CHAPTER 11

Leveraging Parent–Youth Interactions to Measure and Analyze Emotion Regulation

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Dyadic parent–child emotion regulation is a bidirectional developmental process that occurs over the span of more than a decade. Accordingly, the measurement of these interactions and subsequent analysis poses challenges for researchers to translate the theory of complex processes into study design and statistical models capable of inferring directionality and causality. In this chapter, we explore the interplay between parent and child emotion regulation to facilitate a better understanding of opportunities and challenges for improved measurement of these dynamic processes. We begin with a brief review that introduces the corpus of theory regarding interpersonal emotion regulation, directions of effects, and intergenerational transmission of emotion regulation. Then, we cover conceptual, methodological and analytic considerations while providing useful strategies for designing and implementing cutting edge studies on the interactive effects of parent and child emotion regulation.

11.1 Developing a Theoretical Foundation to Study Interactive Dyadic Emotion Regulation

11.1.1 Interpersonal Processes

The study of emotion regulation has historically focused on intrapersonal processes and strategies: how an individual influences what emotions they have, when they have them, and how they experience or suppress them (Gross & John, 2003; see also Chapter 3). Much less research attention has been paid to interpersonal processes, but it is no less relevant to the study of parental emotion regulation. Interpersonal regulation refers to the social contexts in which an individual's emotion is regulated by another's (Hofmann, 2014). Emotion regulation is critical to human

socialization and is a protracted developmental process that originates in early attachment relationships (Morris et al., 2017, 2018). Thus, the parent–child dyad is among the most salient interpersonal contexts of emotion regulation.

11.1.2 Capturing the Developmental Nature of Emotion Regulation

Emotion regulation development begins in early infancy, continues through adolescence and beyond (Silvers et al., 2015; Thompson, 2011), and is entwined with parental processes (Morris et al., 2007, 2018). Children learn to regulate emotions to navigate their world, from tolerating frustration to forming friendships (Cole et al., 1994), often with the aid of parents. In adolescence, emotion regulation tasks involve achieving greater independence, including managing increasingly complex interpersonal relationships. Parents remain a critical influence on adolescent behavior and adjustment during this developmental period (Silk, 2011, 2019; Trucco et al., 2021). Although parents may provide active guidance as adolescents navigate these developmental tasks, parental influence on adolescent emotion regulation originates from a foundation of lessons and interactions earlier in development. Consequently, translating the dynamic, developmental nature of emotion regulation to the study and analysis of interactive parent–child emotion regulation is complex and measurement of dyadic emotion regulation at a single point in time provides only a snapshot of an extended developmental process.

11.1.3 Dyadic Emotion Regulation

Zaki and Williams' (2013) interpersonal emotion regulation model refers to multiperson episodes that occur in social contexts and serve to pursue regulatory goals. In this framework, classes of regulation are distinguished by whether they are (1) internal ("intrinsic") or external ("extrinsic") and (2) influenced by another. Extrinsic regulation involves regulating other people's emotions, whereas intrinsic regulation involves regulating one's own emotion with the help of others. Regarding influence, these processes are either response dependent (i.e. reliant on a response by the another) or response independent (i.e. not reliant on a response of another). For example, a child shares good news with their parent; the child's positive affect can be enhanced if the parent responds enthusiastically (i.e. intrinsic, response-dependent; this scenario could be modeled with sequential analysis techniques referenced later in the chapter). As another example, a parent's prosocial act, such as providing social support to reduce their child's negative affect, can produce a form of positive affect for the parent (extrinsic response-independent; Zaki & Williams, 2013).

11.1.4 Directions of Effects

Investigating the interactive nature of parent–child dyadic emotion regulation requires an understanding of the unidirectional contributions of each dyadic member to interactive emotion regulation, as well as to bidirectional effects.

11.1.4.1 Parent-Driven Effects

Most research on dyadic emotion regulation has focused on the effects of parental emotion regulation on child emotion regulation (i.e. parent-driven effects). The notion that parents can positively or negatively influence their children's emotional responses and regulation dates back decades (Gottman et al., 1997). As was covered in Part II and Part III of this book, regulating emotions well is an essential faculty of parenting that influences child development through several avenues. The pathways of the effects of family socialization on emotion regulation are outlined in the Tripartite Model (Morris et al., 2007), which details influences that include observation (e.g. modeling), parenting practices (e.g. emotion coaching), and emotional climate of the family (e.g. marital relations). These pathways have been documented empirically since (for a review, see Morris et al., 2017).

Parent characteristics such as their own attachment styles, levels of stress and social support, and mental health influence familial socialization of emotion regulation. Most relevant to this chapter, parent-driven effects on child emotion regulation could involve the transmission of emotion dysregulation from parent to child (see more on this in Section 11.1.5). Leveraging this directionality, interventions target parenting skills to improve child behavior/emotion regulation (e.g. Rothenberg et al., 2019). In sum, models with parent-driven effects view emotion dysregulation as originating from the parent and transmitting to the child through various mechanisms.

11.1.4.2 Child-Driven Effects

Less well characterized is the role that children play in the dyadic nature of emotion regulation (i.e. child-driven effects), though research indicates that children can also modulate the flow of parent emotion and corresponding regulatory strategies. Short term, within a parent–child exchange, a distressed child can evoke an emotionally dysregulated state within the parent. Long term, attributes of the child (e.g. difficult temperament) can negatively affect parenting (Micalizzi et al., 2017), perhaps through emotion dysregulation. Patterson's Coercion Theory (Patterson, 2016) captures early child emotion dysregulation as an evocative factor of negative parent behavior that cascades into a coercive dyadic cycle

occurring over many years. Further, Sameroff's transactional model (Sameroff, 2009) outlines both bidirectional and recursive effects to relations between caregivers and children that adds to the complex, dynamic multilevel processes involved in emotion regulation development (Olson & Sameroff, 2009).

11.1.4.3 Interactive Effects

Since Bell's (1968) reinterpretation of directions of effects in socialization processes, an accumulating research base indicates that there are mutually interactive dyadic influences observed between parent and child (e.g. Micalizzi et al., 2017; Thomas et al., 2022). Parent–child interactions can evoke intense and complex emotions from both members of the dyad (Hajal et al., 2019) that can result in proximal, reciprocal exchanges of emotions and regulatory strategies as well as future implementation of these strategies. To illustrate, because a child's emotion regulation abilities result from continuous and reciprocal interactions between the child and their caregiver over time (Sameroff, 2010), a caregiver's response to their child's anger can alter the child's perception of if/how the expression of anger is acceptable and their subsequent expression of anger. At the same time, the caregiver receives information about if/how they must change their regulatory strategies to influence their child's regulatory capacity (Chan et al., 2022). To this end, increased research attention has been paid to the conceptualization of emotion regulation as a dynamic, dyadic process in recent years (Gates & Liu, 2016; Morris et al., 2018; Silk, 2019; Stone et al., 2019; Wright & Hopwood, 2016).

11.1.5 Intergenerational Transmission of Emotion Regulation

Characterizing the origins of emotion regulation is critical to understand the interplay between parent and child emotion regulation. Emotion regulation is transmitted from parents to children through both genetic and environmental mechanisms (see Chapters 4, 9, and 10). Bridgett and colleagues (2015) proposed an intergenerational transmission model that examines the prenatal, social/contextual, and neurobiological mechanisms contributing to the intergenerational transmission of self-regulation (including emotion regulation). Genetic risk, for example, could emerge such that emotion dysregulation is a preexisting issue for the parent that is passed on to the child. Environmental transmission of risk may occur through parental modeling of emotion dysregulation. Although outside of the scope of this chapter, the study of dyadic processes of emotion regulation can be significantly enhanced by broadening the environmental focus to include siblings, co-parents, the family system (Paley & Hajal, 2022), peers, neighborhoods, and culture (Kiel & Kalomiris, 2015).

11.2 Assessing Dyadic Interactions and Parent Emotion Regulation

The preceding review outlined some of the complexity in the dynamic processes of parent–child emotion regulation interactions. We turn now to assessment strategies. Investigating dyadic emotion regulation begins with study design. Prior to data collection, researchers must consider the research question and what process that reflects, feasibility of methods, and analytic techniques. There have been compelling arguments for the implementation of innovative paradigms to capture dyadic emotion regulation and for employing context-sensitive studies of emotion regulation influences (Dixon-Gordon et al., 2015; Morris et al., 2018).

In this section, we review (1) assessment methods to measure parent–child dyadic interactions related to emotion, including surveys, interactive tasks, and physiological methods; (2) challenges researchers encounter when investigating these processes; and (3) suggestions for overcoming these challenges.

11.2.1 Assessment Methods

11.2.1.1 Questionnaires

The most accessible approach to studying interactive dyadic emotion regulation is to administer developmentally appropriate questionnaires to both parents and youth and to employ one of the analytic techniques outlined later in this chapter. If children are too young to self-report, researchers could obtain reports on child emotion regulation from teachers, parents, or researchers depending on the child's age. Because methodological biases could be introduced if parents report on themselves and their children (Podsakoff et al., 2003), different raters for parent and child emotion regulation are preferable.

Measures that assess interpersonal emotion regulation include the Interpersonal Emotion Regulation Questionnaire (Hofmann et al., 2016), the Interpersonal Regulation Questionnaire (Williams et al., 2018), and the Emotion Regulation of Others and Self (Niven et al., 2011). Notably, the psychometric properties of these measures were evaluated among adult samples; administration to children would require further psychometric evaluation. Questionnaires of intrapersonal regulation are more widely implemented and include the Emotion Regulation Questionnaire (Gross & John, 2003) and the Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004).

Generally, questionnaire methods for emotion regulation are poised to tap trait, rather than state, emotion regulation (Silk, 2019). Assessing emotion regulation from parents and children over time would inform stability/change over time and/or how one member's emotion

regulation influences that of the other dyad member over time. Some limitations of self-report measures of emotion regulation include the ability of measures only to provide insight into explicit, conscious processes (i.e. processes for which the individual is aware), reliance on a high degree of the individual's emotional awareness, retrospective recall, and global, rather than context-specific items. Next, we review other methods researchers use that attempt to assess parent–youth interactions and emotion regulation in vivo.

11.2.1.2 Ecological Momentary Assessment

Ecological momentary assessment (EMA), a form of ambulatory assessment and experience sampling, overcomes some of the limitations of questionnaires. EMA involves the repeated assessment of behaviors and experiences in-the-moment to assess a domain of interest when it occurs in real-time in the natural environment (Bettis et al., 2022; Shiffman et al., 2008; Silk, 2019). Using EMA, one can assess the fluctuations of a domain over time and across contexts to minimize recall bias and maximize external validity (Shiffman et al., 2008; Silk, 2019). This enables researchers to make inferences into short-term dynamics of the parent–child dyad, yet it is an underused method for assessing parent–adolescent interactions (Keijsers et al., 2022). With respect to emotion regulation and parenting, EMA can enable parents and/or youth to report on some aspect of their interactions with each other, and/or their emotion regulation throughout the day, with the ability to indicate context (e.g. with peers; Stone et al., 2019). Several studies using EMA demonstrate the role that parents play in supporting adolescents' emotion regulation, based on adolescents' EMA reports (Silk, 2019; Silk et al., 2011; Waller et al., 2014). For example, in adolescents with and without major depressive disorder, the use of EMA to measure daily social interactions after a negative event enabled researchers to determine that adolescents with depression co-ruminate with their parents, which adolescent participants without depression did not do (Waller et al., 2014). Limitations to EMA include potential burden on participants due to the repeated nature of assessments, reliance on self-report, and the potential for missing data (Bettis et al., 2022). Several recent reviews provide further detail on this method and its relevance to emotion regulation (e.g. Bettis et al., 2022; Keijsers et al., 2022; Silk, 2019).

11.2.1.3 Interaction Tasks

Some parent–child interactions may occur less frequently, for only a short period of time (Keijsers et al., 2022), or are difficult to assess with a static survey report, and thus may be better suited to measurement while being induced and observed in a laboratory setting rather than via

questionnaires or EMA (e.g. Thomas et al., 2017, 2019). Furthermore, if the process of how parents and children behave together is the focus, an interaction task is the optimal method to obtain such data. Moreover, behavior and psychophysiology are common facets of emotion regulation (Morris et al., 2018) and such a task enables measurement of both for dyad members. Accordingly, observational procedures for assessing emotion regulation provide some advantages beyond self-report (Girard & Cohn, 2016). Methodologically, it is beneficial to have an objective source of data on emotion regulation, separate from survey reports. Survey reports and behavioral observations are not highly correlated, indicating they do not measure the same things (e.g. parent behavior; Hendriks et al., 2018). Moreover, interaction tasks are often designed to be ecologically valid in order to observe behavior as it may naturally occur between dyads (rather than rely on retrospective recall or insight during survey reports).

Highlighting their importance, even some interventions for childhood behavior problems involve parent–youth interaction tasks. Their inclusion is supported by the role of emotion dysregulation in the context of impairing psychiatric conditions requiring early intervention (Aldao et al., 2016; Sheppes et al., 2015), and the recognition that parents and youth evoke responses from one another that can become entrenched patterns (Patterson, 2016). These tasks enable clinicians to observe patterns of interaction that may elicit emotional reactions that escalate/exacerbate problem behaviors as part of the assessment process, subsequently informing a treatment plan and skill development. One example is Parent–Child Interaction Therapy (PCIT), a treatment for disruptive child behavior in which clinicians coach parents in vivo how to respond to their children during activities. Child emotion dysregulation has been shown to decrease significantly from pre- to post-treatment (Rothenberg et al., 2019).

In laboratory settings, many parent–youth interaction task designs salient to measuring emotion regulation and parenting involve a discussion task focused on problem-solving, planning, or conflict-resolution (Bodner et al., 2018; Cui et al., 2015; Donenberg & Weisz, 1997). In the latter situation, topics about which parent–youth dyads have conflict are introduced (e.g. Issues Checklist; Prinz et al., 1979), and dyads are asked to come to a resolution within a brief period (e.g. 5–10 minutes). The theoretical underpinnings that inform how researchers observe and code parent and child behavior are diverse (e.g. stress, attachment). One commonality of these phenotypes is that many involve facets of emotion regulation, particularly if the objective of the task is to induce stress or replicate an emotionally intense interaction that is typical for the dyad.

In the context of the interaction task, researchers often measure emotional reaction or intensity, often along a spectrum of some variation of

positive affect (warmth/validation) and negative affect (hostility/anger), the psychometric considerations of which are discussed thoroughly elsewhere (Girard & Cohn, 2016). Finally, interaction task measurement may occur from coding behavior such as body language, content of speech, and facial expressions; psychophysiological responding (e.g. heart rate variability during task; Cui et al., 2015; Thomas et al., 2019); and/or post-task ratings of emotions experienced during the task (Chaplin et al., 2012; Turpyn et al., 2015).

In an example study including multiple domains to measure emotion, researchers assessed adolescents' psychophysiology (blood pressure, heart rate) during a 10-minute conflict discussion task with parents and asked them to report on their emotions pre- and post-task (Chaplin et al., 2012). Results indicated an inverse relationship between parenting behaviors during the task and adolescents' emotions, such that lower parental involvement (e.g. offering solutions, setting/explaining rules) and parental support/warmth were associated with greater adolescent anger arousal and greater blood pressure. In another study using the same conflict discussion task, researchers created latent profiles of adolescent emotion regulation during the conflict discussion task, comprised of positive and negative emotional expressions during the conflict task (i.e. coded from observed behavior), self-reports of subjective experiences of anger and anxiety evoked from the task (completed immediately post task), and heart rate reactivity during the task (Turpyn et al., 2015). Parenting behaviors during the task were measured via an existing coding system by trained staff, with a focus on behaviors that were negative/critical (e.g. mocking, interrupting). Negative/critical parenting was associated with a greater likelihood of adolescents belonging to profiles indicative of less emotion regulation (Turpyn et al., 2015). It is important to note that although the two aforementioned studies are cross-sectional, the predominant theoretical rationale, which also underpins the analyses and results, reflect parent-driven effects; however, both articles acknowledge that adolescents' behaviors stemming from emotional reactivity may evoke certain parental responses (i.e. child-driven effects). In sum, parent–youth interaction tasks are a flexible means of assessment that enable derivation of behavior consistent with emotion (dys)regulation, which can then be related to parenting domains and/or youth risk behaviors and psychopathology.

11.2.1.4 Physiological Indices

Although it is beyond the scope of what can be described in detail in this chapter, physiological measurements can be implemented during these interactions. Researchers use physiological measurements, such as of cardiovascular response and brain synchrony/connectivity, to index

facets of emotion regulation (Cui et al., 2015; Ratliff et al., 2021; Reindl et al., 2018; Turpyn et al., 2015). These assessments facilitate investigations of processes like synchrony between parents and youth (Abney et al., 2021) that are theorized to be a mechanism by which parents help their offspring regulate their emotions (Morris et al., 2018). As an example, one study found parent–child brain synchrony during a cooperative interaction task that was not present during a competitive interaction task or when completing tasks with a stranger (Reindl et al., 2018).

11.2.2 Challenges and Solutions to Assessing Dyadic Interactions and Parent Emotion Regulation

The methods described here advance the study of processes of emotion regulation in the context of parent–youth relationships. There are challenges to consider before planning an investigation of these dynamic processes, which we review next. With the proper study design, planning and training, it is possible to collect valid and informative data, the results of which can advance the field of emotion regulation.

11.2.2.1 Study Design

The study research question(s) and how the measures, means, and schedule of administration will fulfill that objective should guide the selection, design, or modification of the measurement instrument and subsequent analysis of data. As a priority, researchers must determine how to define and subsequently assess emotion regulation in the context of parent–youth interactions (discussed next). Then, researchers must decide how to measure interaction, either with a task or statistical inference. In the former case, researchers could implement an existing task (e.g. Chaplin et al., 2012). However, if the research question involves contextual variation of emotion regulation, a sufficient task design is necessary to elicit the behaviors of interest and perhaps include a "control" condition to contrast the conditions under which they expect to observe the target behavior (Thomas et al., 2019). If the investigation involves ratings of observed behavior, sufficient numbers of research staff will be necessary, as well as a plan to monitor reliability of ratings (for a thorough review on considerations related to observational measurement, see Girard & Cohn, 2016). Carefully selecting study design can address the long-standing research question as to whether behaviors are stable across situations or depend on situational context (Donenberg & Weisz, 1997; Silk, 2019); therefore, depending on the researcher's interest, study design and task selection should be adjusted accordingly.

11.2.2.2 Defining Emotion Regulation and Its Level of Analysis

Operationally defining "emotion regulation" is crucial. In the case of a task designed to measure emotion regulation, a primary question is how one observes what may be an internal process. Because some adaptive emotion regulation skills are idiosyncratic to the individual and may be unobservable (e.g. deep breathing, reappraisal; Gross & John, 2003), researchers may instead focus on indicators of lack of emotion regulation or dysregulation. Thus, in many cases of interaction tasks, it has been the manifestation of an emotion that may be excessive (i.e. not adaptive), thereby interfering with the goal of the task (Beauchaine, 2015).

A related challenge is deciding what level of analysis emotion regulation will be recorded. Emotion dysregulation may be assessed at the level of behavior (e.g. yelling), or by measurement of physiological functioning, such as cardiovascular indices (e.g. heart rate) as a proxy for emotional reactivity/regulation that can be recorded continuously throughout the interaction and/or to measure synchrony between dyad members (Morris et al., 2018; Reindl et al., 2018). Moreover, it is also possible to include a parent–youth interaction task to capture a parenting behavior of interest and associate those behaviors with survey reports of emotion regulation. Finally, an emotion regulation latent variable could be derived from different levels (self-report, behavior, physiology; e.g. Turpyn et al., 2015).

11.2.2.3 Selecting a Coding Scheme/Emotion Regulation Metric

Once emotion regulation has been defined, researchers must select an appropriate measurement instrument to facilitate inferences about interaction. Examples include survey, EMA, psychophysiology, or coding of observed behavior during an interaction task. Additional nontrivial considerations when coding behavior include having a laboratory audiovisual recording system so behaviors do not have to be coded live, and sufficient storage space and security for these recordings. For psychophysiological indices of emotion regulation, researchers could use wearables like heart rate watches or a BIOPAC system to record sympathetic and parasympathetic nervous system response (Bettis et al., 2022).

11.2.2.4 Informants

Even when assessing the same construct, parent and youth reports often do not agree, suggesting they may have different perspectives (De Los Reyes et al., 2013, 2015). Although it may complicate the study design, ideally both parents and youth will be included as informants in a study of parent–youth interactive effects of emotion regulation, particularly when investigating questions pertaining to synchrony or coregulation. As discussed previously, shared method variance is of concern if parents

report on both themselves and their child. Relatedly, objective measures like observed behavior by trained raters also address informant issues.

In some cases of prior research, adolescents have reported on facets of their own emotion regulation and reported on another domain that allowed inferences into parental role of emotion regulation (Silk, 2019; Stone et al., 2019; Waller et al., 2014). These investigations are informative; however, when possible, including both informants eliminates bias in relying solely on one informant's perspective. An additional consideration is whether both parent and youth are providing data on the same construct, or whether one dyad member reports on one construct (e.g. parenting), and the other dyad member reports on another construct (e.g. adolescent emotion regulation). To use certain interactive analyses (described in Section 11.3.2.1 Actor–Partner Interdependence Model), data from both members of the dyad on both constructs are required. Relatedly, there may be developmental issues to consider if parents and youth will report on the same emotion regulation domain using different measures. For example, the Difficulties in Emotion Regulation Scale Short Form (Kaufman et al., 2016) is appropriate for adolescents and adults, but if researchers wanted to measure the same emotion regulation domain in young children and their parents, determining which measures would enable inferences about the same domain across different developmental levels is key to avoiding invalid results due to measurement issues. Finally, studying family emotion regulation and interactive effects (i.e. including all members of a family unit) is exceptionally challenging due to translating the data into a consistent format needed for statistical models, and is therefore typically restricted to dyads (*for example, parent and child; for designs integrating mother, father, and child emotion regulation, see, e.g. Kerr et al., 2021; Li et al., 2019*).

11.2.2.5 Timing

Dyadic emotion regulation transactions occur within interaction as well as across time (Morris et al., 2018). Within brief interactions, conventional approaches to the study of dyadic emotion regulation aggregate data over time (i.e. take the arithmetic average), which fails to capture the rich and dynamic moment-to-moment fluctuations. To illustrate, by aggregating data, nuance is lost such that one cannot evaluate how parent–child emotion regulation exchanges manifest over time. For example, the effect of a maternal regulation strategy on the child's subsequent emotional experience or the influence of a child's emotional experience on parent's emotion coaching.

Furthermore, depending on the study design, researchers may prefer to sequentially code behavior on a micro level between parents and youth to infer how the sequence reveals the interaction process (e.g. sequential analysis; Bakeman & Gottman, 1997). For research questions involving synchrony or co-regulation for which psychophysiology serves as a proxy

of emotion regulation indices, it is important to have accurate time stamps of the start and end of tasks, as well as any notable events to match dyadic processes for analysis. Finally, researchers should consider whether the interaction task will be used once with study participants or readministered at intervals (e.g. yearly). If the latter, it is important to consider youth developmental level and select a task that will enable multiple administrations over the time interval while still appropriate for the youth's developmental level.

11.2.2.6 Causality

A brief but important note on causality is warranted, given that many theories are premised on the idea of whose emotion (dys)regulation impacts whom. To infer causality, research studies need sufficient temporal ordering, and an ability to measure change, either within-person over time, or before and after an intervention. Furthermore, experimental manipulation via random assignment to conditions helps eliminate alternate explanations (e.g. Thomas et al., 2019). Although the data may fit a particular analytic method, the use of that method is not what enables researchers to infer causality but rather their research design.

In sum, there are several design, staff, and implementation hurdles to overcome that explain why there are not as many studies on interactive effects of parent–youth emotion regulation as would be useful. Relatedly, it is often difficult to collect large sample sizes when interaction tasks are involved. By reducing complexity without compromising data quality (e.g. automated behavioral coding; Girard & Cohn, 2016) the likelihood is greater that researchers can scale up data collection and obtain a larger sample size.

11.3 Statistical Approaches for Analyzing Dyadic Interactions and Emotion Regulation in the Context of Parenting

In the preceding sections, we described methods of assessing dyadic interactions in the context of emotion regulation and parenting and the associated challenges and opportunities. A potential barrier to conducting a study on this topic is lack of knowledge regarding analytic methods and potential inferences. In this section, we describe some considerations when analyzing dyadic data and provide brief overviews and examples of analytic methods that are appropriate for addressing research questions on emotion regulation and parenting while pointing to further resources.

11.3.1 Violations of Nonindependence Due to Dyadic and Temporal Measurements

An important consideration when pursuing investigations of how parents' and youth's emotion regulation may be linked is the selection

of data analytic strategy. One of the primary considerations when studying individuals who live intertwined lives is accounting for the inherent influence, or statistical nonindependence, that occurs due to their relationship. One of the assumptions of linear regression is that the observations are independent; thus, this assumption is violated when dyad members who are related genetically and/or share environments are studied. An additional nonindependence consideration is temporal (i.e. autocorrelation) for any data over time. Therefore, statistical techniques must be chosen that can account for this nonindependence; otherwise, regression estimates will not be accurate (Cook & Kenny, 2005).

11.3.2 Analytic Strategies

11.3.2.1 Actor–Partner Interdependence Model

The application of the Actor–Partner Interdependence Model (APIM; Kenny et al., 2006) permits evaluation of bidirectional effects in the context of interpersonal relationships (Cook & Kenny, 2005). The APIM tests the effect of one individual's predictor on their own outcome, as well as on the outcome of their dyadic partner (and vice versa), all within one model (Stas et al., 2018). To use the APIM, both dyad members must have data on a predictor and an outcome variable. APIM derives both actor and partner effects, enabling a test of interpersonal and intrapersonal processes. In other words, one can investigate the association between a characteristic (e.g. emotion regulation ability) and an outcome (e.g. depression symptoms) for both dyad members, controlling for the influence of the other. A significant actor effect indicates one's own characteristics are related to one's own outcome, whereas a significant partner effect indicates one dyad member's characteristics are related to another's outcome. If both partner effects are significant, it suggests bidirectional influence, but one significant partner effect indicates interdependence (Cook & Kenny, 2005).

APIM models can be implemented using structural equation modeling (SEM) or multilevel modeling (MLM). To assist with analysis and interpretation, several R Shiny apps have been made available by David Kenny and colleagues that allow the investigator to upload a data set and derive output of results, including tables, figures, text summarizing the analysis and results, and code (DyadR)[1]. Briefly, APIM using SEM is recommended for dyads who are distinguishable, meaning dyad members differ according to an attribute like sex or gender, or family role (e.g. parent, child; Ledermann & Kenny, 2017). Should researchers select this method, there is an R Shiny app (APIM-SEM)[2] that executes the

[1] http://davidakenny.net/DyadR/DyadRweb.htm
[2] https://apimsem.ugent.be/shiny/apim_sem/

analysis, provides text interpretation of the findings, along with tables, figures, and R code, although it is not necessary that researchers know R programming to use this resource (Stas et al., 2018). MLM APIM is recommended when dyad members are not distinguishable (same-sex roommates; Ledermann & Kenny, 2017), which may be less relevant in the study of parent–youth emotion regulation. Best practices for APIM have been reviewed elsewhere (Ledermann & Kenny, 2017; Stas et al., 2018). Versions of this model have been adapted for longitudinal data as well (Bolger & Laurenceau, 2013; Savord et al., 2022), one of which includes a Shiny app (L-APIM[3]; Gistelinck & Loeys, 2019). Longitudinal APIM has recently been applied to parent–child emotion regulation (Boeve et al., 2019). This approach stands to enhance our understanding of the unfolding of dyadic parent–child emotion regulation over time.

There are several examples of the APIM implemented to investigate parent–youth emotion regulation. First, given that psychopathology can be a manifestation of persistent emotional dysregulation (Aldao et al., 2016; Sheppes et al., 2015), in a study of adolescents hospitalized for treatment of acute psychiatric symptoms and their parents, researchers used the APIM to probe the association between self-reports on one's own difficulty with emotion regulation and depression symptoms (Wolff et al., 2020). There were significant actor effects between difficulty accessing emotion regulation strategies and depression symptoms. Further, there was a significant negative partner effect for parental impulsive emotion regulation and adolescent depressive symptoms, demonstrating interdependence between parents and adolescents. Second, a study investigated the associations between parents' and adolescents' reports of sources of parental knowledge with observed parent and adolescent behavior during a conflict discussion task, based on the rationale that how parents and adolescents interact and manage their emotions when resolving conflict (i.e. a goal-directed activity) will be associated with processes of parental monitoring (Thomas et al., 2022). Behavioral codes came from attachment domains representing behavioral categories that either helps or hurts the dyad's goal of resolving the conflict topic. Hostile behavior (e.g. mocking) and an attachment domain known as Secure Base Use (adolescent) or Secure Base Provision (parent) (e.g. validation, smiling) were coded by trained staff for each dyad member. Adolescent reports of greater adolescent disclosure about their activities and whereabouts were associated with more secure base behavior exhibited by both adolescents (actor effects) and parents (partner effect), as well as less hostile behavior exhibited by both adolescents (actor effects) and parents

[3] https://fgisteli.shinyapps.io/Shiny_LDD/

(partner effect; Thomas et al., 2022). These findings support the interdependence of sources of parental knowledge that are related to monitoring, and manifestations of emotion regulation processes during a conflict discussion task (see Figure 11.1, for example APIM figure).

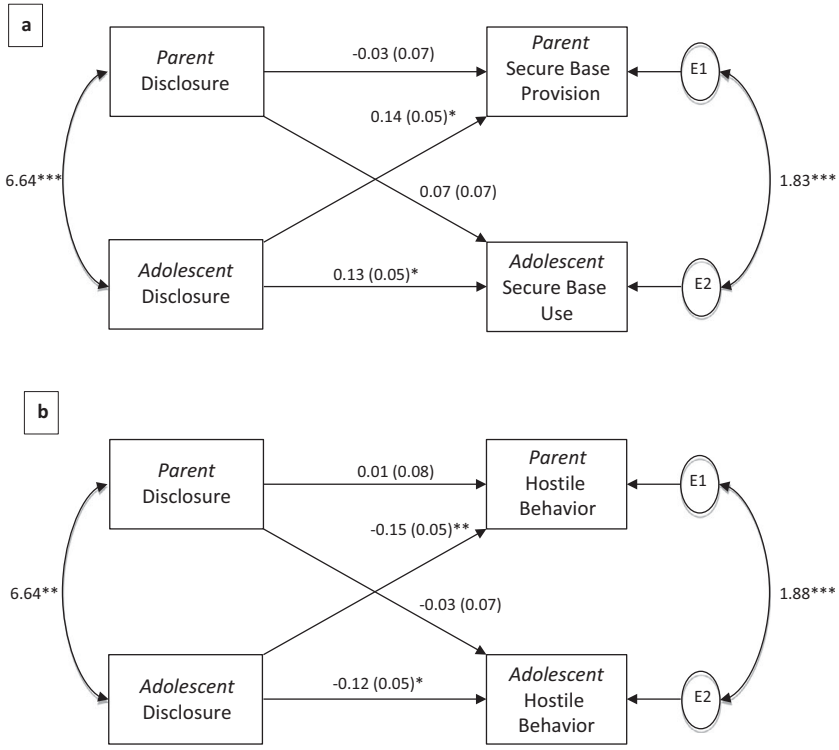

Figure 11.1 Illustration of cross-sectional Actor–Partner Interdependence Models

Note. (a) Unstandardized parameter estimates of actor and partner effects for adolescent- and parent-reports of Adolescent Disclosure in relation to Secure Base behavior, controlling for the effects of age, sex, and sample source (covariate parameters not included in figure). (b) Unstandardized parameter estimates of actor and partner effects for adolescent- and parent-reports of Adolescent Disclosure in relation to Hostile behavior, controlling for the effects of age, sex, and sample source (covariate parameters not included in the figure). Standard errors are presented in parentheses. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

11.3.2.2 Other Strategies

The APIM is not appropriate for all dyadic data, such as with only a youth outcome. In those situations, it is important to use an analytic strategy that will account for the nonindependent nature of the data. Options include generalized estimating equations (Hanley et al., 2003), MLM (Page-Gould, 2017), latent growth models for longitudinal data (Muniz-Terrera et al., 2017), and SEM. SEM permits evaluation of multivariate causal relations and these methods have significantly enhanced our understanding of the bidirectional nature of parent–child interactive effects (e.g. Micalizzi et al., 2016, 2017). A specific model that is widely used is the cross-lagged panel model, a discrete-time structural equation model that can be used to analyze panel data where variables are assessed at least twice over time. The goal of these models is to examine the effect of one variable on the other variable (and vice versa) over time. Furthermore, SEM could be used if a researcher wished to analyze data from two parents and one youth (Kerr et al., 2021; Li et al., 2019). Detailed options for analytic strategies have been reviewed elsewhere (e.g. Gates & Liu, 2016; Thorson et al., 2018).

11.3.2.3 Latent Growth Curve

To measure a behavior over time, latent growth curve models enable assessment of slope and intercept, which can be used to assess the average rate of change in a construct, like emotion regulation. Further, by adding time-varying covariates, one can determine if another variable covaries with the behavior of interest. Consequently, it is also possible to evaluate parent–youth associations related to emotion regulation with growth curve models. To illustrate, researchers used growth curve analyses in a sample of mother–child dyads (half of the mothers were randomized to emotion regulation skills treatment) to investigate how change in maternal emotion regulation over 12 months was related to both the starting point and change in youth emotion regulation (Byrd et al., 2021). In another example, in the context of an intervention for comorbid adolescent psychiatric disorders and substance use, when assessing past 7-day cannabis use over time during and after an intervention, a time-varying covariate of parental frustration was used to determine how cannabis and parental frustration were related over time (Thomas et al., 2020). This analytic technique has important implications for considering how the emotional facets of parent–adolescent relationships can be integral to the fluctuation of target behavior of an intervention over time. Despite the intervention, weekly cannabis use increased across the 1-year follow-up time, and parental ratings of frustration that were higher than their average were associated with greater adolescent cannabis use at baseline, 3-, and 6-month follow-up. This analytic strategy

could be used to understand influence over time in parent–youth relationships and emotion regulation.

11.4 Future Directions

Future directions to advance the study of dynamic parent–youth interactions pertaining to emotion regulation involve thoughtfully selected study designs, the integration of complex technology, and collection of longitudinal data on both short- and long-term time scales. First, with the advent of wearable technology and passive sensing that can detect geolocation, study designs that prompt parents and youth to respond on EMA measures of emotion regulation when they are in the same location can also provide valuable insight into these interactions in the real world (Bettis et al., 2022; Silk, 2019). Second, incorporating parental role into design and measurement will enable inferences about maternal versus paternal or primary versus secondary caregiver role on emotion regulation dynamics, which has been undertaken by few researchers (Kerr et al., 2021; Li et al., 2019). Finally, to adequately capture the protracted, bidirectional development process of emotion regulation, studies are needed that can measure these dynamics from infancy through adulthood. This will be a large undertaking, and will benefit from support from funding agency stakeholders, as well as harnessing the potential of existing large, longitudinal studies (e.g. Adolescent Brain Cognitive Development Study [ABCD] and HEALthy Brain and Child Development Study). Although the ABCD Study includes measures of emotion regulation, data have not been released that capture continuous assessment of parent and child emotion regulation that would allow inference of individual's abilities and how these covary over time. However, because the sample is so large (e.g. 11,875 youth at baseline) and assessments include numerous domains, it may be possible to derive a latent factor representing emotion regulation that could be investigated over time as youth develop. In conclusion, measuring the dynamic processes supporting parent and youth emotion regulation requires careful consideration and a range of skill, and so research teams that bring a variety of skill sets supporting the measurement and analysis of these processes will be well-equipped to address the challenges necessary to advance this field.

11.5 Conclusions

In this chapter, we reviewed the theoretical and empirical underpinnings of dynamic parent–youth emotion regulation processes, their measurement, and analysis. The very type of research designs and analyses that

could advance the field of parent–youth dynamics of emotion regulation are still underused (Keijsers et al., 2022; Silk, 2019). These research gaps represent promising opportunities for innovative study designs, and with technological advancements (Bettis et al., 2022; Girard & Cohn, 2016; Silk, 2019; Stas et al., 2018), conducting these types of studies may be more accessible to researchers than ever before.

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