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Introduction to the Special Issue: Novel Insights into the Externalizing Psychopathology Spectrum in Childhood and Adolescence from Intensive Longitudinal Data

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Abstract

Externalizing psychopathology is highly prevalent in children and adolescents. Yet, current understanding of the externalizing psychopathology spectrum is predominantly founded on cross-sectional and conventional longitudinal designs. Compared to these designs, *intensive longitudinal data* have greater ecological validity and provide insight into within-person fluctuations and short-term developmental dynamics. In this Special Issue, we bring together a selection of 10 innovative and original empirical articles to demonstrate the benefits of intensive longitudinal data for understanding the development of the externalizing psychopathology spectrum during childhood and adolescence, as well as one thoughtful commentary from leaders in the externalizing psychopathology field. In this Introduction to the Special Issue, we describe the articles included in this Special Issue in relation to study designs, timescales, samples, and statistical modeling techniques. We conclude by considering the implications of intensive longitudinal data for informing and enhancing our understanding of externalizing psychopathology with child and adolescent samples, as well as critical future research directions.

Keywords Intensive longitudinal data · Externalizing psychopathology · micro timescale · Daily diary · Ecological momentary assessment · Parent–child interactions

Among children and adolescents, the externalizing psychopathology spectrum collectively refers to emotional and behavioral problems that conflict with societal norms. Common diagnostic categories pertaining to the externalizing psychopathology spectrum include attention-deficit/hyperactivity disorder (ADHD), conduct disorder (CD), and oppositional defiant disorder (ODD; American Psychiatric Association [APA], 2022). ADHD is characterized by a persistent pattern of inattention, hyperactivity, and impulsivity; ODD specifies those children and adolescents who display angry and irritable mood, and defiant and vindictive behaviors; whereas CD is operationalized as aggression toward people and animals, destructiveness and deceitfulness, and serious violation of rules or laws (APA, 2022). Other

constructs closely related to the externalizing psychopathology spectrum and frequently investigated include callous-unemotional (CU) traits, transdiagnostic markers such as irritability and impulsivity, among others. During childhood and adolescence, externalizing psychopathology is highly prevalent and is associated with a vast range of short- and long-term adverse outcomes (Bevilacqua et al., 2018; Goulter et al., this issue; Polanczyk et al., 2015). However, current understanding is predominantly founded on cross-sectional research or conventional longitudinal research that spans relatively long time intervals (e.g., 1-year).

Recent advancements in technology (e.g., smartphone and other portable personal devices) have enabled researchers to conduct intensive assessments over a relatively shorter time period (e.g., over days). Broadly termed intensive longitudinal data, these assessments minimize recall bias and enhance ecological validity relative to traditional longitudinal assessments (Walls & Schafer, 2006). In addition, intensive longitudinal data offer the unique opportunity to examine short-term developmental processes and dynamics on a micro timescale, their changes over the long-term on a macro timescale, as well as their links to short- and

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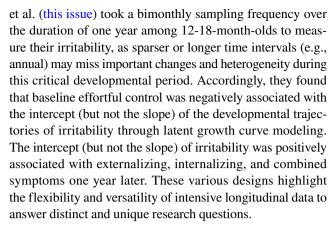
long-term developmental outcomes. Notably, intensive longitudinal data come in multiple forms (e.g., self-reports, ambulatory, observational) and at multiple levels (e.g., neural, physiological, affective, cognitive, psychological, behavioral).

This Special Issue, *Novel Insights into the Externalizing Psychopathology Spectrum in Childhood and Adolescence from Intensive Longitudinal Data,* features 10 original and rigorous empirical articles demonstrating the unique and value-added benefits of intensive longitudinal data for understanding the externalizing psychopathology spectrum during childhood and adolescence, especially through the use of innovative statistical modeling techniques. Studies in this Special Issue cover a wide range of aspects in intensive longitudinal research on externalizing psychopathology spectrum in terms of study designs and timescales, substantive focal variables, and statistical modeling techniques. Their findings offer multiple theoretical as well as practical considerations in understanding and treating externalizing psychopathology in childhood and adolescence.

Study Designs, Timescales, and Samples

Various designs can be adopted to collect intensive longitudinal data on different timescales. For instance, the conventional daily diary design primarily aims to examine relations among variables on the day-to-day level (Bolger et al., 2003), while ecological momentary assessment often involves multiple measurement occasions within one day (e.g., four times a day over nine days, Evans et al., this issue), which emphasizes the within-day associations on the hour-to-hour level (Shiffman et al., 2008). Through measurement burst design, one can assess intensive longitudinal data repeatedly in conventional longitudinal designs that span multiple years, hence uncovering different developmental dynamics on multiple timescales (Sliwinski, 2008). The specific design and timescale required for each study depend on the nature of the focal variables in each study. For example, physiological measures such as respiratory sinus arrhythmia (RSA) fluctuates on a much faster frequency than most typical behavioral measures, requiring closer assessment at the second-to-second level (Kil et al., this issue). Studies examining the contingency and interactions among parent–child dyads in different behavioral tasks as commonly used in observational videotaped studies would similarly require coding at the second-to-second level (Somers et al., this issue; Zhang, Hanson et al., this issue).

Daily diary studies included in this Special Issue also show various lengths of time or duration, ranging from one or two weeks (Bi et al., this issue; van den Akker et al., this issue), one month (Goulter et al., 2023; Zheng et al., this issue), to 100 days (Chaku et al., this issue). Notably, Zhang, MacNeill

et al. (this issue) took a bimonthly sampling frequency over the duration of one year among 12-18-month-olds to measure their irritability, as sparser or longer time intervals (e.g., annual) may miss important changes and heterogeneity during this critical developmental period. Accordingly, they found that baseline effortful control was negatively associated with the intercept (but not the slope) of the developmental trajectories of irritability through latent growth curve modeling. The intercept (but not the slope) of irritability was positively associated with externalizing, internalizing, and combined symptoms one year later. These various designs highlight the flexibility and versatility of intensive longitudinal data to answer distinct and unique research questions.

Two studies in this Special Issue notably extended their assessment from micro timescales onto larger time intervals. Van den Akker et al. (this issue) examined the 1-year predictive value in child externalizing problems by within- and across-episode parental discipline consistency assessed through daily diary surveys, together with general parental discipline consistency in the past month assessed in the baseline. Zhang, Hanson et al. (this issue) examined micro-time observations of coercive interactions among parent–adolescent dyads in multiple behavioral tasks at age 16–17, and examined the relations between the micro timescale coding with long-term substance use and antisocial behaviors during adolescence and into young adulthood at ages 16–17, 18–19, and 21–23 years. The authors found that parent–adolescent dyads with more coercive interactions showed higher rates of growth in adolescent alcohol use, as well as higher levels of antisocial behavior throughout young adulthood. This finding neatly demonstrates how micro timescale dynamics observed through minutes-long dyad behavioral tasks could inform long-term development in externalizing behaviors over multiple years.

It is important to note that the majority of samples examined in this Special Issue were community samples of North American families with a few exceptions. Bi et al. (this issue) explored bidirectional associations between daily parental psychological control and parent-reported children's externalizing problems in a sample of Chinese parents, and found a parent-driven effect where parental psychological control was positively related to children's externalizing problems the following day. Approximately half of the children in Somers et al. (this issue) were diagnosed with ADHD, while half of the children in Kil et al. (this issue) were diagnosed with CD or ODD. Extending this research by examining clinical samples, ethnic-racial diverse populations, as well as families from different cultures or societies (e.g., the Majority World) represents a major endeavor for future work to determine the generalizability and specificity of developmental mechanisms underlying externalizing psychopathology spectrum on both micro and macro timescales.

Statistical Modeling Techniques

There are multiple statistical challenges when analyzing intensive longitudinal data. People and families often demonstrate substantial differences in their short-term dynamics (e.g., Chaku et al., this issue; Zheng et al., this issue). Proper analytic procedures are required to separate within-person fluctuations from between-person differences and to accurately capture population heterogeneity in these within-person processes. One also needs to control for different forms of stability (e.g., time dependency) and any linear and non-linear (e.g., cyclic) trends. It is also challenging to relate the dynamics of two processes (e.g., affective and behavioral) to each other to study their reciprocal influences (Hamaker & Wichers, 2017).

Multilevel modeling framework is among the most common statistical techniques to analyze intensive longitudinal data. For example, Evans et al. (this issue) tested bidirectional associations between adolescent-reported daily sleep quality (once per day) and positive and negative affect (four times per day), as well as whether parent-reported baseline adolescent externalizing symptoms moderated these associations. Poorer-than-usual sleep quality was associated with greater variability and higher peaks in negative affect the following day, but only for those with higher levels of externalizing symptoms. Lower-than-usual positive affect was also associated with poorer sleep quality the following day, but, again, only for those with higher levels of externalizing symptoms.

Multiple studies in this Special Issue have extended beyond using the conventional multilevel modeling framework to analyze intensive longitudinal data with state-of-the-art statistical modeling techniques. For instance, Zheng et al. (this issue) adopted dynamical systems modeling using latent differential equations to investigate the co-regulation of daily parental warmth and adolescent daily ADHD symptoms as two coupled dynamical systems. The authors found an adolescent-driven effect where adolescents felt that their parents would fine-tune their warmth and affection more gradually on days when adolescents reported elevated levels of ADHD symptoms. Among families with higher general levels of parental non-harsh discipline, both daily parental warmth and adolescent ADHD symptoms tended to fluctuate less often and be more stable. Through leveraging innovative statistical modeling techniques, Zheng et al. (this issue) offers a new lens to uncover reciprocal short-term family dynamics at a refined micro level. Chaku et al. (this issue) used the Group Iterative Multiple Model Estimation (GIMME) technique to explore subgroups of adolescents with distinct daily networks in daily inhibitory control, positive and negative urgency, and social time. Findings revealed no group- or subgroup-level relations but substantial between-person heterogeneity in daily relations among the focal variables. In addition, the authors found that adolescents who used substances tended to have more links involving inhibitory control than those who did not use substances. This work illustrates the importance of uncovering person-specific links between daily inhibitory control and impulsive behaviors when adopting an idiographic approach to understand the development of adolescent externalizing problems.

Somers et al. (this issue) observed parent–child dyad interactions across three different tasks (child-led play, parent-led play, clean-up task) and examined the reciprocal relations between parental negative talk and praise and child non-compliance using Dynamic Structure Equation Modeling (DSEM). The authors found that parental praise and child non-compliance negatively and reciprocally predicted each other during the parent-led play, while no links were revealed in the two other tasks. In addition, during the child-led play, child non-compliance positively predicted subsequent parental negative talk, which negatively predicted subsequent child non-compliance; no links were revealed in the two other tasks. The findings revealed substantial heterogeneity across families in these within-dyad parent–child behavioral dynamics, which largely depend on the type of task and child ADHD symptoms. Also using DSEM, Goulter et al. (2023) parsed within- and between-person effects of adolescent daily CU traits at both item and subscale levels, in addition to subscale relations with daily positive and negative affect and emotional and conduct problems. Many CU traits items demonstrated within-person inertia and cross-lagged associations. Cross-lagged associations involving CU traits subscales were revealed between callousness and uncaring, conduct problems and uncaring, and between positive affect and callousness. These findings demonstrate the unique value of intensive longitudinal data in understanding and capturing the state aspects of some constructs in the externalizing psychopathology spectrum that are conventionally conceptualized as traits.

Two studies notably extracted novel indices from intensive longitudinal data to examine their associations with externalizing problems. Kil et al. (this issue) use the root mean square of successive differences (RMSSD) in 5-second intervals to quantify RSA, with fluctuations across several epochs potentially indicating physiological dysregulation. The authors found that children with elevated externalizing behaviors demonstrated larger RMSSD fluctuations across social transgression scenarios than a community sample. Van den Akker et al. (this issue) examined parental discipline consistency both within- and across-episodes of misbehavior in contrast to parent-reported general discipline consistency in the past month. Particularly, the across-episode consistency was calculated by the Index of Qualitative Variation. The findings demonstrated the unique predictive value of across-episode consistency for daily disruptive behaviors (e.g., temper tantrums), while general parental discipline consistency showed longitudinal predictive value for externalizing problems one year later. Together, these findings

highlight the importance of differentiating different conceptualization of parental discipline consistency across different timescales to better understand their relevance in the development of child disruptive behaviors.

Implications and Future Directions

Intensive longitudinal data offer invaluable information on within-person fluctuations above and beyond conventional between-person mean differences or within-person changes at longer durations (Nilam & Gerstorf, 2009). Dynamic characteristics captured in the fluctuations, oscillations, and adaptation of developmental processes on micro timescales hold promise for greatly informing our understanding of both short- and long-term development of externalizing psychopathology. These 10 empirical studies offer multiple novel insights over conventional longitudinal studies on the development of the child and adolescent externalizing psychopathology spectrum. For instance, multiple studies highlight the importance of considering and specifically investigating antecedents of the heterogeneity at between-family or between-person level when exploring within-person processes (Chaku et al., this issue; Evans et al., this issue; Somers et al., this issue; Zheng et al., this issue), as well as the long-term consequences of within-person processes (van den Akker et al., this issue; Zhang, Hanson et al., this issue; Zhang, MacNeill et al., this issue). Some studies revealed nuanced patterns in child-driven vs. parent-driven processes in the relation between parenting and child and adolescent externalizing problems on micro timescales (Bi et al., this issue; Somers et al., this issue; Zheng et al., this issue). Many conceptualizations on the development of externalizing psychopathology are grounded in social and operant learning theories centering on coercive parent–child interactions (Patterson, 1982). Intensive longitudinal designs that incorporate both parent and child processes may further inform modifiable targets for clinical intervention efforts. Other studies introduced novel ways and considerations of conceptualizing inconsistency or dysregulation (Kil et al., this issue; van den Akker et al., this issue), while others have revisited the distinction in traits vs. states in some externalizing spectrum constructs conventionally defined and considered as stable traits (Goulter et al., 2023).

This Special Issue concludes with an inspiring and thought-provoking commentary by a leading expert in the field of externalizing psychopathology. Shaw (this issue) points out several important issues to be considered in future intensive longitudinal research. Particularly, Shaw urges the further integration of intensive longitudinal data on micro timescales with conventional longitudinal designs on macro timescales to inform long-term developmental outcomes, the inclusion of clinical samples in future research to enhance representation and generalizability and to provide guidance for clinicians, as well as the development of scales or measurement tools with sound psychometric properties suitable for intensive longitudinal research.

In addition to the recommendations outlined by Shaw (this issue), we also emphasize the importance of future research focusing on multiple levels of psychopathology and analysis. In this Special Issue, focal variables included a range of constructs broadly falling within the externalizing psychopathology spectrum beyond solely diagnostic categories. Congruent with recent conceptualizations of psychopathology (i.e., Hierarchical Taxonomy of Psychopathology; Kotov et al., 2021), we stress the importance of continued intensive longitudinal research examining externalizing psychopathology across spectra, subfactors, syndromes/disorders, and individual signs, symptoms, and behaviors levels for greater precision in the characterization of externalizing psychopathology through childhood and adolescence. Regarding levels of analysis, only one study in this Special Issue assessed a biological correlate of externalizing psychopathology (Kil et al., this issue). Intensive longitudinal data encompassing other biological measures (e.g., neuroimaging data, genetic/genomic data) should also be considered and incorporated in future research to explore relevant mechanism at multiple levels of analysis. For instance, Zheng & Hu (2021) explored how family socioeconomic status (SES) as a developmental context at the macro level could modulate genetic and environmental contributions to daily emotion processes on a micro timescale. The authors found that higher SES amplified the influences of unique environmental experiences not shared between family members on the emotion system's sensitivity to the change in daily positive but not negative affect among adolescents. Another critically important endeavor is the further expansion of intensive longitudinal research with underrepresented and epistemically excluded samples. As mentioned earlier, studies in this Special Issue and across intensive longitudinal research more broadly have typically focused on community-based North American samples. Greater representation is needed in intensive longitudinal research in terms of cultural, ethnic-racial constructs, as well as sexual and gender-minority status.

It is our hope that this Special Issue will provide critical insights for researchers and clinicians who study and treat child and adolescent externalizing psychopathology in their future research program and practices in terms of conceptualization, study designs, timescales, and analytic modeling techniques. This collection of empirical studies represents a new frontier of research on an exciting and promising developmental timescale that still requires numerous advancement in multiple aforementioned aspects. We are optimistic and look forward to a new era of research on externalizing psychopathology spectrum embracing intensive longitudinal methods while integrating them in tandem

with conventional longitudinal designs to further uncover the potential of within-person fluctuations and short-term developmental dynamics.

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