a more "non-activated" depressive symptom profile that is inversely related to mixed-feature symptom expression. Such patterns highlight the complexity of interpreting depressive severity when mixed-feature symptoms and activation-related behaviors are modeled together, and emphasize that coefficient sign changes in multivariable models should be interpreted as model-dependent statistical phenomena rather than straightforward clinical "protective effects."

A related methodological consideration concerns how depressive symptoms were operationalized. We used PHQ-8ex8 to reduce direct overlap between the depressive-symptom predictor and mixed-feature symptom content, given the conceptual proximity of psychomotor activation to mixed-feature symptomatology. Prior psychometric work supports item-level refinement of PHQ measures in contexts where specific items introduce heterogeneity or conceptual overlap, and removing a single item does not necessarily alter the underlying depressive-symptom structure dominated by core affective–cognitive symptoms[36,37]. Network-analytic findings also suggest that psychomotor functioning may be relatively peripheral in the PHQ-9 symptom network, supporting the rationale for refinement in certain analytic contexts[53]. Reassuringly, robustness checks using PHQ-9 in place of PHQ-8ex8 yielded a similar overall pattern (i.e., a robust PPC–mixed-feature association with less robust indirect effects), suggesting that the principal finding did not hinge solely on the PHQ-8ex8 operationalization (**Supplement Table S1**).

Several clinical implications follow from these findings. First, PPC may function as a clinically meaningful contextual correlate of mixed-feature symptom expression among youth with depressive episodes. Second,

smartphone addiction was associated with mixed-feature symptoms even after accounting for depressive severity and covariates, suggesting that smartphone-related addictive tendencies may be a useful behavioral marker to consider when evaluating youth presenting with depressive episodes[54]. In practice, brief assessment of perceived parental overcontrol and smartphone addiction may help identify individuals who warrant closer monitoring for mixed-feature symptoms and for potential bipolar-spectrum presentations, particularly in settings where time-limited assessments are common.

This study has several limitations. First, the cross-sectional design precludes temporal ordering, and the indirect associations should be interpreted as statistical patterns rather than causal mediation. Second, all constructs were assessed via self-report, and PPC was indexed using a single binary item rather than a validated multi-item measure, which may introduce measurement error and response bias and attenuate effect estimates. Third, mixed-feature symptoms were assessed dimensionally using a self-report scale rather than clinician-rated categorical DSM-5 mixed-features specifiers, and residual conceptual overlap between depressive severity, activation-related symptom expression, and mixed-feature symptomatology cannot be fully excluded. Fourth, although multiple covariates were included, other potentially relevant factors (e.g., temperament, trauma exposure, personality traits, broader digital-media use patterns, and detailed pharmacotherapy characteristics) were not assessed; medication use was coded as a binary variable, limiting examination of treatment heterogeneity[55,56]. Fifth, diagnostic heterogeneity remains a central constraint: while we conducted robustness checks and exploratory stratified analyses, subgroup models were less precise, and BD subtypes (BD-I vs BD-II) were not systematically distinguished, which may limit generalizability across bipolar subtypes. Finally, the sample consisted of student patients from a limited number of sites within a single country, which may restrict generalizability to non-student youth, older populations, and other cultural contexts.

Despite these limitations, the present findings add to the literature by demonstrating a robust association between PPC and mixed-feature symptoms in clinically referred youth with depressive episodes and by highlighting that pathway-level associations involving smartphone addiction may be sensitive to diagnostic heterogeneity. Longitudinal studies with structured diagnostic characterization and multi-method measurement are needed to clarify temporal dynamics and to test whether the observed pathway patterns replicate across diagnostically stratified samples.

Conclusion

In this multi-center clinical sample of student patients aged 16–24 years experiencing current depressive episodes, PPC and smartphone addiction were positively associated with mixed-feature symptoms, and PPC showed a robust association with mixed-feature symptoms across model specifications. In the primary model, indirect association patterns were consistent with a serial pathway involving depressive symptoms and smartphone addiction, although pathway-level findings were sensitive to diagnostic adjustment and depressive-symptom indexing. These results underscore the value of jointly considering family context and smartphone addiction when evaluating mixed-feature symptom expression in youth with depressive episodes and motivate further longitudinal replication in diagnostically stratified samples.

Declarations

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Declaration of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Jianxiang Ma; Shangcun Wang and Binxun Jiang conceived the idea for the article. Jianxiang Ma wrote the main manuscript text and prepared the tables and figures with input from Shangcun Wang. Wanli Sun; Liping Xu; Binxun Jiang and Shangcun Wang recruited and assessed participants. Shangcun Wang performed the statistical analysis. All authors contributed to and have approved the final manuscript.

Data availability

De-identified data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical and privacy restrictions related to human participant data.

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Figures

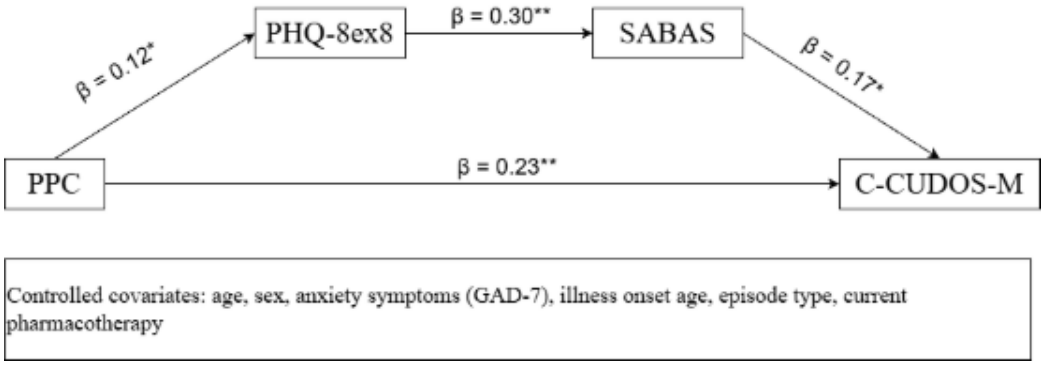


Figure 1

Serial mediation model linking perceived parental control, depressive symptoms (PHQ-8ex8), smartphone addiction (SABAS), and mixed features (C-CUDOS-M).

Supplementary Files

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