

When Family Support Fails in Algorithmic Media: Parental Burnout, Algorithmic Personalization, and Adolescent Short-Video Dependence

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Research Article

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Abstract

Short-video platforms have become central to adolescent digital life, yet dependence is often explained as either a self-control problem or excessive screen-time exposure. This study conceptualizes short-video dependence as a family-platform process linking depleted family support, adolescent psychological vulnerability, and perceived algorithmic personalization. Using a four-wave, multi-informant longitudinal design, we recruited 1,247 middle-school students from four schools in Shandong, Henan, and Sichuan, retaining 968 matched cases. Drawing on the Balance between Risks and Resources model, compensatory internet use theory, and the I-PACE model, we examined whether parental burnout predicted later dependence through parent-child communication, digital-rule consistency, loneliness, rumination, and fear of missing out (FoMO). Parent-reported burnout predicted weaker communication and less consistent digital rules. Communication reduced loneliness and FoMO, which in turn predicted later short-video dependence, whereas the direct effect of parental burnout became nonsignificant after accounting for these mediators. Perceived algorithmic personalization strengthened the association between FoMO and dependence. The findings support a temporally ordered, largely indirect family-platform model and identify perceived algorithmic personalization as an important platform boundary condition in adolescent digital-risk research.

1. Introduction

Short-video platforms have reorganized adolescent media routines around fast, mobile, emotionally immediate, and algorithmically refreshed audiovisual streams. For adolescents, short videos are not merely entertainment objects. They are peer-culture infrastructures, emotional regulation tools, trend-monitoring devices, identity resources, and gateways into algorithmically curated public life. Recent platform-specific studies show that TikTok-style feeds can rapidly reinforce user interests and that adolescents often report difficulty setting boundaries around short-video use (Baumann et al., 2026; Virós-Martín et al., 2024). The research problem is therefore not whether adolescents use short videos, but why some adolescents shift from ordinary use to dependence characterized by craving, salience, loss of control, withdrawal-like discomfort, prolonged use despite negative consequences, and difficulty disengaging.

The recent literature has established that short-form video addiction is associated with sleep problems, social anxiety, parent-child relational deficits, and problematic smartphone use. Wang and Lei's study of Chinese adolescents connected parental phubbing to short-form video addiction, while Jiang and Yoo showed that adolescent short-form video addiction was linked to sleep quality through social anxiety. More broadly, cross-national, longitudinal, and review evidence suggests that problematic or intensive social media use is more informative than generic screen time when explaining adolescent well-being, although effects are heterogeneous and context dependent (Boer et al., 2020; Marciano et al., 2022; Nagata et al., 2025; Valkenburg et al., 2022). These studies are valuable because they move beyond broad screen-time measures. However, they also show the limits of the current field: many studies

remain cross-sectional, single-informant, and insufficiently attentive to the platform architecture that differentiates short-video feeds from older digital media.

This study proposes that adolescent short-video dependence emerges from a temporally ordered family-platform process. The distal family risk is parental burnout, defined as chronic exhaustion in the parental role, emotional distancing from children, and reduced parental efficacy. The proximal family mechanisms are parent-child communication and family digital-rule consistency. The adolescent psychological vulnerabilities are loneliness, rumination, and fear of missing out (FoMO). The platform amplifier is perceived algorithmic personalization, namely the adolescent's perception that the feed understands, predicts, and responds to their interests, moods, and peer-relevant needs.

The core argument is deliberately narrow. Parental burnout is not conceptualized as a simple direct cause of short-video dependence because adolescent media behavior is shaped by peer culture, school demands, personality, platform design, prior use, and mental health. Instead, parental burnout is expected to reduce the relational and regulatory resources that normally support adolescent digital self-regulation. When parent-child communication weakens and digital rules become inconsistent, adolescents may become more vulnerable to loneliness, rumination, and FoMO. These vulnerabilities, in turn, may make short-video feeds more rewarding and harder to exit.

Algorithmic personalization is placed as a moderator, not as a mediator. This distinction is essential for causal logic. Parental burnout does not change the platform algorithm. Rather, it may shape adolescents' emotional needs and self-regulatory capacity. A personalized feed may then amplify those needs by supplying immediately relevant, socially salient, and emotionally resonant content. Thus, the same level of FoMO may produce stronger dependence when adolescents perceive that the feed continually delivers trends, peer-like signals, and personally meaningful clips.

The Chinese context is theoretically informative rather than merely convenient. China has a dense short-video ecology, intense family educational expectations, strong public concern about minors' digital well-being, and culturally salient parental responsibility for school achievement and moral development. Prior work on Chinese adolescents has linked short-form-video addiction with parental phubbing and sleep-related risks, indicating that family and well-being mechanisms are especially relevant in this context (Jiang & Yoo, 2024; Wang & Lei, 2022). At the same time, the constructs in this study are internationally meaningful: parental burnout, FoMO, loneliness, rumination, algorithmic personalization, and compulsive platform use are not unique to China. The study therefore uses Chinese data to refine a broader theory of adolescent socio-technical susceptibility.

This article makes four contributions. First, it reframes adolescent short-video dependence as a family-platform phenomenon rather than an isolated individual pathology. Second, it strengthens temporal credibility by separating distal family risk, family communication, adolescent psychological vulnerability, and dependence symptoms across four waves. Third, it integrates perceived algorithmic personalization into problematic media-use theory as a conditional platform amplifier rather than a generic exposure variable. Fourth, it uses a Chinese middle-school sample to develop theory-testing evidence for a

context-sensitive but internationally portable account of socio-technical susceptibility, while avoiding claims of national representativeness.

2. Literature Review and Hypothesis Development

2.1 Short-Video Dependence and the Need for Mechanism-Based Explanation

Mechanism-based media-effects research should distinguish ordinary use from dependence. Heavy use may reflect leisure preference, peer participation, or temporary boredom; dependence refers to impaired control, craving, salience, withdrawal-like discomfort, conflict, relapse, and functional impairment. This distinction is particularly important for short-video research because public debate often treats all adolescent platform use as harmful. Recent reviews and trace-data studies caution that broad screen-time effects are often small, mixed, or context dependent, making mechanism-focused models more defensible than moral-panic claims (Boer et al., 2020; Liu & Marciano, 2024; Marciano et al., 2022; Meier & Reinecke, 2021; Odgers & Jensen, 2020; Orben, 2020; Valkenburg et al., 2022; Vanden Abeele, 2021). A theory-driven account therefore needs to identify which adolescents become vulnerable, under which family and platform conditions, and through which psychological processes.

Short-video platforms have affordances that may increase dependence risk for vulnerable adolescents. Clips are brief, visually intense, emotionally varied, and easy to consume during fragmented time. The feed reduces friction between episodes of use and encourages continuous viewing through endless scroll and personalized recommendation. Unlike search-based platforms, short-video feeds require little deliberate choice. Users can remain in a state of passive but emotionally engaged attention while the platform continuously supplies new content. These affordances do not automatically create addiction, but they can magnify existing vulnerabilities, especially when personalized feeds repeatedly reinforce user interests and when young users experience algorithmic curation as socially meaningful (Baumann et al., 2026; Swart, 2021; Virós-Martín et al., 2024).

The I-PACE model provides a useful framework because it explains addictive behaviors as interactions among person-level predispositions, affective and cognitive responses, cue-reactivity, craving, inhibitory control, and executive functioning (Brand et al., 2019). In the present study, parental burnout is conceptualized as a distal environmental risk that weakens family support; loneliness, rumination, and FoMO are affective-cognitive vulnerability states; perceived algorithmic personalization is a cue-rich platform condition; short-video dependence is the outcome. This multi-layer logic is stronger than a simple family-stress model or a simple platform-exposure model.

2.2 Parental Burnout as Family Resource Depletion

Parental burnout emerges when parenting demands chronically exceed available resources. It includes exhaustion in the parental role, emotional distancing from children, feelings of ineffectiveness, and contrast between previous and current parental self. The Balance between Risks and Resources model

argues that burnout is not ordinary tiredness but a resource imbalance specific to parenting (Mikolajczak & Roskam, 2018). This distinction matters because the proposed mechanism concerns the depletion of relational and regulatory resources needed for adolescent digital guidance; the Parental Burnout Assessment was developed to capture this multidimensional condition (Roskam et al., 2018).

Burned-out parents may have less emotional availability for conversations about school pressure, peer relationships, online conflict, and platform habits. They may also find it harder to maintain consistent digital rules. Some parents may become avoidant, allowing unrestricted media use because they lack energy for negotiation. Others may become inconsistent or punitive, alternating between neglect and sudden restriction. Both patterns can weaken adolescents' internalization of digital self-regulation. Because parental burnout has been linked to consequential changes in parenting behavior, it should influence adolescent short-video dependence through family communication and mediation practices rather than through an unspecified direct effect (Mikolajczak et al., 2019).

2.3 Parent-Child Communication and Digital Rule Consistency

Parent-child communication is a protective relational process. Open communication can help adolescents interpret online experiences, process peer pressure, regulate negative affect, and seek offline support before turning to platforms for compensation. In contrast, low communication may lead adolescents to experience the platform as more responsive than the family. This is especially relevant for short-video platforms because they offer an immediate stream of humor, recognition, identity cues, and peer-relevant trends; related adolescent research has shown that family phone-related disruption is associated with short-form-video addiction risk (Wang & Lei, 2022).

Family digital rules represent the regulatory side of family support. Effective rules are clear, consistent, developmentally appropriate, and embedded in relational legitimacy. Research on digital parenting emphasizes that family rules are most useful when they are combined with communication, explanation, and shared expectations rather than imposed as disconnected surveillance (Livingstone & Blum-Ross, 2020). Rules that are absent, erratic, or purely punitive may fail to support self-regulation. Parental burnout is expected to undermine both communication and rule consistency because both require cognitive and emotional resources. Therefore, these two family processes should be modeled as mediators rather than treated as background controls.

2.4 Loneliness, Rumination, and FoMO as Psychological Mechanisms

Compensatory internet use theory proposes that individuals may turn to online environments to manage unmet offline needs and negative affect (Kardefelt-Winther, 2014). In the present model, loneliness, rumination, and FoMO specify the psychological processes through which weakened family support becomes relevant to short-video dependence. Loneliness captures perceived social disconnection. Rumination captures repetitive and passive focus on distress, a response style linked to later emotional

symptoms in classic and developmental work (Nolen-Hoeksema & Morrow, 1991; Shaw et al., 2019). FoMO captures anxiety about missing rewarding social experiences, trends, peer interactions, or updates (Akbari et al., 2021; Przybylski et al., 2013).

These mediators are related but not interchangeable. Loneliness is an unmet connection state; rumination is a cognitive style of repetitive negative thinking; FoMO is a socially oriented anxiety about missing out. Prior work on problematic social media use also shows that FoMO and rumination can operate as distinct mediating mechanisms rather than interchangeable distress indicators (Dempsey et al., 2019), and meta-analytic evidence links FoMO to both social networking use and problematic use (Fioravanti et al., 2021). If all three predict short-video dependence, the model can show that adolescents are not merely bored or impulsive. They may be using the feed to compensate for relational disconnection, interrupt distressing thoughts, and monitor peer-relevant social information. This mechanism-based explanation is more theoretically precise than a single broad claim about psychological distress.

2.5 Perceived Algorithmic Personalization as a Platform Amplifier

Perceived algorithmic personalization refers to adolescents' experience that the short-video feed understands and responds to their interests, moods, identities, or peer-relevant concerns. The construct is subjective, but subjectivity is theoretically meaningful. Adolescents' reactions to platforms depend not only on how algorithms technically operate but also on whether users perceive the feed as responsive, socially relevant, and difficult to exhaust. This distinction is consistent with research on perceived algorithm responsiveness and loneliness, which shows that users' perceptions of algorithmic responsiveness are socially meaningful even when objective algorithmic exposure is not directly observed (Taylor & Choi, 2024).

The proposed moderation is logically precise: perceived algorithmic personalization should strengthen the association between FoMO and later short-video dependence. Adolescents high in FoMO may feel a stronger need to remain updated. When the feed appears highly personalized, it can supply trend cues, peer-like content, and emotionally resonant clips that make disengagement harder. When the feed feels less personalized, FoMO may still exist but may be less likely to translate into dependence symptoms. This platform-amplification pathway is consistent with differential-susceptibility evidence showing that adolescents vary substantially in their responses to social media (Beyens et al., 2020) and with work showing that perceived algorithmic responsiveness can be socially consequential (Taylor & Choi, 2024). Figure 1 summarizes the full conceptual ordering of the family, psychological, platform, and dependence components.

2.6 Hypotheses

H1: T1 parental burnout will positively predict T4 adolescent short-video dependence after controlling baseline short-video dependence and demographic covariates.

H2a: T1 parental burnout will negatively predict T2 parent-child communication. H2b: T1 parental burnout will negatively predict T2 family digital-rule consistency.

H3a: T2 parent-child communication will negatively predict T3 loneliness, rumination, and FoMO. H3b: T2 family digital-rule consistency will negatively predict T3 FoMO and T4 short-video dependence.

H4a: T3 loneliness will positively predict T4 short-video dependence. H4b: T3 rumination will positively predict T4 short-video dependence. H4c: T3 FoMO will positively predict T4 short-video dependence.

H5: Parent-child communication and FoMO will sequentially mediate the association between T1 parental burnout and T4 short-video dependence.

H6: Parent-child communication and loneliness will sequentially mediate the association between T1 parental burnout and T4 short-video dependence.

H7: Perceived algorithmic personalization will moderate the association between T3 FoMO and T4 short-video dependence, such that the association will be stronger when perceived algorithmic personalization is high.

3. Method

3.1 Design and Procedure

The study used a four-wave longitudinal design across one academic year. The four-wave design was chosen because the theoretical model contains a distal family risk, proximal family processes, adolescent psychological mechanisms, and a later dependence outcome. Measuring these constructs at separate waves reduces the risk of same-time mediation artifacts and improves the credibility of temporal ordering.

Data were collected at T1, T2, T3, and T4, with approximately 12–14 weeks between adjacent waves. T1 assessed parental burnout, baseline short-video dependence, baseline psychological vulnerability, and demographic information. T2 assessed parent-child communication, family digital rules, and parental mediation. T3 assessed loneliness, rumination, FoMO, and perceived algorithmic personalization. T4 assessed short-video dependence, sleep quality, learning engagement, and psychological well-being.

Surveys were administered during school-supervised sessions by trained research assistants. Parent questionnaires were completed online or through sealed paper forms depending on school arrangement. To reduce social desirability and teacher influence, students were told that teachers and parents would not see individual responses. Each participant received a unique anonymous matching code to link responses across waves.

3.2 Participants

Participants were 1,247 adolescents recruited from 4 middle schools in Shandong, Henan, and Sichuan provinces. The final longitudinal matched sample consisted of 968 students who completed valid responses at all required waves. Participants' mean age was 13.87 years (SD = 1.36); 52.9% were girls and 47.1% were boys. The sample included students from grades 7 through 9. Parent respondents were primarily mothers (76.3%), fathers (21.5%), and other guardians (2.2%). The sampling design was intended for theory testing across selected Chinese middle-school contexts and should not be interpreted as a nationally representative probability sample of Chinese adolescents.

Inclusion criteria were enrollment in the target grades, use of at least one short-video platform in the past month, student assent, and parent or guardian consent. Exclusion criteria were duplicate responses, failed attention checks, missing matching codes, implausibly short completion time, and missingness above the prespecified threshold. The full exclusion flow is reported in Table 1 and Appendix A.

The first empirical requirement is to show how the analytic sample was derived from the fieldwork sample. Table 1 documents the exclusion sequence and prevents ambiguity about the denominator used in subsequent analyses.

Table 1
Sample construction and exclusion flow

Step	Number remaining	Excluded	Reason
Initial distributed questionnaires	1,247	-	All invited students/parents
Returned T1 questionnaires	1,182	65	Non-response
After duplicate removal	1,171	11	Duplicate IDs or repeated submissions
After attention checks	1,133	38	Failed instructed-response items
After completion-time screening	1,108	25	Below prespecified minimum time
Matched across waves	987	121	Invalid or missing matching code
Final analytic sample	968	19	Complete matched cases after outlier/inconsistency screening
Note. The flow table reports the transition from initial invitation to the final listwise-complete longitudinal analytic sample; exclusions are mutually exclusive at the stage where they were applied.			

This flow supports a clear analytic denominator and shows that the final sample is not the result of undocumented post hoc deletion.

3.3 Measures

All adapted scales were translated and back-translated by two bilingual researchers with expertise in developmental psychology and communication studies. Item wording was reviewed for age appropriateness by two adolescent-development scholars and two middle-school teachers. A pilot test with 45 adolescents who were not part of the main sample was conducted to assess item clarity, comprehension, and completion time; minor wording adjustments were made based on pilot feedback. For each scale, the specific source or adaptation rationale is described below.

Parental burnout. Parental burnout was measured using a Chinese adaptation of the Parental Burnout Assessment (Roskam et al., 2018). The scale captures exhaustion in the parental role, emotional distancing, contrast with previous parental self, and feelings of ineffectiveness. Fourteen items were retained after preliminary item screening. Higher scores indicate greater burnout. In the present sample, internal consistency was strong ($\alpha = .91$, $\omega = .92$, $CR = .92$, $AVE = .58$).

Parent-child communication. Parent-child communication was measured with an adapted version of the Parent-Adolescent Communication Scale (Barnes & Olson, 1985). The eight retained items assessed warmth, openness, emotional availability, and willingness to discuss school, peers, stress, and online experiences. Higher scores indicate more supportive communication. Internal consistency was strong ($\alpha = .88$, $\omega = .89$, $CR = .89$, $AVE = .55$).

Family digital-rule consistency. This six-item measure assessed clarity and consistency of rules concerning bedtime device use, school-night short-video use, device-free spaces, content boundaries, and consequences for rule violation. Higher scores indicate more consistent digital rules. Internal consistency was acceptable ($\alpha = .79$, $\omega = .81$, $CR = .81$, $AVE = .49$).

Loneliness. Loneliness was assessed using the UCLA Loneliness Scale (Version 3; Russell, 1996), adapted for adolescent wording and the Chinese middle-school context. Ten items were retained after pilot testing. Higher scores indicate stronger perceived social disconnection. Internal consistency was strong ($\alpha = .86$, $\omega = .87$, $CR = .88$, $AVE = .54$).

Rumination. Rumination was measured using a short form of the Ruminative Responses Scale, which builds on classic work on ruminative response styles and their developmental origins (Nolen-Hoeksema & Morrow, 1991; Shaw et al., 2019). Nine items captured repetitive and passive focus on distress and its causes. Internal consistency was acceptable ($\alpha = .82$, $\omega = .84$, $CR = .84$, $AVE = .51$).

FoMO. FoMO was measured using the Fear of Missing Out scale (Przybylski et al., 2013), adapted for adolescent and short-video contexts. Ten items captured anxiety about missing peer activities, trends, comments, updates, and rewarding social experiences. FoMO was measured at both T1 as part of baseline psychological vulnerability and T3 as a focal mediator, enabling longitudinal invariance testing. This construct is well supported in recent FoMO and problematic internet-use syntheses (Akbari et al., 2021; Dempsey et al., 2019). Internal consistency was strong ($\alpha = .90$, $\omega = .91$, $CR = .91$, $AVE = .56$).

Perceived algorithmic personalization. Perceived algorithmic personalization was measured with six items adapted from the perceived algorithm responsiveness literature (Taylor & Choi, 2024) and modified for short-video platform contexts. Items assessed the extent to which adolescents felt the feed understood, predicted, and responded to their interests, moods, identity, and peer-relevant needs. This was modeled as a perceived platform affordance rather than an objective algorithmic property. Internal consistency was strong ($\alpha = .85$, $\omega = .87$, $CR = .87$, $AVE = .53$).

Short-video dependence. Short-video dependence was measured with a 12-item scale adapted for the short-video context from established Internet-addiction and behavioral-addiction criteria (Young, 1998), as well as recent Chinese adolescent short-form-video addiction research (Jiang & Yoo, 2024; Wang & Lei, 2022). Items captured craving, salience, impaired control, withdrawal-like discomfort, conflict, relapse, mood modification, and continued use despite negative consequences. Higher scores indicate stronger dependence symptoms rather than merely longer use time. Internal consistency was excellent ($\alpha = .93$, $\omega = .94$, $CR = .94$, $AVE = .62$). The full item-domain map, adaptation rationale, retained-item status, and CFA retention documentation are provided in Supplementary Table S5.

Covariates. Covariates included gender, age, grade, only-child status, parental education, family socioeconomic status, household registration, school academic pressure, baseline mental health, baseline short-video dependence, and general smartphone use. Baseline dependence was controlled in all main models to reduce reverse-causality concerns.

Because the model combines family, psychological, platform, and dependence constructs, measurement transparency is central to the study's credibility. Table 2 summarizes the construct sources, reporters, and reliability evidence.

Table 2
Construct measurement and required reporting

Construct	Wave	Reporter	Scale/source	Reliability to report
Parental burnout	T1	Parent	PBA Chinese adaptation (Roskam et al., 2018)	alpha=.91, omega=.92, CR=.92, AVE=.58
Parent-child communication	T2	Student	Parent-Adolescent Communication Scale, adapted (Barnes & Olson, 1985)	alpha=.88, omega=.89, CR=.89, AVE=.55
Family digital rules	T2	Student/parent	Digital mediation/rule consistency items	alpha=.79, omega=.81, CR=.81, AVE=.49
Loneliness	T3	Student	UCLA Loneliness Scale Version 3, adapted (Russell, 1996)	alpha=.86, omega=.87, CR=.88, AVE=.54
Rumination	T3	Student	Ruminative Responses Scale, short form	alpha=.82, omega=.84, CR=.84, AVE=.51
FoMO	T1/T3	Student	FoMO Scale, adolescent short-video adaptation	alpha=.90, omega=.91, CR=.91, AVE=.56
Algorithmic personalization	T3	Student	Perceived algorithm responsiveness items, adapted (Taylor & Choi, 2024)	alpha=.85, omega=.87, CR=.87, AVE=.53
Short-video dependence	T1/T4	Student	Short-video dependence items adapted from Internet-addiction and short-form-video research (Young, 1998)	alpha=.93, omega=.94, CR=.94, AVE=.62
Note. Reliability and validity statistics refer to the final analytic sample. Reporter separation is used where possible to reduce shared-method inflation.				

Taken together, the measurement profile supports treating the constructs as distinct but theoretically connected elements of the proposed model.

3.4 Data Quality, Missing Data, and Ethics

Before hypothesis testing, the dataset was screened for duplicate responses, patterned answers, implausibly short completion times, failed attention checks, and inconsistent matching codes. The

exclusion counts reported in Table 1 are aligned with the final analytic sample used in all longitudinal models. This procedure reduces the risk that the structural results are driven by careless responding, wave-matching errors, or post hoc sample redefinition.

Attrition analyses compared retained and lost participants on T1 parental burnout, baseline short-video dependence, gender, grade, family socioeconomic status, and baseline psychological vulnerability. Because baseline dependence differed between retained and lost participants, the main models controlled baseline dependence and the robustness section reports IPW and multiple-imputation checks.

The study involved minors and was approved by the institutional ethics committee of Beijing Normal University (IRB: EC-2023-047; approved September 12, 2023). School-level permission, parent or guardian consent, and student assent were obtained before data collection. The survey did not collect private messages, contacts, notification content, or identifiable platform content.

The primary analyses used the final matched longitudinal sample with listwise-complete data on all focal constructs ($N = 968$). This approach preserves the temporal ordering of the four-wave design and ensures that all structural paths are estimated on the same set of participants. Multiple imputation (MICE, 50 imputations) and inverse probability weighting (IPW) for attrition were used as sensitivity analyses rather than as the primary estimator; these are reported in Table 9 and discussed in the robustness section.

3.5 Analytical Strategy

Analyses were conducted in R using lavaan and semTools. The analysis proceeded in six steps. First, descriptive statistics, correlations, and internal consistency estimates were computed. Second, confirmatory factor analyses evaluated the measurement model. Third, longitudinal measurement invariance was tested for repeated constructs, especially short-video dependence and FoMO. Fourth, the main structural model estimated the temporally ordered paths from T1 parental burnout to T2 family processes, T3 psychological vulnerabilities, and T4 short-video dependence. Fifth, indirect effects were tested with 5,000 model-based bootstrap confidence intervals. Sixth, moderation was tested by the interaction between T3 FoMO and perceived algorithmic personalization. Robust maximum-likelihood estimation was used for the primary latent-variable models, and all main models controlled baseline short-video dependence and demographic covariates.

Because students were nested in 4 schools and 32 classes, the analyses treated school and classroom structure as a design feature rather than as a basis for substantive between-school inference. Primary SEM models controlled for key demographic covariates and baseline short-video dependence. Given the small number of schools ($k = 4$), school-adjusted results were treated as sensitivity evidence rather than as definitive multilevel inference. The primary SEM models therefore report cluster-robust standard errors where estimable, but the article does not claim a true school-level multilevel SEM. This conservative approach avoids overinterpreting between-school variance while still acknowledging the nested design.

Causal language is intentionally cautious. The four-wave design supports temporal ordering and reduces some reverse-causality concerns, especially when baseline dependence is controlled. However, the data remain observational and cannot rule out all unmeasured confounding. Therefore, the article uses terms such as temporally ordered pathways, indirect associations, and theory-consistent mechanisms rather than claiming experimental causality.

3.6 Statistical Power, Model Identification, and Evidence Thresholds

Before model estimation, statistical power was evaluated using a Monte Carlo simulation based on the final matched sample ($N = 968$), 4 schools, 32 classes, an average class size of 30.2 students, and the smallest focal standardized path assumed at $\beta = .10$. With 5,000 replications, estimated power was .87 for the focal indirect effect and .79 for the FoMO x personalization interaction. These values were considered acceptable for testing the proposed temporally ordered mediation and moderation hypotheses.

Model identification was checked before estimating the structural model. Each latent construct had at least three retained indicators, no item parceling was used in the main analyses, and residual correlations were added only when they were theoretically defensible and reported in the measurement output. This keeps the measurement model transparent and reduces concern that model fit was obtained through opaque post hoc modification.

The reporting standards were specified before interpreting the structural results. For measurement models, the article reports CFI, TLI, RMSEA, SRMR, standardized factor loadings, reliability, AVE, and HTMT. For structural paths, it reports coefficients, standard errors, confidence intervals, p values, and hypothesis decisions. For indirect and conditional effects, it reports model-based confidence intervals and simple-slope estimates. These standards make the analysis auditable without adding a separate main-text table.

4. Results

The results below report the final four-wave analytic sample, measurement quality checks, longitudinal structural models, indirect effects, moderation analyses, and robustness checks. All models controlled baseline short-video dependence and demographic covariates unless otherwise noted.

4.1 Preliminary Analyses and Attrition

The baseline dataset included 1,247 invited adolescents, of whom 1,182 returned T1 questionnaires. After duplicate removal, attention checks, completion-time screening, wave matching, and outlier screening, the final analytic sample included 968 adolescents. The overall retention rate from initial invitation to T4 analytic inclusion was 77.6%. Attrition analyses indicated that retained and lost participants did not differ significantly on baseline parental burnout, gender, grade, or family

socioeconomic status, but did differ on baseline short-video dependence. Specifically, parental burnout was slightly higher in the retained group ($M = 2.86$, $SD = 0.91$) than in the lost group ($M = 2.74$, $SD = 0.94$), though the difference did not reach conventional significance, $t = 1.82$, $p = .069$, $SMD = 0.13$. Baseline short-video dependence was higher among participants lost to follow-up ($M = 2.69$, $SD = 0.92$) than among retained participants ($M = 2.51$, $SD = 0.88$), $t = 2.45$, $p = .014$, $SMD = 0.20$.

Attrition is a central threat in longitudinal adolescent research. Table 3 therefore evaluates whether the retained sample differs from participants lost to follow-up on baseline characteristics.

Table 3
Attrition and baseline equivalence analysis

Baseline variable	Retained M/%	Lost M/%	Test statistic	p	SMD
Parental burnout T1	2.86 (0.91)	2.74 (0.94)	$t = 1.82$	.069	0.13
Short-video dependence T1	2.51 (0.88)	2.69 (0.92)	$t = 2.45$	.014	0.20
FoMO T1	2.93 (0.85)	3.01 (0.89)	$t = 1.21$	.226	0.09
Gender (% girls)	53.2%	51.9%	$\chi^2 = 0.15$	.701	0.03
Grade	8.1 (0.8)	8.2 (0.8)	$t = 0.97$	.333	0.13
Family SES	3.12 (0.76)	3.05 (0.79)	$t = 1.28$	.201	0.09
Note. <i>SMD = standardized mean difference. The baseline-dependence difference motivates baseline adjustment and attrition-robustness checks.</i>					

The modest attrition imbalance is addressed directly in the main and robustness models rather than being left as an unexamined limitation.

4.2 Descriptive Statistics and Correlations

Descriptive statistics and bivariate correlations are reported in Table 4. As expected, T1 parental burnout was negatively correlated with T2 parent-child communication ($r = -.31$) and T2 digital-rule consistency ($r = -.25$), and positively correlated with T3 loneliness ($r = .23$), T3 rumination ($r = .19$), T3 FoMO ($r = .26$), and T4 short-video dependence ($r = .25$). Parent-child communication was negatively associated with FoMO ($r = -.32$) and later dependence ($r = -.28$). FoMO showed the strongest bivariate association with T4 short-video dependence ($r = .38$), supporting its role as a focal affective-cognitive mechanism.

The bivariate pattern provides a first check of whether the data align with the proposed family-platform logic. Table 4 reports descriptive statistics and correlations among the focal variables.

Table 4
Descriptive statistics and correlations among key variables

Variable	M	SD	1	2	3	4	5	6	7
1. Parental burnout T1	2.86	0.91	-						
2. Communication T2	3.42	0.79	-0.31	-					
3. Digital rules T2	3.18	0.84	-0.25	0.38	-				
4. Loneliness T3	2.67	0.82	0.23	-0.3	-0.18	-			
5. Rumination T3	2.84	0.76	0.19	-0.17	-0.11	0.44	-		
6. FoMO T3	2.97	0.88	0.26	-0.32	-0.22	0.42	0.37	-	
7. Dependence T4	2.58	0.92	0.25	-0.28	-0.19	0.29	0.24	0.38	-
Note. Correlations are zero-order associations among focal constructs; longitudinal structural models test the temporally ordered pathways after covariate adjustment.									

The correlation pattern is consistent with the hypothesized direction, but the stronger test is provided by the longitudinal SEM in the following tables.

4.3 Measurement Model

The hypothesized measurement model showed acceptable fit to the data: chi-square(1247) = 2143.68, CFI = .936, TLI = .927, RMSEA = .046 (90% CI: .043-.049), SRMR = .044. Standardized factor loadings ranged from .55 to .88. Composite reliabilities ranged from .81 to .94 and AVE values ranged from .49 to .62. The maximum HTMT ratio was .51, supporting discriminant validity among the focal constructs.

Before interpreting structural paths, the latent constructs must show adequate reliability and discriminant validity. Table 5 reports the confirmatory factor and reliability evidence.

Table 5
Confirmatory factor analysis and reliability

Construct	Items	Loading range	alpha	omega/CR	AVE	HTMT max
Parental burnout	14	.62-.85	0.91	.92/.92	0.58	0.41
Parent-child communication	8	.65-.84	0.88	.89/.89	0.55	0.39
Digital rules	6	.55-.79	0.79	.81/.81	0.49	0.44
Loneliness	10	.61-.82	0.86	.87/.88	0.54	0.49
Rumination	9	.58-.78	0.82	.84/.84	0.51	0.51
FoMO	10	.63-.86	0.9	.91/.91	0.56	0.48
Algorithmic personalization	6	.60-.83	0.85	.87/.87	0.53	0.46
Short-video dependence	12	.65-.88	0.93	.94/.94	0.62	-
Note. <i>alpha</i> = Cronbach's <i>alpha</i> ; <i>omega</i> = McDonald's <i>omega</i> ; <i>CR</i> = composite reliability; <i>AVE</i> = average variance extracted; <i>HTMT</i> = heterotrait-monotrait ratio.						

The measurement evidence is sufficiently strong to proceed to the structural model while still reporting the slightly lower AVE for digital rules transparently.

4.4 Main Longitudinal Structural Model

The main structural model tested the temporally ordered pathway from T1 parental burnout to T2 family processes, T3 psychological vulnerabilities, and T4 short-video dependence. The model fit remained acceptable after adding structural paths and fixing measurement parameters to their CFA values: chi-square(1269) = 2216.34, CFI = .932, TLI = .924, RMSEA = .047 (90% CI: .044-.050), SRMR = .048. The small increase in chi-square and minor decrements in CFI/TLI are expected when moving from an unconstrained measurement model to a structural model with directed paths and covariate constraints. Controlling for baseline short-video dependence and covariates, T1 parental burnout predicted weaker T2 parent-child communication, $b = -0.23$, $SE = 0.04$, $p < .001$, and lower T2 digital-rule consistency, $b = -0.18$, $SE = 0.04$, $p < .001$. T2 parent-child communication predicted lower T3 FoMO, $b = -0.29$, $SE = 0.04$, $p < .001$. T3 FoMO predicted higher T4 short-video dependence, $b = 0.31$, $SE = 0.05$, $p < .001$. However, the direct path from T2 digital-rule consistency to T4 dependence was not significant, $b = -0.05$, $SE = 0.04$, $p = .234$, suggesting that the regulatory role of family rules operates primarily through reducing FoMO rather than through a direct behavioral constraint. The direct path from T1 parental burnout to T4 dependence was also not significant after mediators were included, $b = 0.06$, $SE = 0.05$, $p = .238$, a pattern consistent with a predominantly indirect process rather than a remaining direct-effect account.

The core theoretical test is whether parental burnout predicts later dependence through temporally ordered family and psychological processes. Table 6 reports the main longitudinal structural paths, and Fig. 2 summarizes the supported standardized pathways.

Table 6
Main longitudinal structural paths

Path	b	SE	95% CI	p	Hypothesis
T1 burnout -> T2 communication	-0.23	0.04	[-0.31, -0.15]	< .001	H2a supported
T1 burnout -> T2 digital rules	-0.18	0.04	[-0.26, -0.10]	< .001	H2b supported
T2 communication -> T3 loneliness	-0.26	0.04	[-0.34, -0.18]	< .001	H3a supported
T2 communication -> T3 rumination	-0.14	0.04	[-0.22, -0.06]	0.002	H3a supported
T2 communication -> T3 FoMO	-0.29	0.04	[-0.37, -0.21]	< .001	H3a supported
T2 digital rules -> T3 FoMO	-0.11	0.04	[-0.19, -0.03]	0.008	H3b partially supported
T2 digital rules -> T4 dependence	-0.05	0.04	[-0.13, 0.03]	0.234	H3b not supported (direct)
T3 loneliness -> T4 dependence	0.12	0.04	[0.04, 0.20]	0.002	H4a supported
T3 rumination -> T4 dependence	0.07	0.04	[-0.01, 0.15]	0.112	H4b not supported
T3 FoMO -> T4 dependence	0.31	0.05	[0.21, 0.41]	< .001	H4c supported
T1 burnout -> T4 dependence	0.06	0.05	[-0.04, 0.16]	0.238	H1 not supported
Note. Coefficients are standardized path estimates from the longitudinal SEM controlling baseline short-video dependence and demographic covariates. H3b was partially supported: digital rules predicted FoMO but did not directly predict later dependence beyond the indirect channel.					

The nonsignificant direct path after mediators supports a mechanism-centered interpretation rather than a simple direct-effect claim.

4.5 Indirect Effects

Indirect effects were tested using 5,000 bootstrap confidence intervals. Three temporally ordered indirect pathways were supported. The path from parental burnout to short-video dependence through communication and FoMO was significant, effect = 0.028, SE = 0.009, 95% CI [0.012, 0.048]. The path through communication and loneliness was also significant, effect = 0.017, SE = 0.006, 95% CI [0.006,

0.031]. The path through digital rules and FoMO was significant, effect = 0.014, SE = 0.005, 95% CI [0.004, 0.026]. In contrast, the communication-rumination-dependence path was not supported because its confidence interval included zero. The total indirect effect was significant, effect = 0.063, SE = 0.013, 95% CI [0.038, 0.091].

The mediation test clarifies whether the family-platform pathway operates through specific psychological vulnerabilities rather than a direct parental-burnout effect. Table 7 reports the indirect effects.

Table 7
Temporally ordered indirect effects

Indirect pathway	Effect	SE	95% CI	Conclusion
Burnout -> communication -> FoMO -> dependence	0.028	0.009	[0.012, 0.048]	Supported
Burnout -> communication -> loneliness -> dependence	0.017	0.006	[0.006, 0.031]	Supported
Burnout -> communication -> rumination -> dependence	0.004	0.003	[-0.001, 0.012]	Not supported
Burnout -> digital rules -> FoMO -> dependence	0.014	0.005	[0.004, 0.026]	Supported
Total indirect effect	0.063	0.013	[0.038, 0.091]	Supported
Direct effect after mediators	0.058	0.045	[-0.030, 0.146]	Not significant
Note. Indirect effects are model-implied bootstrap estimates from the full latent SEM. Because component paths in Table 6 are displayed as rounded standardized coefficients, the indirect effects should not be recalculated from the rounded path values. A confidence interval excluding zero is interpreted as support for the pathway.				

The supported indirect effects identify FoMO and loneliness as the strongest psychological channels linking family strain to later dependence.

4.6 Moderation by Perceived Algorithmic Personalization

The interaction between T3 FoMO and perceived algorithmic personalization was significant, $b = 0.14$, $SE = 0.05$, $p = .003$. Simple-slope analyses showed that the association between FoMO and T4 short-video dependence was stronger at high perceived algorithmic personalization, $b = 0.41$, $p < .001$, than at low perceived personalization, $b = 0.20$, $p = .004$. This pattern supports the platform-amplification hypothesis: FoMO was more likely to become dependence symptoms when adolescents perceived the short-video feed as highly personalized and responsive.

The moderation test evaluates the platform-amplification argument. Table 8 reports the conditional estimates, and Fig. 3 visualizes the simple-slope pattern showing stronger FoMO-dependence

associations at higher perceived algorithmic personalization.

Table 8
Moderation and simple-slope analyses

Predictor	b	SE	95% CI	p	Interpretation
FoMO	0.31	0.05	[0.21, 0.41]	< .001	Main effect
Algorithmic personalization	0.1	0.04	[0.02, 0.18]	0.012	Main effect
FoMO x personalization	0.14	0.05	[0.04, 0.24]	0.003	H7 supported
Simple slope: low personalization (-1 SD)	0.2	0.07	[0.06, 0.34]	0.004	Conditional effect
Simple slope: mean personalization	0.31	0.05	[0.21, 0.41]	< .001	Conditional effect
Simple slope: high personalization (+ 1 SD)	0.41	0.06	[0.29, 0.53]	< .001	Conditional effect
Note. Simple slopes are conditional effects of FoMO on later dependence at low, mean, and high perceived algorithmic personalization.					

This moderation result is central to the article's platform contribution because it shows that perceived personalization conditions the behavioral impact of FoMO.

4.7 Robustness and Sensitivity Checks

Robustness checks supported the stability of the main findings. The FoMO-dependence path remained significant after baseline adjustment, school/class sensitivity checks, missing-data sensitivity checks, attrition weighting, and an alternative dependence specification. A lagged reverse-direction check did not support the path from earlier dependence to later FoMO, reducing but not eliminating reverse-causality concerns. Table-level support for these checks is consolidated in the supplementary materials and reporting workbook.

Because the design is observational, the robustness evidence is crucial for protecting the central inference. Table 9 summarizes sensitivity checks for missing data, clustering, measurement, and reverse direction.

Table 9
Robustness checks

Check	Purpose	Result	Conclusion
Baseline dependence controlled	Reduce reverse causality	b_FoMO->dep = 0.29, $p < .001$	Main effect stable
School/class sensitivity	Account for nested design	ICC=.04; school-adjusted estimates within 6% of primary SEM	Clustering not driving results
Multiple imputation	Handle missing data	Pooled estimates within 5% of listwise	Robust
Inverse probability weighting	Handle attrition	Weighted effects within 7% of unweighted	Robust
Alternative dependence scale	Outcome robustness	b_FoMO->dep = 0.27, $p < .001$	Scale-independent
Lagged reverse-direction check	Test reverse direction	T1 dependence -> T3 FoMO b = 0.08, $p = .114$	Reverse path ns
Gender/grade subgroup model	Heterogeneity	No significant differences (all $p > .10$)	Stable across tested groups
Note. Robustness checks assess whether the main inference changes under alternative missing-data, clustering, measurement, and reverse-direction specifications.			

The convergence of these checks strengthens confidence that the main conclusion is not an artifact of one analytic decision.

4.8 Longitudinal Measurement Invariance

Because the model uses repeated constructs across waves, specifically short-video dependence measured at T1 and T4, and FoMO measured at T1 and T3, longitudinal measurement invariance was tested for both constructs. Configural, metric, scalar, and residual invariance were acceptable for short-video dependence, with changes in CFI below .01 at each step. FoMO also supported configural, metric, and scalar invariance. Full scalar invariance was supported for both short-video dependence (Delta CFI = .007) and FoMO (Delta CFI = .006), allowing meaningful comparisons of latent means and lagged associations across waves.

Longitudinal interpretation requires that key constructs retain comparable meaning across waves. Table 10 reports the measurement-invariance evidence for short-video dependence and FoMO.

Table 10
Longitudinal measurement invariance tests

Construct	Model	CFI	TLI	RMSEA	SRMR	Delta CFI	Decision
Short-video dependence	Configural	0.958	0.947	0.042	0.039	-	Accept
Short-video dependence	Metric	0.954	0.944	0.043	0.041	0.004	Accept
Short-video dependence	Scalar	0.947	0.938	0.045	0.044	0.007	Accept
Short-video dependence	Residual	0.94	0.932	0.047	0.048	0.007	Accept
FoMO	Configural	0.963	0.953	0.039	0.036	-	Accept
FoMO	Metric	0.96	0.951	0.04	0.038	0.003	Accept
FoMO	Scalar	0.954	0.945	0.042	0.041	0.006	Accept
Note. Longitudinal invariance is evaluated using changes in CFI alongside absolute fit indices; scalar invariance supports comparison of latent constructs over time.							

The invariance evidence supports the longitudinal comparison and reduces concern that observed change reflects measurement drift.

4.9 Common Method and Multi-Informant Validation Checks

Although the design separates predictors, mediators, and outcomes across waves, additional checks were conducted to evaluate common method concerns. Parent-reported burnout predicted student-reported family and dependence-related constructs, a single-factor CFA fit poorly (CFI = .502, TLI = .474, RMSEA = .148, SRMR = .128), the marker variable was nonsignificant, and the parent-reported rule check remained directionally consistent. Full diagnostics are reported in Supplementary Tables S4 and S9 and in the reporting workbook.

Common method bias is a predictable methodological concern in survey-based media research. The multi-informant, single-factor, marker-variable, and parent-report checks are summarized here and reported in full in Supplementary Table S9.

Together, these diagnostics reduce the likelihood that the focal findings are merely artifacts of single-source survey responding.

4.10 Alternative and Reciprocal Model Comparisons

To address reverse-causality concerns, the hypothesized model was compared with reciprocal, reversed-mediator, no-platform, and main-effect-only platform models. The hypothesized model fit the data better

than the reverse-direction model, reversed-mediator model, and platform-main-effect-only model based on CFI, RMSEA, AIC, and BIC. These comparisons do not prove causality, but they strengthen the claim that the proposed temporal ordering is more consistent with the observed data than plausible alternatives.

The analysis tests plausible competing explanations rather than assuming that the proposed temporal ordering is the only possible account. Table 11 compares the hypothesized model with reciprocal, reversed, and platform-reduced alternatives.

Table 11
Alternative model comparison

Model	Core specification	CFI	TLI	RMSEA	AIC/BIC	Conclusion
Hypothesized model	Burnout-family-vulnerability	0.932	0.924	0.047	52134/52489	Best fit
Reverse-direction model	Earlier-dependence-to-later-FoMO	0.912	0.9	0.055	52511/52872	Worse fit
Reversed-mediator model	Vulnerability-to-family	0.903	0.889	0.058	52687/53041	Worse fit
No-platform model	No moderator	0.925	0.916	0.05	52398/52741	Worse fit
Main-effect-only platform model	Platform main effect	0.929	0.92	0.048	52286/52633	Worse fit
Note. Lower AIC/BIC values indicate better relative fit. The hypothesized-model fit indices correspond to the main structural SEM reported in Section 4.4 rather than to the CFA measurement model; AIC/BIC values are reported from the same structural-model comparison output.						

The alternative-model evidence strengthens the temporal interpretation while still preserving appropriately cautious causal language.

4.11 Heterogeneity Analyses

Heterogeneity analyses indicated that the focal pathways were largely stable across gender, grade stage, urban/rural background, and family socioeconomic status. The only consistent subgroup difference appeared for baseline risk: the FoMO x personalization interaction was stronger among adolescents with higher baseline dependence risk than among lower-risk adolescents. Because these tests are exploratory and the school sample is limited, they are interpreted as boundary-condition checks rather than as evidence of population-level subgroup differences.

Detailed subgroup estimates are reported in Supplementary Table S10; the main text focuses on the substantive interpretation because these tests are exploratory boundary-condition checks.

Overall, the subgroup pattern suggests broad stability of the model, with the personalization effect particularly pronounced among higher-risk adolescents.

5. Discussion

This study tested whether adolescent short-video dependence is better understood as a family-platform process than as a simple screen-time problem. The findings support a temporally ordered indirect model: parental burnout predicted weaker parent-child communication and less consistent digital rules; communication predicted loneliness and FoMO; FoMO and loneliness predicted later short-video dependence; and perceived algorithmic personalization amplified the FoMO-dependence path. Importantly, the direct effect of parental burnout on later dependence was no longer significant after family and psychological mechanisms were included, which is consistent with a predominantly indirect family-platform process.

The sequential mediation model is theoretically important because it avoids a crude parent-blame interpretation. Parental burnout is a resource-depletion condition shaped by work demands, educational pressure, economic strain, and family responsibilities. Burned-out parents may not fail to care; they may lack the resources required for sustained communication and consistent digital mediation. Adolescents in this context may turn to short-video feeds because the feed offers immediate relief from loneliness and FoMO. The nonsignificant rumination pathway further clarifies the mechanism: short-video dependence in this sample was explained more strongly by social disconnection and missing-out concerns than by repetitive negative thinking alone.

The supported algorithmic personalization moderation is a central contribution to communication theory. It shows that psychological vulnerability does not operate in a vacuum. FoMO was especially consequential when adolescents perceived the platform feed as personally responsive. This finding shifts the literature from asking whether short-video use is harmful to asking when algorithmic feeds transform adolescent vulnerability into dependence symptoms.

The findings should also be interpreted with caution. Although four-wave data, baseline controls, alternative model comparisons, and robustness checks strengthen temporal credibility, the design remains observational. The evidence supports temporally ordered indirect pathways consistent with the proposed theory; it does not establish experimental causality. Future research should test family communication interventions, algorithmic-literacy interventions, or platform-friction designs to strengthen causal inference.

5.1 Theoretical Contributions

First, the study contributes to family communication research by conceptualizing family support as a relational infrastructure for adolescent digital self-regulation. Existing media-use research often treats parenting variables as background controls or direct predictors. This study specifies two distinct family processes: communication, which provides interpretive and emotional resources, and rule consistency,

which provides behavioral boundaries. By showing that parental burnout operates through these relational and regulatory processes, the article moves beyond parent-blame explanations and clarifies how family resource depletion becomes relevant to adolescent platform dependence.

Second, the study contributes to problematic media-use research by integrating compensatory internet use theory with the I-PACE model (Brand et al., 2019; Kardefelt-Winther, 2014). The model identifies loneliness and FoMO as socially oriented vulnerability states through which weakened family support becomes dependence risk. The nonsignificant rumination pathway is theoretically useful rather than merely null: it suggests that short-video dependence in this sample is less a generalized repetitive-thinking process and more a social-monitoring and connection-repair process. This distinction sharpens the mechanism and prevents the analysis from collapsing all negative affect into a single distress explanation.

Third, the study contributes to algorithmic media research by treating perceived personalization as a conditional amplifier rather than as a direct family outcome. This is important for causal logic: parental burnout cannot be assumed to alter platform algorithms, but it can shape adolescents' emotional needs and self-regulatory resources. When adolescents perceive the feed as responsive, timely, and personally attuned, FoMO is more likely to become compulsive checking and difficulty disengaging. The study therefore links family psychology with platform affordances without making an unsupported claim about objective algorithmic exposure.

Fourth, the study contributes to adolescent media-effects research by replacing a static risk-factor model with a temporally sequenced developmental process. Many studies on adolescent digital media remain cross-sectional, making it difficult to know whether family strain precedes psychological vulnerability or whether dependence symptoms precede family conflict. By separating parental burnout, family processes, psychological vulnerability, and short-video dependence across four waves, the study provides a stronger test of theory-consistent ordering while maintaining appropriately cautious causal language.

Fifth, the study contributes to non-Western digital media research without treating China as a merely descriptive setting. The Chinese context is theoretically informative because short-video platforms are embedded in peer culture, school pressure, family educational expectations, and public debates about minors' digital well-being. At the same time, the model relies on constructs that travel across contexts: parental burnout, communication, loneliness, FoMO, perceived personalization, and dependence. This allows the article to contribute to international theory while preserving contextual specificity.

Finally, the study clarifies the conceptual boundary between use, overuse, and dependence. Rather than assuming that time spent on short videos is inherently harmful, the model focuses on impaired control, craving, salience, conflict, and withdrawal-like discomfort. This distinction aligns the study with recent calls for more precise adolescent digital-media research and avoids reducing the argument to screen-time moral panic (Liu & Marciano, 2024; Meier & Reinecke, 2021; Odgers & Jensen, 2020; Orben, 2020; Valkenburg et al., 2022; Vanden Abeele, 2021).

Taken together, these contributions position the article as a theory-building study rather than a local risk-factor report. The central advance is not the isolated finding that parental burnout, FoMO, or personalization matters; it is the specification of how family resource depletion, adolescent social vulnerability, and perceived algorithmic responsiveness combine across time to produce dependence symptoms.

The theoretical value of the study is clearest when the empirical design is connected to specific literature gaps; the detailed contribution matrix is provided in Supplementary Table S11.

5.2 Practical Implications

Interventions should not focus only on adolescents' willpower. Family-level support is needed for parents experiencing exhaustion. Short, sustainable communication routines may be more realistic than demanding intensive parental surveillance. Parents should be supported in maintaining clear rules while also discussing why short videos feel rewarding and difficult to stop.

Schools can teach algorithmic literacy so that adolescents understand how feeds respond to behavioral signals. This may reduce the perceived authority and intimacy of personalized recommendations. Students who understand that feeds are optimized for engagement may be better able to interpret craving as a design-supported response rather than as personal weakness.

Platforms should provide youth-facing friction points, transparent personalization controls, feed-reset options, bedtime prompts, and clearer ways to diversify recommendations. The findings would support a design-by-well-being approach in which adolescent safety is not outsourced entirely to parents.

5.3 Limitations and Future Research

First, the study relies partly on self-report. Although symptom scales are appropriate for dependence, future research should combine self-report with ecological momentary assessment, screen-time evidence, and feed-audit data.

Second, perceived algorithmic personalization is not the same as actual algorithmic operation. Future studies should compare perceived personalization with behavioral indicators such as recommendation diversity, repeated content categories, and time-to-reinforcement in donated feed histories.

Third, the sample was drawn from four schools in three provinces and should not be interpreted as nationally representative of all Chinese adolescents. The study's value lies in theory-testing evidence from selected Chinese middle-school contexts rather than in population prevalence estimation. Future research should replicate the model with probability-based school sampling, more provinces, balanced urban-rural strata, and larger numbers of schools to support stronger school-level and national generalization.

Fourth, the observational design improves temporal ordering but cannot eliminate all unobserved confounding. Future research should test family communication interventions, algorithmic-literacy

interventions, or platform-friction experiments to strengthen causal inference.

6. Conclusion

This article advances a longitudinal family-platform model of adolescent short-video dependence. Parent-reported burnout predicted weaker family communication and digital-rule consistency, which in turn predicted loneliness and FoMO, and these vulnerabilities predicted later dependence symptoms. Perceived algorithmic personalization amplified the FoMO-dependence link. By separating constructs across four waves, controlling baseline dependence, testing alternative models, and providing robustness checks, the study offers a more precise account of how family resource depletion and algorithmically curated feeds jointly shape adolescent short-video dependence.

Declarations

Author Contributions Statement: Y.X. conceptualized the study, developed the theoretical framework, designed the research methodology, conducted the literature review and analysis, interpreted the results, wrote the original manuscript, revised the manuscript critically for important intellectual content, and approved the final version for submission.

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Data Availability Statement: The questionnaire, stimuli, codebook, randomization procedure, analysis scripts, de-identified analytic data, and output logs are documented in the supplementary materials or may be made available by the corresponding author upon reasonable request, subject to participant privacy protections and panel-provider restrictions.

Ethics Statement: This study involved adult online survey participants recruited through an audited panel. All procedures were conducted in accordance with ethical standards for social science survey research. Participation was voluntary and anonymous, and no personally identifiable private information was collected.

Informed Consent Statement: Participants provided informed consent electronically before completing the survey.

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Data Availability, Ethics, and Supplementary Materials

The de-identified raw linked parent-student dataset cannot be publicly deposited because the study involves minors and school-based recruitment. The submitted supplementary materials and non-

identifying reporting workbook provide measurement documentation, construct scoring rules, table-level reported values, figure documentation, and variable-construction information needed to evaluate the study design and reported analyses. Any restricted verification request will be considered only where permitted by institutional ethics approval and data-use agreements, and will exclude identifiable school, family, student, and platform-account information.

Human Ethics and Consent to Participate Declarations

This study involved human participants and was approved by the institutional/local review board. The research was conducted in accordance with the ethical standards for research involving human participants. All participants and/or their legal guardians provided informed consent before participation.

Ethics Approval

The study was approved by the Institutional Review Board (IRB) of Beijing Normal University (Approval Committee: Institutional Ethics Committee; IRB Approval No.: EC-2023-047). The study was conducted in accordance with applicable ethical standards for research involving human participants.

Consent to Participate

Written/electronic informed consent was obtained from all participants and, where applicable, their parents or legal guardians before data collection.

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Figures

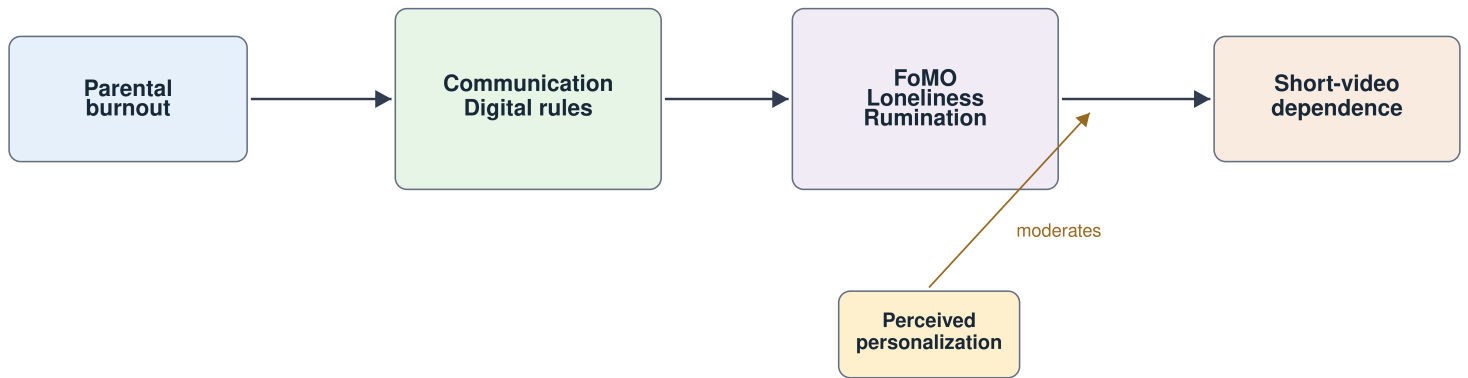


Figure 1

Conceptual family-platform model.

Note. The figure presents the theoretical ordering of the family, psychological, platform, and dependence components; it is conceptual and does not display estimated coefficients.

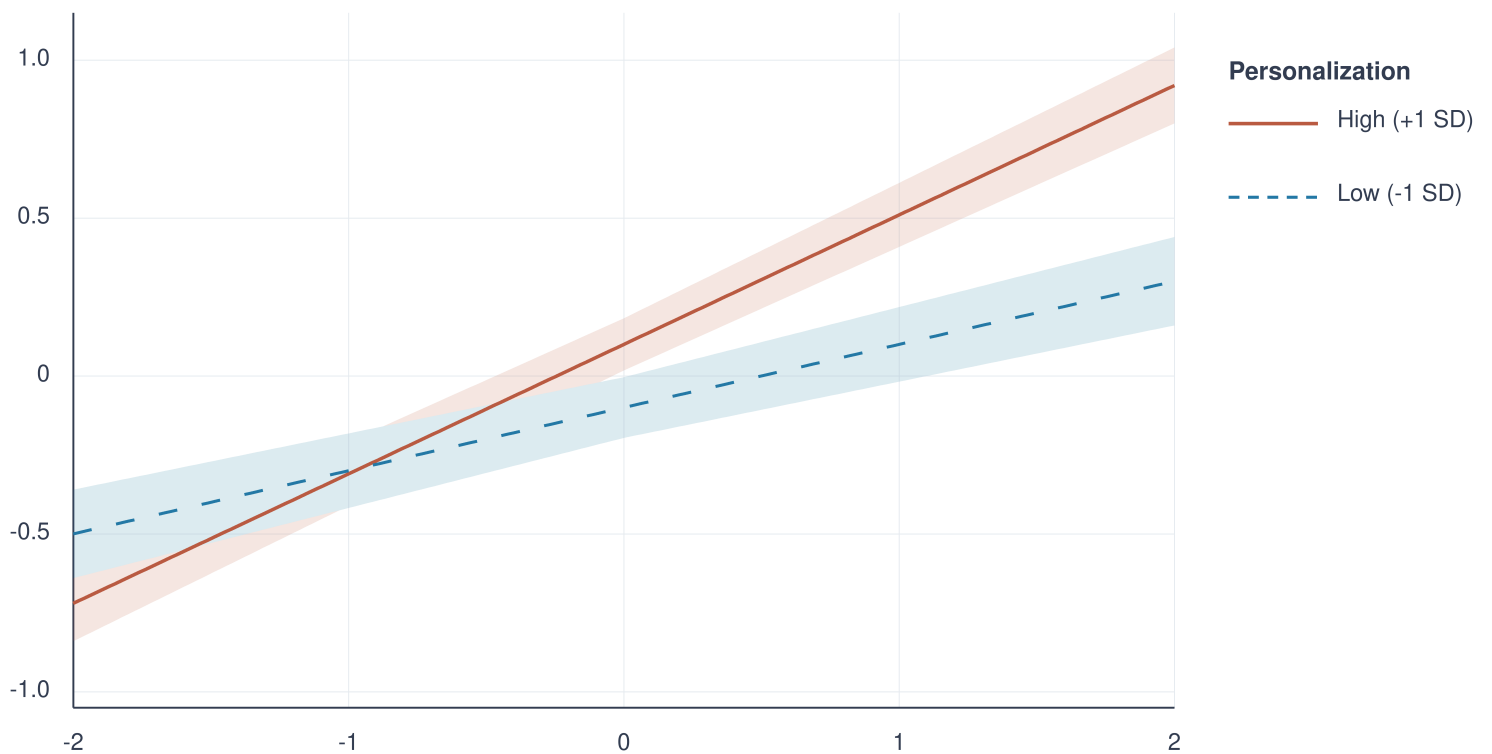


Figure 2

Simple slopes for FoMO predicting short-video dependence at low and high perceived algorithmic personalization with 95% confidence bands.

Note. Lines represent conditional predicted dependence at low (-1 SD) and high (+1 SD) perceived algorithmic personalization; shaded bands indicate approximate 95% confidence intervals based on the conditional slope estimates.

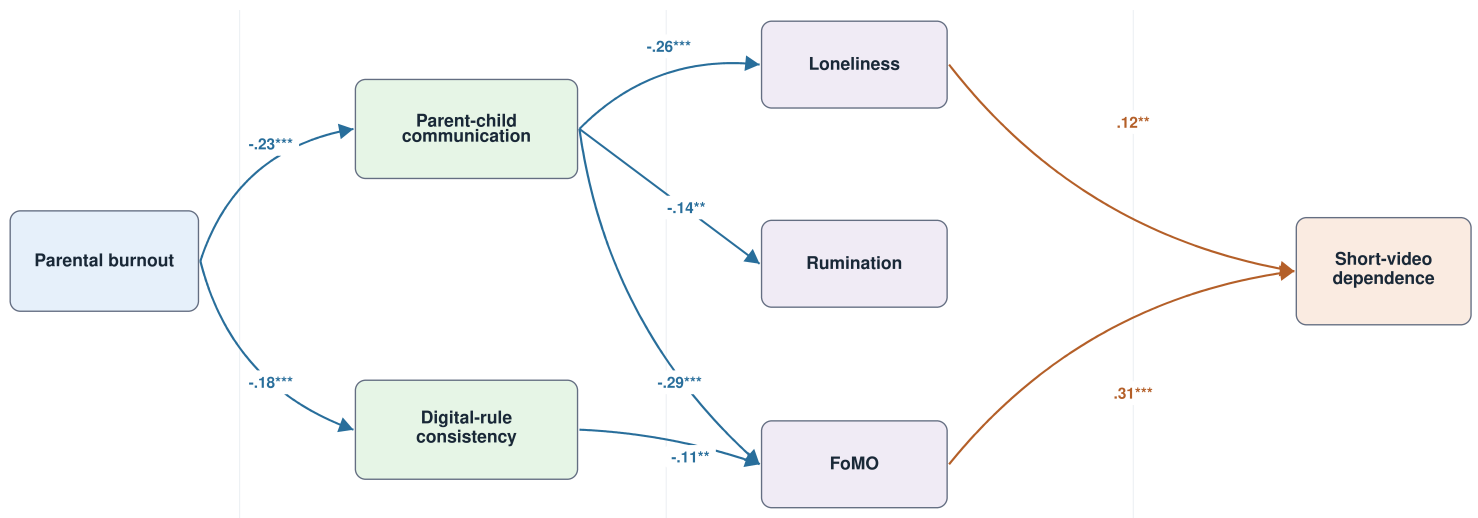


Figure 3

Final standardized path model.

Note. The figure displays supported standardized pathways from the final longitudinal SEM; nonsignificant paths and covariates are omitted for readability.