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HOW INTERVENTIONS WORK FOR FAMILIES:
PARENTS’ CHANGE PROCESSES IN A FAMILY PREVENTION PROGRAM

A Dissertation in

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by

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Interventions designed to produce positive changes in parents and families usually test change with assessments at baseline and post intervention. However, the relatively long intervals between baseline and post intervention make detection of mechanisms of change difficult and miss the micro timescale trajectory of change. This dissertation consists of three interrelated studies focusing on more frequent assessment during this period of change.

Study I used data from the Strengthening Families in Pennsylvania Project (SFP in PA), an RCT of the Strengthening Families Program (SFP 10-14). Study I aimed to elucidate whether mothers’ attendance and engagement in the intervention, assessed weekly, predicted their post-intervention benefit. Results showed no significant effect of mothers’ attendance or engagement on their program benefit and this did not vary by fathers’ attendance. Future research should use more thorough measures of parents’ daily engagement with more immediate measures of change to better understand how parents influence this change process.

Study II presents a rationale for using intensive longitudinal methods (ILM) in the evaluation of family interventions. ILM are assessment protocols with rapid in situ measurement that capture aspects of participants’ daily lives and momentary experiences. ILM are sensitive to micro timescale change and provide valid assessments of momentary experiential constructs. Thus, ILM are particularly suited to investigating patterns and processes of change as well as interaction-level or daily-level family functioning outcomes. Study II suggests future research questions that can be informed by ILM.

Study III examined the trajectories of micro timescale change in parents’ outcomes for a subset of parents in the SFP in PA trial. Parents completed daily assessments of mindful parenting and affective quality of the parent-youth relationship throughout the intervention. Using heterogeneous variance multi-level models, Study III tests two hypotheses: incremental increase in functioning, indicating behavior change, and increased day-to-day variability, indicating disruption in homeostasis of the family system, for parents experiencing more exposure to intervention sessions (i.e., attendance). Affective quality showed evidence of both patterns of change for more-exposed parents. Future research should explore the relation of the micro timescale patterns of change to macro timescale change.
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Chapter 1
Introduction

Different patterns of micro timescale change (e.g., over the days and weeks of intervention) constitute different experiences for families and may influence the degree and permanence of intervention-induced change. For example, family systems theory suggests that change in family members’ behavior is more likely to be sustained by the family system when the family system reorganizes around the changed behavior. Absent disruption and reorganization of the family system, negative feedback (i.e., stabilizing, normalizing) processes may return the behavior back to baseline homeostasis. Thus, from a family systems perspective, high day-to-day variability in behavior as a result of participation in an intervention (an indicator of disruption on a micro timescale) may be a precursor to more permanent macro timescale change (e.g., developmental change over months and years). Participants may influence these micro timescale processes of change with their own effort (e.g., attendance, in-session engagement, daily skill practice), enhancing their own uptake of intervention content. Currently, it is unclear what micro timescale processes (e.g., fluctuation, smooth increase, synchronous improvement among parents) are associated with participants’ effort and which processes lead to greater or more permanent macro timescale change. There has been little research on participants’ engagement during evidence-based interventions (EBIs) beyond measuring participant attendance, yet active engagement and learning is often necessary for behavior change.

This dissertation contains three papers that examine parents’ engagement during a universal family intervention, families’ day-to-day patterns of change during a universal family intervention, and a review of the utility and next steps in the use intensive longitudinal methods
for evaluation of family interventions. All three papers focus on aspects of how research can *dig deeper into interventions’ effects to understand how interventions work for families*. I will briefly review the rationale for a deeper understanding of family change processes during intervention, discuss the value of intensive longitudinal methods, provide context to this dissertation by describing the Strengthening Families Program for Parents and Youth Ages 10-14 model and then outline the three papers included herein.

**Evaluation of How Interventions Work**

Interventions designed for parents and families aim to produce family change between baseline and post-intervention assessments. The first generation of program evaluation for family interventions focused on whether programs worked (Barrera & Sandler, 2006). Numerous preventive intervention programs have now reached the standard of being EBIs by demonstrating overall effectiveness post intervention for those who enroll (Catalano et al., 2012; Kumpfer & Alvarado, 2003). This has created a “black box” model of understanding of the effects of EBIs (Chen & Rossi, 1983); that is, when change occurs there was little knowledge of the process of change (Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011). There has been a growing consensus that a necessary research agenda is to understand how EBIs work, how to optimize intervention effectiveness, and which aspects of the intervention and characteristics of participants influence the process of change (Kazdin, 2004).

**Previous Research**

As indicated by variation in effects, some participants benefit from EBIs more than others. At this stage of evidence, more research is needed to explain how EBIs work and for whom (Kazdin, 2004; Sandler et al., 2011). Previous research has focused on participant characteristics such as demographic factors and dosage (attendance) as moderators of intervention
effects (e.g., Bakermans-Kranenburg et al., 2008; Connell et al., 2007). Currently, there is substantial work on measuring implementation fidelity and attendance during sessions (Gresham, 2009); however, influences on families’ change may go well beyond fidelity and attendance in sessions. Some studies have shown a relation between parents’ engagement (e.g., attention, quality of participation) and treatment response (Breitenstein et al., 2010; Nix, Bierman, McMahon, & CPPRG, 2009).

To understand the process of change, research has focused on proximal outcomes at post-intervention assessment as mediators of longer-term effects. For example, in Parent Management Training- Oregon Model (PMTO; Forgatch, 1994), changes in parenting from baseline to year 1 mediated delinquency eight years later and arrest record at year 9 (Forgatch, Patterson, Degarmo, & Beldavs, 2009). However, there has been very little focus on examining mediators prior to the end of interventions, such as behavior during intervention sessions or early patterns of micro timescale change. One qualitative study did investigate parents’ narratives of their micro timescale change (Holtrop, Parra-Cardona, & Forgatch, 2014). A recent review of parenting interventions identified a substantial lack of information about the specific mechanisms by which family interventions impact long-term reductions in substance use and youth problem behavior (Sandler et al., 2011). More research is needed to carefully examine mechanisms of EBI change (Kazdin, 2007).

The Importance of Understanding Family Intervention Processes

Calls to better understand how interventions work and illuminate the “black box” necessitate assessment during a critical period of change: the time during the intervention implementation. The relatively long intervals between assessments at baseline and post intervention make detection of mechanisms of change difficult and do not allow for investigation of micro timescale processes of change (Kazdin, 2007). Assessing change during the period when
families are changing may allow researchers to better-understand the experiences of families, how interventions work, and micro timescale patterns of change that may be associated with larger and more permanent program benefit. Thus, the broad goals of this research agenda should include a focus on the micro timescale process of change and on constructs assessed during intervention delivery that may explain program effects.

These research goals require methodological innovation to capture the necessary information within this critical period. Two approaches gather information about families and their patterns of change in this critical period with some frequency: intensive longitudinal methods (ILM), and in-session assessment. One promising construct located within this critical period is participant engagement, which may be a factor in participants’ process of change and may be able to elucidate differences among participants’ degrees of benefit.

**Intensive Longitudinal Methods**

ILM are assessment protocols with rapid (one or more assessments per day), in situ measurement that capture aspects of participants’ daily lives and momentary experiences. Intensive longitudinal study designs allow researchers to go beyond the current standard model of mediation which usually utilizes a post-test score as the mediator, and ILM are particularly suited to investigating patterns and processes of change over short periods of time. Experiences such as variations in child behavior, parent stress, and parenting emotions impact the process of change on a day-to-day timescale by affecting the level of skill practice, affecting parents’ evaluation of the relevance and usefulness of intervention content/skills, or parents’ evaluation of self-efficacy in enacting changes. Additionally, assessing proximal outcomes relevant to this micro timescale such as daily parenting practices, may allow researchers to track the trajectories of change at this timescale.
In-Session Assessment

Measuring aspects of implementation may be another way to investigate how interventions effect change. EBIs teach new cognitions, attitudes, and behaviors and therefore require active participant engagement in the change process for effectiveness (Barsade & Gibson, 2012; Dumas et al., 2007). Attention to parents’ engagement during sessions recognizes that participants have a role in achieving benefits through uptake of EBI content, and that implementation is an interaction among participants, facilitators, and program content (Berkel et al., 2011). This means that understanding engagement (e.g., active participation and interest in the sessions, at-home practice, evaluation of intervention content, excitement about intervention content or the change process; Bamberger & Coatsworth, 2013) and its contribution to the change process may be vital to understanding nuances of the change process over time (e.g., Low et al., 2013; Nix et al., 2009). Levels of or variability in engagement also have the potential to further differentiate among participants who attended the same number of sessions in their outcomes.

The Strengthening Families Program for Parents and Youth Ages 10-14

I have applied this research agenda to The Strengthening Families Program for Parents and Youth Ages 10-14 (SFP 10-14). This is a family preventive intervention that follows a skills-building model of intervention. The implications being that skills-building programs (implicitly) theorize a relatively straightforward relation between both attendance and engagement and parents’ uptake of new skills. In family interventions, these relations may depend on parental subsystem structure and family dynamics that may or may not allow for changes in parenting. In real life, these relations may depend on daily experiences in and out of the family context, parents’ intentional practice of new skills, etc. The uptake process should occur in relation to the frequency and timing of program implementation, once per week for seven weeks, and the
introduction and practice of new skills. According to the logic model of the program, uptake of new skills should be related to change in parenting behavior and eventually, prevention of adverse youth outcomes.

Youth who initiate early substance use are at increased risk for later substance abuse and a variety of other problems such as greater likelihood of conduct disorder, mental illness, delinquency, violence, and dependence (Grant & Dawson, 1997; Reid & Eddy, 1997). As such, there has been a proliferation of programs that successfully target common early risk and protective factors to prevent substance abuse and other associated problems (Durlak, 1998; Hawkins et al., 1992; Swadi, 1999). In particular, many prevention programs such as family skills training programs involve families of youth (Kumpfer & Alvarado, 2003) possibly because families are the hub of adolescents’ experiences in other contexts (e.g., parents control some activities with peers) and are the most consistent context across development. SFP 10-14 is one such program that is designed for pre/young teenagers and their families and has shown prevention of adolescent substance use (Spoth, et al., 2001) by targeting family, parenting, and child risk factors, including affective quality of parent-child relationship and parenting skills.

SFP 10-14 has been extensively implemented and researched. In terms of primary outcomes, much of the evidence comes from the developers and their colleagues at Iowa State University through both the PROSPER trial and a three-condition RCT of this curriculum. The PROSPER trial has shown that SFP 10-14 in combination with one of three school-based prevention curricula, has preventive effects on substance use 18 months after baseline (Spoth, Redmond, Shin, Greenberg, Clair, & Feinberg, 2007). In another study comparing SFP 10-14 alone with Preparing for the Drug-Free Years curriculum (now known as Guiding Good Choices), SFP 10-14 prevented new use of alcohol and cigarettes in 10th grade (4 years after baseline;

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1 Logic model can be found at http://episcenter.psu.edu/sites/default/files/13-06-10%20Full%20SFP%2010-14%20Logic%20Model.pdf (EPISCENTER, 2013)
Spoth, Redmond, & Shin, 2001) and in 12th grade (6 years after baseline; Spoth, Redmond, Shin, & Azevedo, 2004) compared to controls but did not result in lower frequency of use among users of alcohol in 10th grade (Spoth et al., 2001). This trial also showed that SFP 10-14 prevented aggression and hostility 4 years after baseline (Spoth, Redmond, & Shin, 2000) compared to controls. Based on the results of this trial on age of first reported alcohol use, SFP 10-14 was found to be cost-beneficial in the prevention of projected cases of alcohol use disorder (SFP 10-14 also has beneficial effects on other outcomes in this trial compared to control; Spoth, Guyll, & Day, 2002). Research by the developers of SFP 10-14 has focused heavily on substance use prevention outcomes, but has also shown indirect effects on sexual risk factors via effects on substance use (Spoth, Clair, & Trudeau, 2014). Because of this research, SFP 10-14 has been listed as promising program by Blueprints for Violence Prevention and as an evidence-based program by many federal agencies (e.g., Office of Juvenile Justice & Delinquency Prevention, U.S. Department of Education, Substance Abuse & Mental Health Services Administration), allowing SFP 10-14 to be implemented in communities across the country. The implementation-facilitator’s adherence and quality has been studied in SFP 10-14 and other parenting interventions (Harachi et al., 1999; Spoth et al., 2002).

**The Current Studies**

There is much to be learned about how families change over the course of an intervention. Studies that examine change in family systems through intensive longitudinal assessment and in-session assessment have the potential to provide greater insight into how interventions work (Harachi et al., 1999; Smyth & Stone, 2003). Data used in this dissertation are drawn from The Strengthening Families in Pennsylvania project (SFP in PA) which has used facilitator-rated in-session assessment of participant dosage and engagement. Overlaid on SFP in PA, I collected ILD to assess parents’ daily experiences of family functioning and skills practice.
during the seven weeks of SFP delivery. The combined study designs use data across multiple timescales: ILD collected daily, weekly in-session data on participant engagement, and traditional baseline and post-test assessment of families to examine influences on the process of family change due to intervention.

**Study I**

In Chapter 2, I examine participants’ role in intervention uptake using attendance and engagement collected in-session as a predictors of program benefit. In this study, I use the entire sample of mothers from a randomized controlled trial of SFP 10-14 and a modified version of the curriculum. The goal of this study is to determine whether, in this sample, attendance and engagement independently contribute to program benefit in proximal outcomes.

**Study II**

Chapter 3 conceptually explores the rationale for using ILM to evaluate family intervention programs. ILM are sensitive to change in the micro timescale, and can be used to provide valid assessments of momentary experiential constructs. For these reasons, ILM are particularly suited to evaluate family functioning outcomes, which occur at an interaction-level or daily-level, involve micro timescale processes like emotion contagion, spillover, and momentary reactions. I discuss novel research questions that can be addressed to evaluate family interventions using ILM.

**Study III**

Chapter 4 studies a select set of parents from the SFP in PA study in order to empirically explore the promise of ILM; specifically, I aim to study their patterns of day-to-day change in intervention outcomes collected daily.
References


Chapter 2

Attendance and Engagement Predicting Program Benefit for Intervention-Assigned Mothers

Universal prevention programs have been extensively evaluated and can be effective (Barrera & Sandler, 2006). Yet, because of their universality and recruitment approach, there is diversity in the level of functioning of families recruited: many families in these samples are high-functioning and may have little need for immediate change, and the families most in need may require more intensive services to change (e.g., counseling, wrap-around). Casting this wide recruitment net necessitates that universal prevention programs work for different families at different times, for various outcomes, and to varying degrees. Looking closer at the between-family differences in degrees of benefit from universal and targeted prevention programs has led researchers to consider the roles of various factors on program benefit. Researchers have investigated parents’ investment in the program in the form of attendance and engagement (e.g., Nix, Bierman, McMahon & CPPRG, 2009; Connell, Dishion, Yasui, & Kavanagh, 2007), participant characteristics that may indicate sensitivity to intervention (Bakermans-Kranenburg, Van IJzendoorn, Pijlman, Mesman, & Juffer, 2008), and baseline levels of functioning that may indicate need for change (e.g., Gonzales et al., 2012). This research agenda has spanned prevention curricula.

The Strengthening Families Program for Parents and Youth Ages 10-14 (SFP 10-14) is a family intervention that targets youth substance use initiation by (a) teaching parents a variety of skills, including monitoring, effective discipline and clear communication about expectations, (b) teaching youth a variety of skills, including peer-resistance, and stress management, and (c)
promoting positive family interactions through model activities (Molgaard, Spoth & Redmond, 2000). SFP 10-14 is implemented as a universal program with groups of parents who opt in, and has been extensively implemented across the United States. In terms of primary outcomes, much of the evidence comes from the developers and their colleagues at Iowa State University through both the PROSPER trial and a three-condition RCT of this curriculum (e.g., Spoth, Redmond, Shin, & Azevedo, 2004; Spoth, Redmond, Shin, Greenberg, Clair, & Feinberg, 2007). This study examines whether mothers’ attendance and engagement in the original SFP 10-14 and adapted sessions relate to program response, and whether this relation differs by parenting subsystem structure.

**Coparenting**

Ideally, parents work together as members of the executive subsystem (Minuchin, 1974) that is ideally, parents coparent. The coparenting literature places emphasis on not only the quality of parenting or parenting practices of an individual parent, but on coordination of parenting as influencing child development (e.g., Belsky, Putnam, & Crnic, 1996; Vaughn, Block & Block, 1988). Coparenting includes these aspects of coordinated parenting: support/undermining, childrearing agreement, division of labor, and joint family management (Feinberg, 2003). Parents who attend the intervention together may prioritize childrearing agreement between parents and therefore prioritize joint exposure to the intervention. Childrearing agreement is the degree to which parents share an approach to parenting and perspectives on children’s needs. Additionally, parents who attend together may have greater respect for each other’s contributions and opinions about parenting and therefore wish to attend the intervention together in order to evaluate the intervention together. Respect for the other’s contributions is an aspect of coparenting support. Finally, attending an intervention together may indicate strong joint family management in the recognition of need for guidance and direction in family interactions. Because the strength of coparenting may be driving patterns of attendance in
the executive subsystem, this study investigates whether the impact of mothers’ attendance and engagement on intervention benefit differs depending on whether her partner attended.

**Previous Research on Participation and Its Relation to Program Benefit**

**Research on Attendance**

The idea that participants who attend more sessions uptake more information and show greater program response has been investigated for a variety of intervention programs and, although this relation is not always consistent, generally, higher exposure is related to greater program response (e.g., Gorman-Smith, Tolan, Henry, et al., 2002; Gross, Garvey, Julion, et al., 2009; Prado, Pantin, Schwartz, Lupei, & Szapocznik, 2006). This is based on common sense and behavior change theory, and also has clear connections with a medical model of dosage: Greater exposure to new skills and content that may prompt behavior change should, for at least a portion of the sample, lead to greater improvement in intervention-targeted behavior. In some studies, this degree of change is compared to a control group where exposure is zero by randomization or assignment. In other studies, this is compared to parents who attended fewer sessions by choice or circumstance. In both cases, minimal or developmental change is expected in the zero exposure parents, and a positive relation between attendance and response is expected for exposed parents.

For SFP 10-14 specifically, independent research suggests that the benefit of SFP 10-14 on outcomes related to family functioning may differ among families based on the number of sessions that the family has attended. Families attending fewer than five sessions demonstrated iatrogenic effects on family functioning outcomes while families attending the “full dose” of six or seven sessions showed positive effects of moderate effect size (Riesch et al., 2012). No other research on SFP 10-14 appears to have been published on differential effects of the program based on the number of sessions attended (i.e., exposure to the intervention).
Integrating this consideration of attendance with the reality of the family system, the relation between a parent’s attendance and program response may be a function of the parent’s influence on the parental subsystem (Minuchin & Fishman, 1981). A direct relation between one parent’s attendance and program response may be expected for single parent families where one parent’s exposure directly translates to parenting in the home. In two-parent families, both parents’ attendance may need to be taken into account because two parents influence the parenting subsystem and the parenting in the home. In two-parent families, where mother attends and father does not, mother may be exposed to content that tends to change her behavior but is also exposed to father’s parenting which is less likely to change with no exposure to the intervention. There has been no known research on this topic, and these hypotheses are largely conjecture.

Research on Engagement

There also may be differential program effects based on participants’ engagement such that participants who are more involved and invested may also uptake more program content and show greater program response. The relation between engagement and program outcomes could be expected because engagement involves a set of behaviors, thoughts, and feelings that are consistent with learning. Higher engagement may indicate more learning. Further, engagement may widely vary among program participants as well as for the same participants in different sessions, lending variability to the prediction of program response. Patterns of change in engagement may also be related to program outcomes: for example, decreasing engagement may reflect a process of disengagement from the program where material learned in earlier sessions is rejected as ineffective or inconsistent with parenting goals. Our own work has shown that parents in the current sample vary in their engagement and patterns of change in engagement (Bamberger, Coatsworth, Fosco, & Ram, 2014).
Some studies have shown a relation between parents’ engagement and treatment response. In the Chicago Parent Program, a preschool intensive intervention for low-income children and their families, participants’ levels of paying attention, participating, being supportive of other participants, etc. were related to improvements in child behavior problems and parent depressive symptoms (Breitenstein et al., 2010). In the Fast Track study of families of children at-risk for later problems due to high aggression at the entrance to school, quality of participation was related to parents’ treatment response in all domains reported: perceptions of child, parental warmth, physical punishment, and school involvement (Nix, Bierman, McMahon, & CPPRG, 2009). A relation between parents’ engagement and program response has not been examined for SFP 10-14.

**Study Hypotheses**

Few studies have examined the role of engagement beyond attendance. Is simple exposure sufficient for program response or is some level of active engagement necessary? The current study will address this gap in the literature, examining mothers’ attendance and engagement in SFP 10-14 as predictors of program response on parenting and family functioning. Parents constitute an executive subsystem within the family, and parents who coparent coordinate their parenting behavior and may be influenced by each other. Therefore, I expected that change in mothers’ outcomes might depend on her own exposure and also on her partner’s exposure to the intervention. The relation between attendance, engagement and program response was examined using four groups of mothers: (a) single mothers, and (b) married/partnered mothers whose husbands did not attend, (c) married/partnered mothers whose husbands attended fewer than 5 sessions, and (d) married/partnered mothers whose husbands attended 5 or more sessions. The specific outcomes that were chosen to index program response were child management, intervention-targeted parenting skills, and affective quality of the parent-to-youth relationship. These are posited as proximal outcomes of SFP 10-14 and are directly targeted in the parent
component of the program. I hypothesize that the effect of mothers’ attendance would be diluted in two-parent families where the father attended few sessions or not at all because only one half of the parenting subsystem (the mother) was exposed to the program content; the relation between mother’s attendance and program benefit will be smallest for these families. I use single mothers as a comparison group because I hypothesize that the effect of mother’s attendance on program benefit would straightforward, the mother constituting the entirety of the parenting subsystem. I hypothesize a synergistic effect of mothers attending the majority of sessions in a two-parent family where father attended the majority of sessions—evidence that both parents are working together to attempt change—which would be shown by an increased relation between mother attendance and program benefit for families where the father attended many sessions. I hypothesize that, while attendance would be linked with these outcomes, engagement in the sessions would be related to the outcomes beyond attendance; that is, engagement would be the driving force of mothers’ skill uptake. I also explore similar relations between groups of mothers based on father attendance and the impact of mother’s engagement on program benefit.

Methods

SFP in PA Trial

This project is a three-arm RCT conducted over 6 cohorts with 350 families testing SFP 10-14, a Mindfulness-Enhanced version of the Strengthening Families Program (MSFP), and a home study control (Coatsworth et al., 2015). SFP 10-14 is an evidence-based, universal, family-focused intervention designed to prevent the onset and escalation of adolescent substance use and problem behavior. Both versions of the intervention consist of seven two-hour sessions in which parents and youths meet in separate groups for the first hour and conjointly for the second (see Molgaard, Spoth, & Redmond, 2000) in skill building exercises. During the second hour, youth and parents are reunited and all three facilitators led family activities and skills practice.
MSFP is an adapted version of SFP 10-14 in which activities to nurture mindfulness in parenting are integrated into the parenting curriculum beyond SFP 10-14’s focus on self-regulated parenting (Coatsworth et al., 2014). The format of MSFP, including session length and number, was identical to SFP 10-14, but some of the original activities were shortened or moved. New training activities related to parent mindfulness represented a five-dimension conceptual model (Duncan et al., 2009).

The information-only home study condition featured two short booklets mailed to families. The booklets were composed from information readily available on the internet and focused on social-emotional changes in adolescents and family life with adolescents. Study procedures were approved by the Penn State IRB.

Participants

Families completing baseline/pre-intervention assessments were randomly assigned to MSFP (n = 129), SFP 10-14 (n = 126), or home study (n = 95). Parents were 70% European American, 17% African American, 7% Latino, and 5% Asian, which reflects the population in Pennsylvania. Sixty-six percent of families included two parents and 85% of fathers participated in this study. Twenty-five percent of mothers and 30% of fathers had a high school diploma or less; median annual family income was $48,000. Fifty-three percent of target youths were female; the average age of youths was 12.17 (SD = .65).

The current study includes mothers (N = 264) in the SFP (n = 134) and MSFP (n = 130) conditions. I included mothers for whom there was any data at baseline or post-test on the three program response indicators and who had been assigned in our records to SFP or MSFP. I wanted to include mothers who attended and did not attend (i.e., the full range of attendance), which also meant I included mothers who did not participate in baseline surveys but whose child completed surveys about her.
See Table 1 for a demographic description of the sample. Seventy-two percent of mothers were married or living together; 81% reported their race as white, 11% as black, and 5% as asian; (3% reported their ethnicity as Hispanic/Latino); and 96% had graduated high school or earned a GED or completed more education. Median family income was $57,500 (SD = 275,189). The children (45% boys) with whom mothers participated were, on average age 12.16 years, and fewer were white compared to their mothers (73%).

Measures

Child Management was assessed at baseline and post-intervention. Mothers self-reported using 25 items tapping six subscale constructs: monitoring, inconsistency in discipline, harsh discipline, inductive reasoning, recurring conflict, and intimidation/avoidance, on a scale from never (0) to always (4) (Spoth, Redmond, & Shin, 1998; Tilton-Weaver et al., 2010). Negatively worded items were reverse-scored so that higher scores indicated better child management practices for all items. Total scores were an average of all subscales at baseline (Cronbach’s $\alpha = 0.79$) and post-intervention (Cronbach’s $\alpha = 0.80$). Children reported on mothers’ child management using 22 items tapping five subscale constructs: monitoring, inconsistency in discipline, harsh discipline, inductive reasoning, and attempted understanding, on a scale from never (0) to always (4). Total scores were an average of all subscales at baseline (Cronbach’s $\alpha = 0.76$) and post-intervention (Cronbach’s $\alpha = 0.86$). For use in the current study, mother and child total scores were averaged at baseline ($r = 0.02, p > .05; M = 2.38, SD = 0.40$) and post-intervention ($r = 0.20, p < .05; M = 2.47, SD = 0.43$).

Intervention-Targeted Parenting was assessed at baseline and post-intervention. Mothers self-reported using 19 items tapping 5 subscale constructs: support, guidance, substance use rules, involvement, and anger management, on a scale from never true (0) to always true (4) (Spoth et al., 1998). Total scores were an average of all subscales at baseline (Cronbach’s $\alpha = 0.84$; $M = 2.81; SD = 0.50$) and post-intervention (Cronbach’s $\alpha = 0.87$; $M = 3.02; SD = 0.46$).
Affective Quality of the Parent-Youth Relationship was assessed at baseline and post-intervention using both positively worded and negatively worded items on a scale from never (0) to always (6) (Spoth et al., 1998). Negatively worded items were reverse-scored so that higher scores indicated better affective quality for all items. Total scores for mothers’ self-report were an average of all 9 self-report items (Cronbach’s α baseline= 0.80, Cronbach’s α post-intervention = 0.82). Total scores for children’s reports of mothers were an average of all 14 child report items at baseline (Cronbach’s α = 0.87) and post-intervention (Cronbach’s α = 0.90). In the current study, mother and child total scores (correlation at baseline $r = 0.35$, and post-intervention $r = 0.35$, $p < .05$) were averaged at baseline (M = 4.38, SD = 0.74) and post-intervention (M = 4.50, SD = 0.80).

Attendance was assessed at the program sessions using official records compiled through parent sign-in sheets and facilitator records of attendance. For the current study, attendance reflects the total number of sessions attended (0-7) by each mother (M = 5.45, SD = 1.76).

Engagement was assessed at the program sessions. Facilitators rated parents on four engagement items reflecting participation, interest, positive affect with facilitator, and positive affect with others. Total scores (1-4) were an average of these items at each session (across all person-sessions M = 3.54, SD = 0.58).

For the current study, the initial level of and change in engagement were used in the analyses. A linear multi-level model of change (Singer & Willett, 2003) was used to estimate the initial level of engagement and rate of change in engagement over seven sessions. The intercept coefficient (i.e., individual intercept) quantifies individual differences in initial level of engagement for each mother (M = -0.00023, SD = 0.47). The linear rate of change coefficient (i.e., individual slope) quantifies individual differences in how mothers’ engagement increased/decreased across sessions (M = -0.00008, SD = 0.04).

Parental subsystem structure was compiled based on whether the household was a two-parent household (i.e., whether the mother was married/lived with a partner) or not at baseline.
and based on the partner’s level of attendance (i.e., high, low, none). Parenting subsystem structure represents the degree of influence that mothers’ attendance and engagement may have on the parenting in the household. Seventy-five mothers in this sample were single (and by default had no partner attendance; group 1). Of married/partnered mothers, 86 mothers in the sample had husbands who attended many sessions (group 2), 58 mothers in the sample had husbands who attended few sessions (group 3), and 45 mothers in the sample had husbands who did not attend any program sessions (group 4). I used dummy codes of these four groups of mothers in the analysis to investigate whether parental subsystem structure had an impact on the relation between mothers’ attendance and engagement with her program response (single mothers were the comparison group). Three variables represented the four groups: ‘High’, ‘Low’, and ‘None’. For the ‘High’ variable, married mothers whose partners attended the majority of sessions (group 2) had a value of 1, whereas all other groups had a value of 0. For the ‘Low’ variable, married mothers whose partners attended few sessions (group 3) had a value of 1, whereas all other groups had a value of zero. For the ‘None’ variable, married mothers whose partners did not attend any sessions (group 4) had a value of 1, whereas all other groups had a value of zero. Single mothers were identified by a value of zero across all three variables.

Depression was assessed using a modified version of the CES-D self-report at baseline (Radloff, 1977). Each item asks how often during a week the mother experiences 20 symptoms of depression from rarely (0) to almost all the time (3). Total score is the sum of all items and represents the frequency of depression symptoms (M = 12.25, SD = 8.36). The distribution approximated a normal distribution (skewness = 0.86, kurtosis = 0.35).

Education was assessed on an ordinal scale from less than 7th grade (1) to graduate education (7) asking mothers what level of education they had completed (M = 5.42, SD = 1.13). The distribution approximated a normal distribution (skewness = -0.29, kurtosis = -0.49).
Data Processing

All variables except parental subsystem structure were sample-mean centered, so all parameters from Equation 1 could be interpreted as applying to the average mother in the sample who is in a single-mother parental subsystem (i.e., when all other parameters in the model are equal to zero). Parental subsystem effects should be interpreted for the subsystem structure being tested in comparison to all other mothers.

I sought to predict the portion of the post-intervention outcome score unexplained by the baseline score, a strategy that allows for prediction of the different-from-average degree of change in the outcome over that period of time. The hypothesis that initial engagement and change in engagement would predict intervention benefit accounting for attendance is tested by main effects of initial engagement and change in engagement. This is tested first by a standard regression model for each outcome (affective quality, child management, and targeted parenting):

\[
postY_i = b_0 + b_1 baselineY_i + b_2 education_i + b_3 depression_i + b_4 attend_i + b_5 initialeng_i + b_6 changeeng_i + e_i
\]

Building on this model, the hypothesis that the effect of mothers’ attendance on program benefit would be affected by fathers’ attendance is tested by interaction terms between high, low, and no attendance group and mother’s attendance, initial engagement, and change in engagement. I conducted a separate regression for each outcome (affective quality, child management, and targeted parenting) using a standard regression model:

\[
postY_i = b_0 + b_1 baselineY_i + b_2 education_i + b_3 depression_i + b_4 attend_i + b_5 initialeng_i + b_6 changeeng_i + b_7 High_i + b_8 Low_i + b_9 None_i + b_{10} High_i*attend_i + b_{11} Low_i*attend_i + b_{12} None_i*attend_i + b_{13} High_i*initialeng_i + b_{14} Low_i*initialeng_i + b_{15} None_i*initialeng_i + b_{16} High_i*changeeng_i + b_{17} Low_i*changeeng_i + b_{18} None_i*changeeng_i + e_i
\]

In each regression model, the intercept, \(b_0\), is the expected value of the post-intervention outcome (i.e., affective quality, child management, and targeted parenting) for the average
mother. The $b_1$ parameter indicates the unique association between baseline levels and post-intervention levels of the outcome of interest, independent of other factors that may also influence the degree of change over that period, mother’s depression, $b_2$, and mother’s education, $b_3$. Of particular interest are the parameters $b_4$, $b_5$, and $b_6$, representing the effects of attendance, initial engagement, or change in engagement on the outcome, respectively. Additionally, I hypothesized that the effect of mothers’ attendance and engagement on post-intervention outcomes would depend on attendance in the parenting subsystem structure. These moderation effects of parental subsystem structure on the effects of attendance, initial engagement, and change in engagement are captured by parameters $b_{10}$-$b_{18}$.

Models were estimated using SAS 9.4 proc reg. Missing data, particularly for those parents with incomplete baseline data, were accommodated using multiple imputation. Forty plausible datasets were imputed and analyzed, and results were combined using proc mi in SAS 9.4 (Graham, Olchowski, & Gilreath, 2007). The diagnostic plots indicated that the imputation was adequate for the 15 analysis variables included in the model (Graham, 2012).

**Results**

Correlations among study variables using non-imputed data are reported in Table 2-2. Correlations among baseline and post-intervention time points on the same variable were moderate to high and significant $r_s = [0.45 – 0.72]$. The post-intervention outcome variables were not correlated with attendance, initial engagement, or change in engagement. Change in engagement and initial engagement were highly negatively correlated ($r = -0.91$). Other predictor variables were not significantly correlated or were moderately correlated with each other and with the post-intervention outcome variables $r_s = [0.00 – -0.37]$. In particular, it is interesting that mother’s depression was not correlated with either attendance or either engagement variable, and mother’s education was only modestly so. Also interesting, attendance was only modestly
correlated with initial engagement and not correlated with change in engagement—evidence that attendance and engagement (partialed out in this way) are distinct constructs.

The results of models examining mothers’ attendance, initial engagement, and slope of engagement as predictors of mothers’ child management, targeted parenting, and affective quality with the participating child are presented in Table 2-3. The larger models testing whether these effects differed by parenting subsystem structure are presented in Table 2-4.

**Effects of Attendance and Engagement**

In the following regression models, attendance, initial engagement, and change in engagement were added as predictors in the model of each post-intervention outcome, accounting for baseline levels of the outcome. This model is designed to test whether mothers’ attendance and engagement influence her intervention benefit.

**Affective Quality.** In a model regressing baseline affective quality, attendance, initial engagement, and change in engagement on post-intervention affective quality, attendance was a significant predictor (B = 0.05*). Neither initial engagement nor change in engagement significantly predicted post-intervention affective quality.

**Child Management.** In a model regressing baseline child management, attendance, initial engagement, and change in engagement on post-intervention child management, attendance, initial engagement and change in engagement did not significantly predict post-intervention child management.

**Targeted Parenting.** In a model regressing baseline targeted parenting, attendance, initial engagement, and change in engagement on post-intervention targeted parenting, attendance, initial engagement and change in engagement did not significantly predict post-intervention targeted parenting.
Differences among Parenting Subsystems

In the following regression models, in addition to attendance, initial engagement, and change in engagement, the control variables (i.e., mother depression, mother education) and group variables (i.e., married, father not attending; married, father low attendance; married, father high attendance where single mothers are represented by the absent dummy variable; and their interactions with attendance and engagement variables) were added as predictors in the model of each post-intervention outcome. This model is designed to test whether effects of mother’s attendance and engagement are impacted by the parental subsystem structure.

Affective Quality. The first column of Table 2-4 shows the results of the model predicting affective quality. The intercept score indicates that on the 0-6 scale, the expected post-intervention affective quality score for the average parent was 4.50. Baseline level of affective quality predicted post-intervention affective quality: for every one unit higher the baseline score, post-intervention affective quality was predicted to be 0.78 units higher ($p < .05$). No other parameters were significantly different than zero—The degree to which attendance and engagement predicted affective quality did not differ significantly by parental subsystem structure, and mother’s attendance, initial engagement, and change in engagement did not predict affective quality. This was a difference from the initial model of affective quality where attendance significantly predicted affective quality.

Following up on this model, I conducted stepwise regressions to determine which variables, when added to the model, attenuated the effect of mothers’ engagement. The interaction between parental subsystem variables (indicating fathers’ attendance and single mothers) and mothers’ attendance attenuated the effect of mothers’ attendance on mothers’ affective quality. This result indicated that the effect of fathers’ attendance obscured the effect of mothers’ attendance.
**Child Management Practices.** In the second column of Table 2-4 are the results of the model predicting child management. The intercept score indicates that on the 0-4 scale, the expected post-intervention child management score for the average parent was 2.38. Baseline level of child management predicted post-intervention child management: for every one unit higher the baseline score, post-intervention child management was predicted to be 0.48 units higher \((p < .05)\). Attendance, initial engagement, and change in engagement remained non-significant in this model. Married mothers in the low dad attendance group were predicted to have child management scores that were 0.20 units higher compared to other groups \((p < .05)\). No other parameters were significantly different than zero, indicating that the relations of mothers’ attendance and engagement to her child management post intervention did not differ significantly by parental subsystem structure.

**Intervention-Targeted Parenting.** In the last column of Table 2-4 are the results of the model predicting intervention-targeted parenting. The intercept score indicates that on the 0-4 scale, the expected post-intervention targeted parenting score for the average parent was 3.07. Baseline level of targeted parenting predicted post-intervention targeted parenting: for every one unit higher the baseline score, post-intervention targeted parenting was predicted to be 0.57 units higher \((p < .05)\). Attendance, initial engagement, and change in engagement remained non-significant in this model. Depression predicted post-intervention targeted parenting: for every one symptom more mothers reported, targeted parenting at post-intervention was 0.01 unit lower than otherwise predicted. Additionally, married mothers with low partner attendance showed 0.15 units lower post-intervention targeted parenting than otherwise predicted compared to other mothers; that is, fathers’ attendance impacted mothers’ intervention-targeted parenting. No other parameters were significantly different than zero, indicating that the relations of mothers’ attendance and engagement to her targeted parenting post intervention did not differ significantly by parental subsystem structure.
Discussion

Summary and Conclusions

This study investigated whether mothers' attendance and engagement were associated with additional benefit from the intervention. Affective quality was expected to be a corollary of attendance and engagement in the program because SFP 10-14 teaches not only parenting skills appropriate for parenting pre-teens, but also encourages parents to see their child’s perspective, spend time with their child, and build a stronger relationship. Child management and intervention-targeted parenting skills were taught directly in the parent sessions of SFP 10-14. Indeed, this trial has shown that parents in this sample did show improvement in mothers’ report of affective quality and mothers’, fathers’, and youths’ report of aspects of child management and intervention-targeted parenting at post-intervention (Coatsworth et al., 2015).

Many previous studies have shown a relation between mothers’ attendance and intervention benefit, which we tested in the first set of regressions. This study further investigated this relation by analyzing: (a) whether the relation was stronger for mothers who have more influence on the parenting in their household (single parents), and (b) whether the relation was stronger when mothers were engaged during those sessions. We anticipated that there would be differences in program benefit based on levels of fathers’ attendance. Fathers’ engagement in interventions has been a focus of some researchers based on some research and assumptions that the participation of both parents in the parenting subsystem would boost a family’s benefit from intervention (e.g., Fabiano, 2007; Frank, Keown, Dittman, & Sanders, 2015). Although I did not test this hypothesis directly, the results show that differences in attendance among fathers did not boost program benefit for mother-youth outcomes except that low father attendance predicted less program benefit for one outcome compared to single-mother households.

I based my hypotheses in ideas supported by family systems and co-parenting perspectives: that parents constitute a parenting subsystem and parents coordinate parenting
behavior and may be influenced by each other. Therefore, I expected that change in mothers’ outcomes might depend on her own exposure and also on her partner’s exposure to the intervention. I predicted that the effect of mothers’ attendance might actually be diluted in two-parent families where the father attended few sessions or not at all because only one half of the parenting subsystem (the mother) was exposed to the program content. I also predicted that the effect of mother’s attendance on program benefit would be essentially a 1:1 relation, the mother constituting the entirety of the parenting subsystem. I thought there could be a synergistic effect of mothers attending the majority of sessions in a two-parent family where father attended the majority of sessions—evidence that both parents are working together to attempt change.

There was an effect of mother’s attendance on the affective quality outcome when accounting for baseline affective quality and both engagement variables. When adding the control variables and group variables, attendance becomes non-significant (B = 0.00). This suggests that the effect of attendance is obscured by some combination of mother depression, mother education, and parenting subsystem structure, although none of these variables was a significant predictor of post-intervention affective quality. Follow-up tests suggested that the interaction between mother’s attendance and father’s attendance may be obscuring this effect. I found no overall effect of mother’s attendance on child management and targeted parenting outcomes, and I did not see evidence that a mother’s attendance led to more or less change for some families compared to single mothers.

There was no synergistic effect of both parents attending, which would have been reflected in a more positive relation between mothers’ attendance and program benefit for families with high father attendance. Likewise, the effect of mothers’ attendance was not diminished by fathers attending fewer sessions, which would have been reflected in a less positive relation between mothers’ attendance and program benefit for families where the father attended few or no sessions.
There were no main effect differences in program benefit between families where fathers attended the majority of sessions, or not at all. I found that married mothers whose partners attend few sessions benefitted less from the intervention on the intervention-targeted parenting outcome (by 0.15 units), yet this difference could not be attributed to mothers’ attendance or engagement. This difference in benefit was also not due to a ceiling effect of the baseline intervention-targeted parenting scores for this group of married mothers; in fact, single mothers’ baseline intervention-targeted parenting scores were higher (M = 2.92) than those of married mothers whose partners attended few sessions (M = 2.74). Perhaps these mothers found it difficult to change these specific parenting practices because their partners had low motivation or had rejected the new strategies taught in SFP 10-14. More research is needed to determine if this is a true and meaningful result because the magnitude of this effect was small. The opposite effect was found for child management practices, where married mothers whose partners attended few sessions benefitted more from the intervention (by 0.20 units); again, this difference could not be attributed to mothers’ attendance or engagement. These effects of the low father attendance group together are not necessarily consistent, but may point to a pattern of fathers’ degree of attendance impacting mothers’ intervention benefit for some outcomes and her own attendance impacting her intervention benefit for other outcomes.

I had similar predictions for mothers’ initial engagement and increase in engagement, which also were not supported. I did not find evidence that mothers who engaged more or increased their engagement benefitted more than other mothers. These nonsignificant associations did not support our hypothesis that engagement in the sessions was the driving force of mothers’ skill uptake.

Limitations and Future Research

For engagement, this lack of association may be accounted for by low variability in our measurement of engagement. Assessing engagement on a 4-point scale (1-4) may not provide
sufficient conceptual space for the nuances of engagement, leaving most parents with ratings of 4 or 3 at each session (SD = 0.58) and very little change in their scores over time. Using a growth curve model, we found that a subsample of parents did significantly increase in their engagement over time, and there was some variability in the degree of increase (i.e., variability among groups of parents; Bamberger et al., 2014); Additionally, we found that there was some degree of variability among parents in their levels of engagement, so we were hopeful that this variability was meaningful. Yet, the amount of variability in the raw engagement measure is lower than for at least some previous studies (e.g., Nix et al., 2009 used a z-scored measure of engagement where the SD was 1.00 on a 5-point scale). Our scale may not be detecting meaningful changes in engagement that reflect either changes in parents’ uptake of skills and willingness to implement new parenting strategies in their homes or differences among parents. Thus, any influence of engagement on mothers’ outcomes may not be captured in our measurement of engagement.

Mothers’ attendance and engagement was not related to program benefit in this sample. This was not the first time attendance and program benefit were not related (e.g., Nix et al., 2009; Ogden & Hagan, 2008), but although engagement has been less often studied, it seems to be more consistently related to program benefit. Perhaps investigating attitudes or behaviors that may moderate or supersede the effects of attendance and engagement could be fruitful, such as motivation to change, practice/use of new parenting skills, or evaluation/appraisal of new parenting strategies.

Future studies should investigate aspects of engagement that our study did not assess, such as cognitive and affective engagement, and engagement in the principles and skills of the program at home/outside the sessions. To capture these aspects of engagement (i.e., immersion), future studies will need to use multiple informants, including self-report. It may also be enlightening to assess the degree to which parents discuss the intervention content and their coordinated plans to implement novel parenting strategies. To glean valuable data, future studies should use larger scales. In weekly and daily self-report, we have found 0-100 scales both are
easy for parents to interpret and provide meaningful variability in the data while capturing nuance. Studies implementing these strategies will be better poised to determine whether engagement is related to greater program benefit.
References


Table 2-1. Descriptive characteristics of mothers in the sample (N = 264)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Entire sample</th>
<th>Single mothers, group 1 (n = 75)</th>
<th>Married mothers high, group 2 (n = 86)</th>
<th>Married mothers low, group 3 (n = 58)</th>
<th>Married mothers no, group 4 (n = 45)</th>
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<td>Mean</td>
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<td>1.16</td>
<td>3.45</td>
<td>6.67</td>
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</tbody>
</table>

Note. No missing data unless otherwise noted. Married, no partner attendance is abbreviated as “Married mothers no”; married, low partner attendance is abbreviated as “married mothers low”; married, high partner attendance is abbreviated as “married mothers high”

<sup>1</sup> N = 263  <sup>2</sup> N = 263  <sup>3</sup> N = 257  <sup>4</sup> N = 263
Table 2-2. Correlations Among Study Variables

<table>
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<th>N</th>
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<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
<th>11.</th>
<th>12.</th>
<th>13.</th>
<th>14.</th>
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<td>1. tpp</td>
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<td></td>
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<td>0.36*</td>
<td>0.62*</td>
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<td>264</td>
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<td>0.08</td>
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<td>-0.14*</td>
<td>0.18*</td>
<td>0.16*</td>
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<tr>
<td>12. m/no</td>
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<td>264</td>
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<td>-0.04</td>
<td>0.00</td>
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<td>13. m/h</td>
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<td>264</td>
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<td>-0.13*</td>
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<td>-0.01</td>
<td>0.01</td>
<td>-0.07</td>
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<td>-0.00</td>
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<td>-0.00</td>
<td>-0.24*</td>
<td>-0.37*</td>
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</tbody>
</table>

Note. Tpp represents the targeted parenting scale score at post-intervention assessment; tpb represents the targeted parenting scale score at baseline assessment; cmp represents the child management scale score at post-intervention assessment; cmb represents the child management scale score at baseline assessment; aqp represents the affective quality scale score at post-intervention assessment; aqb represents the affective quality scale score at baseline assessment; m/no represents the married, partner no attendance group; m/h represents the married, partner high attendance group; m/l represents the married, partner low attendance group.

a centered
Table 2-3. Models regressing attendance and engagement variables on outcomes at post-intervention

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Affective Quality</th>
<th></th>
<th>Child Management</th>
<th></th>
<th>Intervention-Targeted Parenting</th>
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<td></td>
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<td>SE</td>
<td>Parameter estimate</td>
<td>SE</td>
<td>Parameter estimate</td>
<td>SE</td>
</tr>
<tr>
<td>Intercept</td>
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<td>2.46*</td>
<td>0.02</td>
<td>3.00*</td>
<td>0.02</td>
</tr>
<tr>
<td>Baseline</td>
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<td>0.05</td>
<td>0.47*</td>
<td>0.06</td>
<td>0.58*</td>
<td>0.05</td>
</tr>
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<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
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<td>0.01</td>
<td>0.12</td>
<td>0.01</td>
<td>0.12</td>
</tr>
<tr>
<td>Engagement, slope</td>
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<td>1.98</td>
<td>-0.54</td>
<td>1.39</td>
<td>0.83</td>
<td>1.44</td>
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</table>

* p < .05
Table 2-4. Models regressing parenting subsystem structure variables and their interactions on outcomes at post-intervention

<table>
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<th>Affective Quality</th>
<th>Child Management</th>
<th>Intervention-Targeted Parenting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter estimate</td>
<td>SE</td>
<td>Parameter estimate</td>
</tr>
<tr>
<td>Intercept</td>
<td>4.50*</td>
<td>0.07</td>
<td>2.38*</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.78*</td>
<td>0.05</td>
<td>0.48*</td>
</tr>
<tr>
<td>Attendance</td>
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<td>0.04</td>
<td>-0.02</td>
</tr>
<tr>
<td>Engagement, initial</td>
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</tr>
<tr>
<td>Engagement, slope</td>
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<td>5.09</td>
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</tr>
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<td>Depression</td>
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<td>0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td>Education</td>
<td>0.02</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Married, no partner attendance*</td>
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<td>0.11</td>
<td>0.02</td>
</tr>
<tr>
<td>Married, low partner attendance*</td>
<td>-0.05</td>
<td>0.11</td>
<td>0.20*</td>
</tr>
<tr>
<td>Married, high partner attendance*</td>
<td>0.04</td>
<td>0.10</td>
<td>0.13</td>
</tr>
<tr>
<td>No*attendance</td>
<td>0.01</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>Low*attendance</td>
<td>-0.05</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>High*attendance</td>
<td>-0.04</td>
<td>0.07</td>
<td>-0.01</td>
</tr>
<tr>
<td>No*initial engagement</td>
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<td>0.19</td>
</tr>
<tr>
<td>Low*initial engagement</td>
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<td>0.39</td>
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<td>High*initial engagement</td>
<td>-0.05</td>
<td>0.51</td>
<td>0.17</td>
</tr>
<tr>
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<td>7.18</td>
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<td>Low*engagement slope</td>
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<td>6.51</td>
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<tr>
<td>High*engagement slope</td>
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<td>6.00</td>
<td>3.92</td>
</tr>
</tbody>
</table>

Notes. Married, no partner attendance is abbreviated as “No”; married, low partner attendance is abbreviated as “Low”; married, high partner attendance is abbreviated as “High”

* compared to single moms (with no partner attendance)

* p < .05
Chapter 3

The Application of Intensive Longitudinal Methods to Investigate Change:
Stimulating the field of applied family research²

A paper published in the Clinical Child and Family Psychology Review
Katharine T. Bamberger

Consider the gold standard study design for evaluating the efficacy of an intervention with families—a randomized controlled trial (RCT) with standardized baseline and post-intervention assessments. In it, first, family members are assessed with questionnaires and sometimes observed to ascertain their baseline levels of functioning. Questionnaires are usually retrospective, asking family members to determine a single rating summarizing experiences in the last few months on indices of interactions, feelings, and/or behavior. These questionnaires give researchers a sense of family members’ functioning in broad strokes—general experiences and characteristics of the person and family. Then, families are randomized to conditions, including the treatment of interest and a control condition. After the intervention has concluded, family members are again assessed with questionnaires and observations to ascertain their current (post-intervention) level of functioning. This allows for evaluation macro timescale change—over months and years—in their general experiences and characteristics. Family members may be assessed numerous times after the intervention, usually after six months or more, or at developmental transitions to ascertain later levels of functioning. This assessment schedule has served the field well for addressing the overall efficacy of interventions programs based on group comparisons and change on a macro developmental timescale. For example, questions like—does the intervention group have a better developmental outcome than the comparison group on characteristic levels of affective quality —can be addressed with this assessment schedule. But,

what additionally important information can be gained from extending the RCT design with other assessment methods? The current paper will demonstrate the substantial value that incorporating intensive longitudinal methods (ILM)—in situ assessment at a micro timescale including moments, interpersonal interactions and days—into applied family research studies can add to yield insights into how interventions work for families.

To do this, I first define ILM, reviewing protocols, and their use, and advantages. I then summarize our current understanding of the mechanisms of family intervention programs, highlighting limitations of the current methodologies. Third, I review theoretical perspectives that emphasize family processes of intervention change to illustrate the rationale for assessing families at micro timescales. Fourth, I propose research questions that could be addressed using ILM and that would increase the depth and specificity of evaluation of family interventions. Finally, I review research demonstrating the feasibility and added value of ILM in both basic family research and intervention evaluation. The goal of this paper is to spur intervention scientists across the treatment spectrum to consider utilizing ILM in study designs to better understand families’ process of change and how family interventions work.

In this paper, I discuss the evaluation of family intervention programs. These are programs that engage parents and possibly additional family members to optimize family functioning and/or child development. I will be taking a broad perspective, encompassing all levels of intervention from universal prevention that invites all families to participate to treatment that aims to alleviate existing problems.

To answer the question posed earlier: what information can we gain from extending the traditional assessment schedule of the RCT with ILM, consider a second study with a different assessment schedule—a multiple timescale design overlaid on a RCT. Here, each family member reports on domains of daily life such as his/her own feelings, behavior, and interactions with other family members. Family members make these ratings based on the current day or current interpersonal interaction and do so in “bursts” of several days at baseline, during the intervention,
and again post-intervention. Because these assessments occur frequently and close to the time of the actual experience, such data can be used to evaluate changes at a micro timescale and estimate the functional form of change, which is not possible with traditional survey methods.

As prevention and intervention sciences increase their focus on understanding how interventions work, ILM can be used to further investigate within-subject change processes. Advantages of using ILM to understand intervention effects are discussed further below.

**Intensive Longitudinal Methods**

This paper will use the terms *intensive longitudinal methods* (ILM), *intensive repeated measure studies*, and *intensive longitudinal data* as labels for rapid *in situ* assessment protocols, studies that employ these protocols, and the resulting data, respectively (Bolger & Laurenceau, 2013). Intensive repeated measure studies use ILM to assess participants repeatedly in short intervals—often multiple times per day—conducting assessments *in situ*, as participants go about their lives. This method of assessment is ideal for capturing momentary experiences or characteristics, which Conner and Barrett (2012) refer to as the experiencing self. ILM encompass protocols including daily diaries, experience sampling, and ecological momentary assessment and can be used as a general term to describe any of these protocols (Stone & Shiffman, 1994; Smyth & Stone, 2003; Bolger, Davis, & Rafaeli, 2003; Laurenceau & Bolger, 2005).

The following is a review of various ILM protocols including their similarities, differences, and uses; see Table 1. Ecological momentary assessment refers to protocols that capture proximal experiences at a short micro timescale and can be contingent on intervals, events, or device signals—whichever matches the theoretical or empirical time course of the process being investigated (Stone & Shiffman, 1994). For example, sampling can occur at specified intervals such as every two hours, or after a specified event such as the enactment of a family routine (Shiffman, 2007; Stone & Shiffman, 1994). Experience sampling protocols, used
since the 1970s, are device-contingent protocols notifying participants at random moments of the day to record their current experience (Csikszentmihalyi, Larson & Prescott, 1977; Hektner, Schmidt, & Csikszentmihalyi, 2007). Beyond self-report measures, technological advances have made additional modes of intensive data collection possible, including passive data collection, which is often referred to as ambulatory assessment (Society for Ambulatory Assessment, 2014). Ambulatory assessment can be conducted on event, interval, and device-contingent protocols and can collect many types of data without user input such as Global Positioning System (GPS) location, nearby Bluetooth devices and Wi-Fi networks, accelerometer data/actigraphy, ambient sound (i.e., electronically activated recorder; EAR), video or photo recording, cardiac activity, respiration, and skin conductance (Trull & Ebner-Priemer, 2009; 2013).

Daily diaries are completed once per interval, generally at the end of each day to assess thoughts, feelings, behaviors, and/or experiences from that day, making their micro timescale longer than many other protocols. They have been used to study marital and family relationships and stress among other topics (e.g., Birditt, Nevitt, & Almeida, 2014; Grzywacz, Almeida, & McDonald, 2002; Scott, Sliwinski, Mogle, & Almeida, 2014; Sin, Graham-Engeland, & Almeida, 2015).

ILM have become increasingly popular due to both new technologies to administer these assessments (Shiffman, 2007; Smyth & Stone, 2003) and new statistical methodologies to fully exploit the intensive longitudinal data (Mehl & Conner, 2012; Walls & Schafer 2006). The major benefits of ILM are the measurement advantages that they confer, which make these methods ideal for investigating questions involving within-subject change and dynamic processes manifested as within-subject variability (Collins, 2006; Ram & Gerstorf, 2009; Sliwinski, 2008). ILM have three main advantages compared with retrospective self-report: (1) avoidance or minimization of retrospective recall bias (Stone, Shiffman, Atienza, & Nebeling, 2007), which is especially important for behaviors that are frequent and/or irregular and for assessing intensity of experience (Schwarz, 2007), (2) ecological validity of the assessment context, which is a benefit
over laboratory task-oriented observational methods (Stone et al., 2007), and (3) specificity of
temporal events, which allows the study of dynamic within-subject processes (Collins, 2006;
Stone et al., 2007; Stone & Shiffman, 1994). Because of these advantages, ILM provide
temporally rich and specific data. See Table 2 for a summary of differences between ILM and
retrospective assessment and the measurement and timescale benefits of ILM.

In family research, ILM allow an in-depth perspective on families’ lives (Larson &
Almeida, 1999). These methods capture family interactions that happen within a given day—
aspects of life that both directly contribute to development and are targeted in family
interventions (Smyth & Heron, 2014), yet which otherwise elude measurement. Because these
interactions recur with variation many times within the usual time frames specified for
questionnaires, it is often more difficult for participants to recall distinct interactions, and
therefore information about each interaction is lost. Capturing these interactions by assessing
individuals on a micro timescale is the added value of ILM—these methods allow estimation of
rapid change or fluctuation in within-family and within-person (i.e., within-subject) processes.

In intervention evaluation using multiple-timescale designs, we can examine intervention
effects on these dynamic characteristics and processes, which can only be captured by assessing
individuals on a micro timescale. Here, I take a moment to define dynamic characteristics and
processes (c.f., Ram & Gerstorf, 2009). These outcomes are integral to the advancements that can
be made by incorporating ILM in program evaluation designs. Dynamic characteristics can be
thought of as short-term (e.g., moment-to-moment or day-to-day), fluctuations that may be
characteristic of the person, his/her context or experience. They appear as time-unstructured (i.e.,
random) fluctuations. Conceptually, dynamic characteristics can be thought of as sensitivity,
lability, robustness, or plasticity. For example, fluctuations in affect may represent lability while
fluctuations in use of parenting skills/strategies may represent plasticity or willingness to try new
strategies. Also important to evaluating family interventions, dynamic processes are the time-
ordered processes of change viewed at a fine-grained timescale. Dynamic processes are smooth
changes that can be modeled by equations (e.g., sine curves, quadratic functions). Conceptually, they yield insight into short-term change processes such as skills uptake, adaptation, and homeostasis.

ILM can increase our knowledge of intervention effects in three ways presented in Table 3. First, they allow researchers to test for intervention-related change in momentary experiences and dynamic characteristics and processes, i.e., new outcomes that encompass variability in those behaviors, feelings, and interactions that occur in daily family life (Robbins & Kubiak, 2014). Second, ILM can chart intervention-related change as it occurs on the micro timescale and provide sufficient data to uncover the functional shape and causes of change and thus contribute to evidence of mechanisms (Bolger & Laurenceau, 2013; Shiffman, Stone, & Hufford, 2008). Comparisons among programs in the functional shape of change may also be useful. For example, a treatment where families begin changing as soon as the program begins and change more rapidly may be more desirable than a treatment where families reach the same level of change at the end of the study but have a delayed and slower rate of change. Third, ILM allow researchers to investigate which factors influence micro timescale change, including behavior, stable trait characteristics, and dynamic characteristics and processes. Although the benefits that ILM offer are substantial, these benefits are tempered with the realization that the use of ILM will increase participant burden by having more frequent, albeit brief, assessments. This may prove to be more costly, especially for higher-risk samples whose compliance in intensive assessment protocols may need to be closely monitored. The issue of burden is further discussed in the section on Challenges and Considerations.
Evidence for Family Programs

Efficacy of Family Programs

During the last 20 years there have been major advances in the evaluation and widespread dissemination of family prevention and treatment programs (IOM, 2009; Barrera & Sandler, 2006; Mrazek & Haggerty, 1994; Weisz, Sandler, Durlak, & Anton, 2005; Spoth et al., 2013). Reviews and meta-analyses show that programs work to prevent and treat a variety of outcomes (e.g., drug abuse, delinquent behavior) and promote competencies in a variety of populations (Barrera & Sandler, 2006; Weisz et al., 2005; Durlak & Wells, 1997; Curtis, Ronan, & Borduin, 2004; Thomas & Zimmer-Gembeck, 2007). However, the types of effects that have been evaluated have been limited to global outcomes (e.g., parents’ monitoring behavior, discipline, affective quality of relationships), macro-time effects (e.g., changes from baseline to post-intervention, over months), and between-person and between-group comparisons (e.g., comparing those assigned to the intervention to those assigned to the comparison group). We know very little about the dynamic processes involved in change, the functional shape of micro timescale change due to interventions, within-subject influences (e.g., what factors impact changes within persons across time) or about change in experiences and dynamic characteristics.

Mechanisms of Family Programs

Although the effectiveness of family programs is now well-documented, albeit in broad strokes, much less is known about how these evidence-based programs work. One way this has been pursued is through mediation analysis to uncover the mechanisms by which programs have their effects (Barrera & Sandler, 2006; Kazdin, 2004; Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011; Weisz et al., 2005). Intervention mechanisms are those changes in cognitions, affect, and behavior that account for the intervention’s effect on a certain outcome. For example, parent factors such as the quality and frequency of positive and hostile parent-child interactions,
sensitivity, and behavioral control are mechanisms that can be targeted by intervening with parents to impact child development (Lamborn, Mounts, Steinberg, & Dornbusch, 1991; Poulin, Nadeau, & Scaramella, 2012).

The following is a brief account of work that contributes to our understanding of intervention mechanisms. Rather than a comprehensive review, this section highlights research that investigates intervention mechanisms. The Nurse-Family Partnership (NFP), a home-visiting program for first-time high-risk mothers targets key risk and protective factors in the family’s life course. Three targeted risk factors; prenatal health behaviors, sensitive competent parenting, and parental life course decisions have been impacted in RCTs testing NFP’s effects (Olds, 2012). While these risk factors are hypothesized to be mechanisms of NFP’s effects on more distal factors, including later parental outcomes, child functioning, and child abuse and neglect injuries, their link with these distal factors has not been tested.

Variables that show statistical mediation are likely to be intervention mechanisms (unless they are proxies for processes that are not yet well understood). Recent mediation studies have revealed support or partial support for theories of the intervention and developmental theories of risk factors. Parent Management Training- Oregon Model (PMTO; Forgatch, 1994) is a parent intervention targeting parenting practices to ultimately impact child delinquency. PMTO is tested with divorced and single parents; divorce both confers risk associated with having a single parent and is a period of transition, making this sample ideal for efficacy trials. Mediation studies have shown that the intervention impacts parenting, and change in a global summary of parenting practices from baseline to year 1 was related to reductions in delinquency eight years later. Another model showed similar results for changes in parenting mediating year 9 arrest frequency (Forgatch, Patterson, Degarmo, & Beldavs, 2009). Similarly, with Somali and Pakistani mothers living in Norway, baseline to post-intervention changes in positive parenting and reduction in harsh discipline mediated PMTO’s effects on child conduct problems (Bjørknes, Kjøbli, Manger, & Jakobsen, 2012). A limitation of this study was that parenting practices and child conduct
problems were both assessed at the post-intervention time point. In another study, a theoretical model of cascading effects was tested, where PMTO was hypothesized to impact parenting, which would impact child behavior, which would impact parental depression, and these effects would cascade, affecting each other thereafter. Findings indicated that, changes in parenting from baseline to one year partially mediated latent growth in both internalizing and externalizing child behavior (DeGarmo, Patterson, & Forgatch, 2004).

Family Check Up (FCU; Dishion & Stormshak, 2007) is a tiered intervention targeting parenting practices and family functioning. Recent studies investigating multiple mediators and intervening variables of the FCU have found support for the following hypotheses using structural equation modeling. In one study, FCU improved family relationship quality over four years after the intervention which accounted for differences in parent monitoring and early sexual experience-- both of which were partial mediators of high-risk sexual behaviors across gender and race groups (Caruthers, Van Ryzin, & Dishion, 2014). In a study of the mediators of FCU’s impact on adolescent antisocial behaviors, change in family conflict over three years mediated the relation between change scores in parents’ behavior concerns at one year and adolescent antisocial behavior three years later (Fosco, Van Ryzin, Stormshak, & Dishion, 2014). In a report on FCU’s impact on obesity in young adulthood, improvements in parent-child relationship quality predicted intervening differences in eating attitudes in late adolescence, which predicted obesity in young adulthood (Van Ryzin & Nowicka, 2013). Healthy behaviors and depressive symptoms were found to not be mediating effects of obesity. These findings show the importance of mediation analysis for testing the theory of the intervention. However, these studies also show that studies are apt to miss measurements of intermediate change constructs (e.g., actual parenting behaviors at meal time) and possible indicators of time-varying individual differences (e.g., daily childhood eating attitudes and behaviors at meal time) due to absence of intensive data collection during the trial.
The above reviewed mediation studies illustrate recent findings on intervention mechanisms. These findings demonstrate that little is known about the process of change even when between-person mediators have been identified and when those mediators involve between-person differences in change over time. Results of between-person mediation, while productive, may not correspond to mechanisms of change for an individual (Molenaar, 2004). Sandler and colleagues (2011) reviewed parenting programs that have assessed longer-term outcomes (1 year+) in order to evaluate whether changes in parenting that had been identified as intervention mechanisms were in fact mediating child outcomes. Results indicated that a wide range of parenting programs affected both long-term child outcomes and parenting. The authors concluded that still little is known regarding the theory and process of long-lasting change (i.e., series or cascade of mechanisms).

ILM may shed light on this process of long-lasting change; for example, changes in families’ micro timescale interactions may accumulate and contribute to long-lasting change in family members and their relationships. ILM can be used to investigate within-subject processes that may mediate intervention effects (Heron & Smyth, 2010).

Also important in influencing the change process is participants’ active engagement in intervention programs. Learning can be influenced by personal characteristics and by factors outside of the intervention sessions like family members’ reactions to new tactics learned in an intervention, both of which are not observable by practitioners. It is possible to capture the dynamic and unobservable aspects of engagement with ILM (e.g., practice, self-reflection, motivation, and evaluation of the intervention). This can allow investigators to understand what participants do, think, and feel over the duration of the intervention to influence their own processes of change (Bamberger & Coatsworth, 2013; Bamberger, Coatsworth, Fosco, & Ram, 2014).
Theoretical Underpinnings

In this section, I review the theoretical underpinnings and rationale for using ILM in applied family research. Specifically, I connect the importance of theory-based momentary and dynamic micro timescale constructs to their assessment with ILM.

Dynamic Constructs in Developmental Theory

Families’ everyday interactions are among the most direct (i.e., proximal and constant) contributions to development (Bronfenbrenner & Morris, 1997; Sameroff & MacKenzie, 2003) and are influenced by the development of each family member (Schermanhorn & Cummings, 2008). Family interactions occur in micro timescales and accumulate over time, becoming of great importance to child outcomes (Bai & Repetti, 2015). Thus, directly assessing these interactions in real time as they are experienced by parents and child may yield new insights into development (Bai & Repetti, 2015; Laurenceau & Bolger, 2005; Smyth & Heron, 2014).

This idea of the importance of momentary experience is shared across multiple theoretical perspectives. Bronfenbrenner places the family at the central hub of the bioecological model, both influencing development directly from its own characteristics and processes and as the mediating factor for indirect effects of contextual influence (1986). In this formulation, Bronfenbrenner viewed the family as exerting influence through “family processes”, such as parenting behaviors like reciprocal verbal interactions (1986, p.724). Bidirectional influences within a family system are also emphasized in system theories (Cox & Paley, 1997; Minuchin & Fishman, 1981; Sameroff & Fiese, 2000). Family systems theory suggests that systems develop over micro timescales through amplifying and dampening variations in individuals’ behavior and interactions; positive feedback amplifies and provides the possibility of novelty, and negative feedback dampens variations and tends to encourage stability (Granic, Dishion, & Hollenstein, 2003). Modeling system processes is a promising avenue for uncovering developmental and
intervention change processes in the family because new patterns of interaction may emerge, and
this emergence can be modeled at the level of individual interactions over time (Fosco,
Bumbarger, Bamberger, & Van Ryzin, 2015; Granic, Dishion, & Hollenstein, 2003;
Schermherhorn & Cummings, 2008). In the ecocultural framework, everyday activities and
routines both carry cultural meaning and are the natural units of experience for family members
(Weisner, 2002). This framework suggests that family routines that are meaningful and consistent
with the family’s cultural values, fitting the family’s resources, providing predictability, and
balancing family members’ interests/reducing conflict, will produce well-being (Weisner, 2010;
Weisner, Matheson, Coots, & Bernheimer, 2005). Assessing families in a micro timescale with
ILM can provide a rich dynamic picture of the family change process (Shiffman et al., 2008) from
these theoretical perspectives.

**Dynamic Constructs in Family Intervention Theory**

In terms of the types of change interventions induce in families, interventions differ in
their implicit (or sometimes explicit) theories of change. Two main possibilities include
disrupting the family’s homeostasis to allow for more functional, healthy patterns of interaction to
emerge (as in family therapy) and, alternatively, additively improving functioning by building on
family members’ skills and competencies (implicit as skill-building interventions’ theory of
change). ILM can allow researchers to directly test theories of change by modeling indicators of
functioning throughout the period of change to determine whether these outcomes gradually
improve or show a period of disruption and variability.

Assessment on micro timescales may be especially sensitive to detecting changes (e.g.,
changes in momentary experiences that have not yet accumulated to impact broader outcomes or
global perceptions) and therefore especially useful for the evaluation of preventive interventions
and in microtrials of intervention components (Leijten et al., 2015), which may in the short-term
show small changes that cascade later in development. Examples of momentary experiential
outcomes include affective quality of a parent-child interaction, child behavior, child internal states, and lability of these daily experiences.

ILM can capture minute changes in mediating interactions that can be expected to repeat and accumulate over longer periods of time and predict cascading changes in children and parents. Hypothesized mechanisms that involve day-to-day behaviors and interactions include: family chaos, positive family routines, calm reactions to disclosure, appropriate behavior management, emotion coaching, and responsive parenting.

The Application of Intensive Longitudinal Methods to Applied Family Research

Theoretical perspectives on change processes that occur on a micro timescale inform what trajectories can be expected, and guide assessment timing and spacing, research questions, and data analysis. In this section I focus on measurement timing, new research questions and suggest an example study that could advance research on the intervention change process and provide valuable information for clinical practice.

Measuring Processes on a Micro Timescale

To best assess the dynamic processes occurring rapidly in micro timescales such as the course of change and intervention mechanisms, participants should be assessed as the intervention is delivered to capture the beginning and course of the change process. To capture the change process, which may be complex and recursive, frequency of assessment during this period necessarily should be high—randomly sampling moments throughout the day, for example. As mentioned above, these methods closely match theories of development and theories of change of many family interventions, which suggest complex short-term change processes in parenting behaviors and family interactions such as reactivity to changes in family members’ behavior, system adaptation, negative feedback loops, escalation within an interaction, disruption to homeostasis, and systematic effects of nonlinear time such as day of the week. In order to use
intensive longitudinal assessment to examine macro timescale intervention efficacy on impacting dynamic characteristics and momentary experiences, participants should be assessed intensively at baseline and, at a minimum, at one post intervention burst in a multiple timescale design (Nesselroade, 1991; Sliwinski, 2008). In addition to these decisions about macro timescale assessment timing, attention should be paid to the timing of assessment at the micro timescale as with dynamic processes, above, to achieve valid measurement of dynamic constructs and their variability in each burst. Figure 1 shows how frequency and timing of measurement will impact conclusions about the trajectory of a construct over micro time. That is, assessments must be matched with the rapidity of the fluctuation or change lest the within-subject variability be underestimated or the process of change be misestimated. Timing assessments to capture critical moments of change can help to minimize the frequency of assessments needed.

Taking these recommendations together results in the recommended protocol of assessment bursts at baseline, during, and post intervention. This protocol will cover macro timescale change using comparisons between baseline and post-intervention bursts. Additionally, this protocol will cover the medium timescale process of change within the “during intervention” burst. The researcher will need to refer to previous repeated measure studies and theory specific to the constructs of interest to determine the appropriate assessment frequency and timing in the micro timescale within each burst.

**An Example Intervention and Intensive Protocol**

Here, I present an example intervention and study design on which research questions in the subsequent section are based. This family treatment program that targets enforcing rules calmly, and the reduction of negative/harsh communication and escalating conflict in families that are referred. The long-term outcomes include improved child mental health and improved family functioning (e.g., parent-child closeness). The intervention targets of this program can be measured by ILM to obtain a fine-grained dynamic picture of the variability and changes in each
target across time, and the relations among these aspects of functioning over time. Control families are also assessed for comparison. This could provide valuable information about the inner workings of this intervention.

An intensive repeated measures study with mothers, fathers, and children participating in this intervention might assess family members over a sampling of moments each day for two weeks at baseline, during, and post-intervention (i.e., interval or device contingent). Because the constructs of interest are highly variable throughout the day and can be context-based, assessment frequency is high at 5 assessments per day. Important to analysis strategies and for triangulating perspectives across family members, all members in a family are assessed on the same sampling schedule. Questions are rated on sliding scales of 0-100.

At each of the moments sampled, the protocol includes items assessing intervention-targeted outcomes: family members’ feelings about their family relationships (e.g., parent-child closeness) and internal states (e.g., affect, stress and distress, and internalizing symptoms) in that moment. The protocol also includes items assessing the targeted mechanisms of negative communication and escalating conflict. So that the information gathered is fine-grained and specific to that conflict, details are collected at the sampled moments about the most recent conflict. Family members are also asked to rate calm rules enforcement with regard to the interval since the previous assessment. The micro timescale assessed in this study is within-day, and due to the differing variabilities across constructs, the assessment protocol differs slightly at this micro timescale for each construct (i.e., affect is moment-specific, conflict intensity is conflict-specific, and rules enforcement is interval-specific).

**Some Research Questions Made Possible by ILM**

Table 4 maps a selection of the research questions proposed here and examples of appropriate statistical techniques. The treatment program itself can be tested as a between-subjects predictor of treatment effects. For example, (A) does the family treatment program
stabilize within-day variability in distress, affect, and internalizing symptoms compared to control families? This question focuses on differences in micro timescale dynamic constructs. Variability as a dynamic construct in mental health may be considered instability or vulnerability, although some variability is normal responsiveness to the context. Also, (B) does the family treatment program decrease the frequency and intensity of family conflict events over time, especially between the child and his/her parent? In this research question, ILM contributes measurement benefits of frequency and intensity of conflict and may allow for within-family analysis.

Models of within-subject change might also be investigated to determine the functional form of change. During intervention, change may be non-existent, smooth or fluctuating. Interactions between parents and their child may fluctuate more during periods of change in parenting as an indicator of system disequilibrium. (C) Does practice of new skills disrupt family homeostasis resulting in a period of fluctuation in a family’s level of adaptive functioning? For example, a parent who has not enforced rules before may be met with a child’s backlash or confusion as parent and child pave new patterns of interaction. Alternatively or perhaps co-occurring, (D) do families in the intervention program show a smooth increase in the average rating of closeness over the weeks of the intervention?

For family members assigned to the intervention, the path of change among family members can be examined. Within the coparenting subsystem, (E) does the father’s change in parenting such as beginning to enforce rules calmly influence the mother’s use of that skill on the following day? Or vice versa? Intervention effects may evolve in recursive ways, with changes in some family members influencing or eliciting change in other family members. ILM provides the temporal specificity needed to determine the influence among family members on change processes.

Researchers can examine the relations among constructs over time for families assigned to the intervention. For example, intensive assessment of the intensity of family conflicts and of child internal states allows one to understand how conflict intensity and internal states co-occur
over time for each child. Beyond covariation, on days when a child reports having more intense conflict with his/her mother, the child may experience more distress. Intervention studies can investigate (G) whether treatment leads to decoupling of conflict and symptoms such that family conflict does not lead to mental health problems. Alternatively, (G) a decrease in conflict intensity may mediate an intervention’s decrease in mental health problems. Practice of new skills is the beginning of generalization and change, so investigating the application of new skills at home may provide insight into the change process. For example, (H) on days when a parent practices enforcing rules calmly, is the relationship with his/her child affectively more positive and closer?

Common approaches to analyzing intensive data include variations of the multi-level model. Multilevel within-subject mediation and within-subject causal models are common methods used to model dynamic mechanisms and mediating processes (Bauer, Preacher, & Gil, 2006; Nezlek, 2001; Schwartz & Stone, 2007). With appropriate intensive longitudinal data, these models can provide an understanding of whether parents and children behave differently on days following versus preceding intervention modules and what factors contribute to higher-functioning days. For example, for one family, on occasions when a parent’s monitoring behavior is higher than usual, child behavior is improved whereas in another family, on occasions when a parent’s monitoring is higher than his/her usual level of monitoring, the child acts out. In this case, the direction and magnitude of within-subject mediation of monitoring is different among families and may not represent the results of between-subject mediation. Each parent in the within-subject mediation analysis has a unique estimated parameter to explain the unique relation between their monitoring and their child’s behavior (see Bolger and Laurenceau, 2013, pp 177-195; Bauer et al., 2006). In a basic research analysis focused on these within-subject associations, Telzer & Fuligni (2009) found that on days when adolescents spent more time helping family members, they were happier, an association that was accounted for by higher feelings of role fulfillment on those days and was stronger for adolescents with better family relationships.

Multivariate time-series models such as bivariate (i.e., dual or paired) multilevel models are
common methods used to model linkages among family members’ change processes because outcomes of both members of a dyad can be modeled simultaneously in a single model (Laurenceau & Bolger, 2012; e.g., Granic, Hollenstein, Dishion & Patterson, 2003; Saxbe & Repetti, 2010). The heterogeneous variance multilevel model allows predictors of variance in (not just level of) the outcome (e.g., Hedeker et al., 2002). For example, this can be used to test the hypothesis that families attending the intervention show more day-to-day variance during the intervention as a time of disruption and change compared to non-attending families (i.e., families not experiencing disruption).

In determining the functional form of change, a large and increasing variety of mathematical equations are available, which allows the flexibility to test specific hypotheses and parameters of growth or change and with varying purposes such as summarizing the shape of change across a sample, and determining patterns in variability. Some of the most commonly used techniques include nonlinear multi-level models (e.g., Fritz, 2014; Ram & Grimm, 2007; Teachman, 2014), and dynamic models (e.g., Chow, Mattson, & Messinger, 2014; Ram, Shiyko, Lunkenheimer, Doerksen, & Conroy, 2014), or using statistical summaries of within-subject (i.e., intraindividual) variability (c.f., Ram & Gerstorf, 2009).

**An Example Study to Build on Prior Research**

An excellent example of using ILM to illuminate the process of intervention change and the role of within-subject mechanisms that contribute to change would be to supplement the exciting qualitative work that has been done by Holtrop, Parra-Cardona, and Forgatch (2014) on the processes of change experienced by parents using the Parent Management Training- Oregon (PMTO) model. Holtrop and colleagues used sequential coding of parents’ interviews on their experiences with PMTO based on grounded theory to examine the process of change. They found that attempting to change, appraising the PMTO parenting strategies, and applying the skills were stages of parents’ reports of change. Appraising happened throughout the learning process and
fed into future attempts to use skills. In the long term, parents often reported inconsistent use of PMTO strategies because they no longer need such serious strategies to manage their child’s behavior (Holtrop et al.). This type of study provides an important foundation for more deeply understanding the process of change, including its cyclical nature, and influences on change such as parents’ evaluation of the methods taught in a program.

By collecting information while these change processes occur in daily life, ILM can both corroborate and add temporal specificity to the change process described by Holtrop and colleagues. To verify parents’ sense that attempting to change and appraising skills influenced skill use, an intensive repeated measures study could empirically investigate: what time-varying or stable factors influence the use of skills on subsequent days? To verify parents’ sense of not needing skills as the reason for discontinuing skill use, an intensive repeated measures study could empirically investigate: what factors precipitate a decrease in skill use—improved child behavior, parent stress, changes in context? Expanding on their line of questioning, research questions might be, Is parents’ skill use consistent day-to-day, or does it show significant variability? Does appraisal of skills change over time: during the session, throughout the week, through the duration of the intervention? Does the use of a skill (successful vs. unsuccessful use) impact the appraisal of that skill? Is the use of skills more common on days that the child goes to school, the child misbehaves, or the parent feels less stressed? Is the child better behaved on days following high parent skill use?

Use of Intensive Longitudinal Methods in Clinical and Prevention Practice

ILM can be used to monitor treatment success by assessing constructs of targeted change throughout implementation (Bai & Repetti, 2015; Chorpita et al., 2010; Trull & Ebner-Priemer, 2009). Throughout a program, practitioners can use participants’ frequent reports to improve the likelihood of treatment success (Trull & Ebner-Priemer, 2013). For example, review of and feedback on participants’ intensive data may boost treatment effects (c.f., Rofey et al., 2010).
Support can be initiated with parents one-on-one as a second-line additive intervention to overcome barriers such as low motivation when intensive data suggest the parent may be less likely to respond to treatment (c.f., Burns et al., 2011). Additionally, practitioners can conduct adjunctive one-on-one sessions with parents who may be struggling in order to reinforce skills or provide additional treatment; for example, coaching parents on skills that are reported as being used infrequently may help parents practice and improve these skills. Coaching has been an effective method in eliciting parents’ behavior change in intervention programs (Barnett, Niec, & Acevedo-Polakovich, 2014; Guttentag, 2014). More broadly, by monitoring outcomes such as psychological symptoms, experiences, and behavior along with their contexts, participants provide more accurate information to practitioners about the patterns and covariations among these occurrences allowing practitioners to develop better treatment plans (Myin-Germeys, Birchwood, & Kwapii, 2011). Intensive data could then be used to track outcomes and evaluate the effectiveness of additional support provided to improve treatment success.

Related Current Applications of Intensive Longitudinal Methods

In our own work, we have utilized daily assessments during a family intervention and found that attendance was positively related to the day-to-day variability in reports of outcomes, potentially reflecting the disruption and change process that occurs with a family system’s exposure to an intervention (Bamberger, Ram, Greenberg, & Fosco, in preparation). Besides this single application to family intervention evaluation, researchers have begun using ILM across many fields of research. Here, I summarize some of those most closely connected to applied family research—intervention evaluation and basic family research, which can guide future applications of ILM to family intervention evaluation in the absence of more directly related studies.
Evaluation of Interventions on a Micro Timescale

Intervention studies outside the area of family research have been quite promising in using ILM to advance scientific knowledge. Most studies have used ILM to assess intervention effects on momentary and dynamic experiences, but other contributions include novel approaches to modeling change processes and prediction of treatment impact using momentary experiences at baseline.

In therapy and behavioral interventions, intensive repeated measures studies have investigated intervention effects and tested theories of change. One study evaluated a drinking intervention (moderation training) with adults and revealed that ILM constituted a feasible way to evaluate this intervention and found that, among other variables, episode-specific mood predicted excessive drinking during a drinking episode (R. L. Collins, Morsheimer, Shiffman, Paty, Gnys, & Papandonatos, 1998). In an evaluation of a structured writing intervention on objective arthritis and asthma indicators, Smyth and colleagues found that intensively assessed mood and health behaviors did not mediate the significant intervention effects at either the between-subjects or within-subject level (reported in Smyth & Stone, 2003). In a comparative treatment study for anxiety in children and adolescents, Cognitive Behavioral Therapy (CBT) but not Child-Centered Therapy was associated with lower peak negative affect within the hour prior to random assessment calls at the end of treatment (week 12 and post-treatment) compared to week 4 of treatment (Silk et al., in press).

Recent medical studies have also shown that ILM advances evaluation science. In treatment of child and adolescent depression and anxiety, one study found that momentary positive affect and the ratio of momentary positive to negative affect on the week before treatment predicted treatment impact in symptom severity, while self-reported (retrospective/trait) symptoms at baseline did not (Forbes et al., 2012). This study demonstrates the validity and added benefit of ILM and the current experiences that they assess.
Perhaps the type of interventions most tied to intensive assessment in the research literature is ecological momentary interventions (i.e., EMI, mHealth interventions)—interventions delivered *in situ* and in the moment such as messages delivered on smart phones (Heron & Smyth, 2010; Riley et al., 2011). Intensive assessment is inherent in many EMIs because information from the participant is used to inform the delivery of intervention messages, especially in individualized and tailored EMI (Elfeddali, Bolman, & de Vries, 2012; Rotheram-Borus et al., 2012). ILM have been applied to the evaluation of EMI with varying degrees of sophistication, and certainly can be leveraged to evaluate these programs to a greater degree (Heron & Smyth, 2010; e.g., Voogt, Kuntsche, Kleinjan, & Engels, 2014).

Although ILM have not been applied to the evaluation of family interventions, the application of ILM to other types of interventions shows great potential and feasibility for this avenue of research.

*Research with Families on a Micro Timescale*

Family researchers have begun applying ILM to basic family research (for a recent review see Repetti, Reynolds & Sears, 2015). Studies have reported good compliance and feasibility of ILM with a variety of samples including with parents and children; for example, a 56-day (two-month) protocol of five-minute daily diaries was feasible for parents and their 8-13 year olds (Robles, Reynolds, Repetti, & Chung, 2013).

Family research has shown that ILM capture valid and important daily family interactions that are related to outcomes. For example, studies have shown that family tension and conflict are interrelated among family subsystems and relate to outcomes such as distress and positivity: Tense interactions between parents spill over to parents’ tense interactions with children the next day (Almeida, Wethington, & Chandler, 1999). Parent-adolescent conflict is the mediator by which day-to-day interparental conflict leads to adolescent emotional distress (Chung, Flook & Fuligni, 2009). On days when adolescents experience interparental conflict, adolescents are more
distressed than on other days (Chung et al., 2009). This research illuminates the path by which interparental subsystem functioning may impact the adolescent on a day-to-day basis. These findings reflect a broader principle of spillover (especially of negativity) from one family subsystem to another, which can only be modeled with intensive longitudinal data collected once or more daily (Larson & Almeida, 1999; Repetti, 1987).

Research has also revealed time-trends in family conflict along with time-varying interplay of conflict and well-being among family members. Almeida and McDonald (1998) found that parent-adolescent tension shows rhythms in frequency across days of the week, and the occurrence of tension was predicted by parents’ work-related and home-related stress, especially mothers’ home stress. Within the family system, parent-child tension was similar for both parents, determined for both parents by mothers’ stress and spouse-child tension. It seems that day-to-day conflicts are sources of distress for parents, more so than for adolescents (Steinberg, 2001), and the repetition of conflicts impacts mothers’ mental health (Silverberg & Steinberg, 1987 as cited in Steinberg, 2001). In addition, girls who report a large proportion of days getting along with their family have low levels of internalizing comparable to those of boys (Telzer & Fuligni, 2013). Broadly, this line of research demonstrates that there are reciprocal effects between the adolescent and the parent within the family system; because such feedback loops are rapid processes, they can only be modeled with intensive longitudinal data collected at the interaction-up to the daily-level.

Other studies focus on interactional dynamics within the family (Fuligni, 2014). For example, between conflict events, wives’ positivity was not predictable, but husband’s positivity was predicted by wives’ positivity from the previous conflict episode (Schernerhorn Chow, & Cummings, 2010). Ferrer and Helm (2013) have shown that couples co-regulate their heart rates and respiration rates in laboratory tasks, and that the degree to which females’ physiology changes to match their partner’s physiology is associated with the degree to which their daily reported affect changed to match their partner’s. This synchrony occurs as persons become more
similar and change together across time and can be modeled with many data points from each person in a couple.

In summary, basic research with families using ILM is beginning to lead to greater precision and specificity in our understanding of family dynamics, interactions, and the ways in which they impact family members’ well-being and development. ILM expands the research agenda by allowing measurement of these rapid family dynamics. Both the areas of basic family research and intervention evaluation have benefitted from using ILM specifically in the areas of complex temporal processes in the micro timescale and predictors of within-subject effects. In a similar manner to the above advances in basic family research, ILM can be leveraged to understand families as they undergo change in an intervention (Bolger and Laurenceau, 2013; Smyth and Stone, 2003).

**Challenges and Considerations**

There are many considerations in designing an intensive repeated measures study to achieve the benefits of ILM and address new research questions. Decisions among assessment protocols—such as whether interval-, event-, and/or signal-contingency is used and frequency of assessment in the micro timescale—should be made to capture within-subject variability in the constructs of interest (e.g., are processes of interest occurring day-to-day or interaction-to-interaction?). This should be balanced with participant burden to ensure that adequate data are collected but not so much data as to cause undue burden to participants. Timing of assessments bursts should be conducted at theoretically relevant time points in the macro timescale as well in order to further our understanding of change processes (e.g., consideration of the expected timing of change and maintenance or fade out).

There are substantial advantages to using ILM in applied family research, but, there are challenges that come with their use. The number and frequency of assessments in intensive repeated measures studies calls for frequent introspection and recall, which could result in
participant reactivity (Repetti, Reynolds, & Sears, 2015; Bolger & Laurenceau, 2013). Reactivity results to the extent that participants are influenced by their own increased attention to and evaluation of the assessed constructs and respond by changing their behavior—such as decreasing or increasing the number of “events” they experience in event-contingent designs, or attempting to enact more personally acceptable behavior. This is not a phenomenon of changing responses (e.g., social desirability bias) but rather changing actual behavior. There is not much evidence published to support or refute reactivity effects in the context of intensive repeated measures studies, but reactivity may be more likely in study designs that involve several assessments per day. Some researchers suggest that ILM can be perceived as unintrusive and may not alter daily life (Ho & Intille, 2005; Smyth & Heron, 2014). One study had mixed conclusions about whether event-contingent assessment multiple times per day resulted in greater reactivity than end of day assessment in a two-week protocol (Merrilee, Goeke-Morey, & Cummings, 2008); specifically, no differences in husbands’ or wives’ behavior were noted in observation of conflict tasks completed after the reporting period, yet husbands’ daily reports of global marital quality declined over time in only the event-contingent group. Runyan and colleagues (2013) have used ILM as an intervention targeting self-awareness through repeated introspection, yet increased self-awareness does not necessarily lead to changes in behavior, and even in this study decreased compliance across the study could have contributed to statistical differences in reported behavior. On one hand, repeated assessment and resulting reactivity could be viewed as a comparatively easy and potentially effective intervention to the extent that reactivity supports positive change; on another hand, this effect calls into question the external validity of the depiction of daily life that can be garnered from ILM.

In addition, although ILM can be perceived as unintrusive, the timing and frequency of data collection may cause significant participant burden, which may result in issues with compliance, fatigue, or drop-out (Repetti, Reynolds, & Sears, 2015; Bolger & Laurenceau, 2013). In device-contingent and interval-contingent designs, time-stamping completed responses allows
researchers to evaluate participant compliance with the assessment protocol; on-time completion rates are usually acceptable in these designs especially with additional incentives and other strategies to increase compliance, but compliance is difficult to determine in event-contingent designs because event occurrence often cannot be verified when surveys are not completed. Also problematic, compliance may wane over the study period due to fatigue. Because of this risk, measures must be brief and questions must not be cognitively demanding (Stone & Shiffman, 1994). As a result, lengthy standardized questionnaires developed for retrospective data collection cannot be used in intensive repeated measures studies. Yet, current states and experience can be captured accurately and quickly. With few, brief items per construct and sliding scales with large ranges, within-subject variability is captured most accurately, making this type of measurement appropriate for the research questions that ILM addresses. In the context of an intervention study, we have found that intensive daily data collection is acceptable for a volunteer group of parents based on post-study satisfaction surveys and produces useful data demonstrating the complexity and nature of the change process (Bamberger, Ram, Greenberg, & Fosco, in preparation).

Because participants will be responding to the same questions time and again, training participants to use new technologies and interfaces along with the meaning of assessment questions and, in event-contingent designs, definitions of events is useful for data quality (Stone & Shiffman, 1994). Yet, training each participant may be logistically difficult, and some aspects of a protocol in which adults would need training may be even more difficult for young children.

It is yet to be seen whether children younger than about eight years of age can complete these assessment protocols, which could be of concern for family researchers who focus on families with young children. Otherwise, children are often familiar with the devices and technology that are often used for ILM, and guided interaction can be used to familiarize children with new interfaces (Plowman & Stephen, 2007). Additionally, because of the low cognitive demands of the brief measures used in ILM, there is reason to believe that even young children may be able to complete thoughtfully constructed protocols.
ILM capture information about all or a sample of moments in the participant’s life, creating an abundance of data. Yet, in predicting long-term developmental outcomes, it cannot be assumed that each moment is of equal importance in its contribution. Thus, researchers will be tasked with using lots of available data to obtain meaningful summaries of experience that relate to these long-term outcomes. This task may prove challenging, and for the purpose of predicting long-term outcomes, may not be more useful than asking a participant to summarize their experience into retrospective reports of constructs of interest. While it remains to be seen whether intensive longitudinal data is useful and efficient for this type of research, intensive longitudinal assessment is very likely to be ground-breaking in its usefulness in modeling dynamic characteristics and processes.

Depending on the technology and interface used, compliance enhancements necessary, and training involved in a given ILM protocol, this method of data collection can be costly. Thus, ILM should be used to answer research questions that require this method not simply to produce large amounts of data.

**Resources for Designing Intensive Repeated Measures Studies and Using Intensive Longitudinal Data**

Researchers interested in applying ILM to evaluating family intervention programs can consult several noteworthy sources for practical considerations of study design, measurement, and data analysis.

Stone, Shiffman, Atienza, and Nebeling (2007) introduce the historical development of ILM (here, “EMA”) with a useful summary of rationale, benefits, and challenges of ILM. There is a brief guide on analysis of intensive longitudinal data. The editors also include examples of research using ILM in behavioral and medical health fields. Perhaps most useful to researchers new to using ILM is a chapter discussing study design, which details the considerations of matching the time sampling protocol to the timing of experiences of interest.
Mehl and Conner (2012) have edited a volume that is entitled and can indeed be thought of as a handbook of ILM. They include theoretical rationales for collecting data in the real world, in real time, and within person (many repeated measures), which I have covered here more specifically as family and developmental theories and the goals of applied family research. The chapters also go into great depth on the wide variety of protocols and technology that can be used in ILM and considerations for choosing among these in designing a study, which I have only covered cursorily. Also covered are a wide variety of statistical modeling strategies that can be applied to intensive longitudinal data structures, which go beyond the examples that I have included throughout this paper. Some applied family researchers may also find useful the chapters on the application of ILM to specific fields of psychology, especially perhaps, chapters on the application to the fields of close relationships, developmental psychology, and clinical psychology.

Diehl, Hooker, & Sliwinski (2015) provide a conceptual focus on the dynamic constructs across the lifespan that can be assessed with ILM, reviewing previous work that examines within-subject variability in these constructs. Later chapters also cover the developmental significance of within-subject variability, including its relation to long-term developmental change and its role in understanding complex developmental processes.

Bolger and Laurenceau (2013) and Walls and Schafer (2006) have focused on the analysis of intensive longitudinal data. Bolger and Laurenceau briefly describe the method and types of study designs. The authors focus on analysis in several chapters that serve as a step-by-step guide to implementing common analyses with intensive longitudinal data. They include code for SPSS, SAS, R, and other statistics programs, write-ups of results, and recommended further reading for each analysis model. Walls and Schafer provide a chapter each on advanced modeling strategies for intensive longitudinal data, including state-space modeling and systems modeling among many others. Ram and Gerstorf (2009) also discuss analysis, focusing on within-subject variability and many statistical methods to explore it.
These and additional noteworthy and applicable resources can be found in the References section indicated by asterisks.

**Recommendations**

Evaluating change processes in interventions requires methodological and analytical innovation because the established long intervals between baseline and post assessments make detection of mechanisms and processes difficult (Kazdin, 2007). Additionally, innovation is necessary to measure dynamic characteristics and processes and link these micro timescale constructs with intervention-induced change over macro timescales. ILM, especially multiple timescale design, is an innovation that can be applied with intervention participants to make these advancements.

In carrying out multiple timescale designs, I recommend that applied family researchers (1) assess participants in their evaluation studies using ILM in bursts at baseline, throughout the intervention, and after the intervention at theoretically important time points in the macro timescale to capture the intervention change process. Specifically, separating bursts by two weeks to four weeks may allow researchers to capture these periods while giving participants a break between bursts to minimize burden, though the ideal timing, length, and separation of bursts may differ among intervention curricula.

I recommend that applied family researchers (2) consider the theoretical and empirical micro timescales of change and variability for each construct when determining the intensive assessment schedule to ensure that enough data is collected to model within-subject processes and dynamic constructs while minimizing participant burden. Because the ideal frequency of assessments within each burst is highly dependent on both the constructs of interest and the frequency of delivery and the theory of change of the intervention curriculum, researchers must be very thoughtful about this aspect of the study design.
I recommend that applied family researchers (3) employ training, compliance monitoring, and incentives to maximize participant compliance in intensive repeated measure study designs. Training should also be used to ensure comprehension of the questions and rating scales. There are few things worse than investing resources for seven weeks of daily data and receiving only a few days’ surveys from some participants. The reliability of within-subject estimates of variability and change can be low for participants giving so few points of information over time. Making the device and interface easily accessible goes a long way toward compliance. Active efforts to train, touch base with participants, and communicate that the data matter to the researchers are best practice because they increase compliance even further.

The most useful applications of ILM utilize the many data points that each participant provides, answering questions that cannot be addressed by other (less intensive) study designs. I recommend that applied family researchers (4) use ILM to investigate within-subject processes of change during and after an intervention (e.g., mediators, influences among family members, shape of change). Research questions about within-subject change utilize the time-structure of participants’ data points and may elucidate the process by which interventions have their effects on families.

I recommend that applied family researchers (5) use ILM to investigate intervention effects on within-subject variability (e.g., lability, sensitivity, homeostasis). Research questions about within-subject variability utilize summaries of the variability in participants’ data. Besides or instead of impacting the overall level of positive affect, for example, interventions may decrease lability in affect from unhealthy to healthy levels. Changes in variability may indicate increases or decreases in the stability of a family system. By addressing research questions on within-subject change and variability, studies using ILM and corresponding statistical methods to evaluate family interventions will contribute substantially to the understanding of intervention effects and change processes in families.
References


Bamberger, K., Ram, N., Greenberg, M.T., & Fosco, G.M. (in preparation). A test of family system change in a prevention program: Heterogeneous variance in intensively assessed day-to-day functioning.


Teachman, J. (2014). Latent growth curve models with random and fixed effects. In S.M. McHale, P. Amato, and A. Booth (Eds.), Emerging Methods in Family Research (pp. 3-17). National Symposium on Family Research. New York, NY: Springer. doi: 10.1007/978-3-319-01562-0


Table 3-1. ILM protocols based on timescale and contingency using parent’s stress as an example construct

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Interval-contingency (at specified intervals)</th>
<th>Event-contingency (after event)</th>
<th>Device-contingency (at random time)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short micro timescale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological momentary assessment</td>
<td>Stress level now or over past interval</td>
<td>Stress level now after family argument</td>
<td>Stress level now</td>
</tr>
<tr>
<td>Experience sampling</td>
<td>—</td>
<td>—</td>
<td>Stress level now</td>
</tr>
<tr>
<td>Ambulatory assessment</td>
<td>Diurnal cortisol</td>
<td>Cortisol stress response after family argument</td>
<td>Heart rate, skin conductance now</td>
</tr>
<tr>
<td><strong>Long micro timescale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily diary</td>
<td>Stress level over past interval (i.e., today)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Table 3-2. Measurement and timescale benefits unique to ILM

<table>
<thead>
<tr>
<th>Retrospective/Trait Assessment</th>
<th>ILM</th>
<th>Benefits/added value of ILM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assesses remembering and believing selves—heuristic and global summaries</td>
<td>Experiencing self</td>
<td>Captures momentary experience with ecological validity and comparatively little bias</td>
</tr>
<tr>
<td><strong>Timescale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Few data points for each person, usually before and after intervention</td>
<td>•Measurement during change</td>
<td>Captures specificity of temporal events and the course of change in influences, mechanisms, and processes</td>
</tr>
<tr>
<td></td>
<td>•Many data points over micro time for each person</td>
<td></td>
</tr>
<tr>
<td></td>
<td>•Few to many samples over macro-time</td>
<td></td>
</tr>
</tbody>
</table>
Table 3-3. Value added by ILM over retrospective assessment in understanding intervention effects

<table>
<thead>
<tr>
<th>New research goals</th>
<th>Example constructs</th>
<th>Process speed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retrospective assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patterns over time in characteristics</td>
<td>• Summary of experience, behavior, and feelings</td>
<td>Slow change</td>
</tr>
<tr>
<td><strong>ILM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patterns over time in dynamic constructs or momentary experiences</td>
<td>Dynamic characteristics</td>
<td>• Lability in emotions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Variability in relationship quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consistency of practice</td>
</tr>
<tr>
<td></td>
<td>Dynamic processes</td>
<td>• Decrease in variability (approaching homeostasis)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Oscillation in level of practice (uptake)</td>
</tr>
<tr>
<td>Functional form of change</td>
<td>• Onset</td>
<td>Medium process</td>
</tr>
<tr>
<td></td>
<td>• Acceleration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Duration</td>
<td></td>
</tr>
<tr>
<td>Influences on within-subject change</td>
<td>Stable trait characteristics</td>
<td>• Parent level of education</td>
</tr>
<tr>
<td></td>
<td>Time-varying characteristics or behavior</td>
<td>• Engagement in session</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Practice of skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Any dynamic construct above</td>
</tr>
</tbody>
</table>

Note. Multiple timescale designs add further benefits to understanding intervention effects because they allow the identification of linkages between micro timescale dynamic characteristics and processes and macro timescale change (Ram & Diehl, 2015).
--- indicates that process speed varies with construct
### Table 3-4. Example research topics matched with examples of appropriate analytical approaches

<table>
<thead>
<tr>
<th>Research question</th>
<th>Construct</th>
<th>Construct variability</th>
<th>Example sampling protocol</th>
<th>Examples of appropriate analytical techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Does the family treatment program stabilize moment-to-moment variability in affect?</td>
<td>Affect</td>
<td>Highly variable and context-specific</td>
<td>Random sampling</td>
<td>Heterogeneous variance multilevel model (level 1 moment: affect, level 2 person: treatment)</td>
</tr>
<tr>
<td>(D) Across the duration of intervention delivery, what is the functional form (i.e. smooth shape) of change in parent-child closeness?</td>
<td>Level of parent-child closeness</td>
<td>Variable across days</td>
<td>Daily</td>
<td>Nonlinear multilevel growth curve model (level 1 day: closeness; level 2 person)</td>
</tr>
<tr>
<td>Research question</td>
<td>Construct</td>
<td>Construct variability</td>
<td>Example sampling protocol</td>
<td>Examples of appropriate analytical techniques</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>-----------------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>(E) Does father’s skill use influence the mother’s skill use/ parenting on the following day? Vice versa?</td>
<td>Skill use</td>
<td>Variable across interactions</td>
<td>Random sampling 3x daily on last interaction with child. Same assessment timing for mother and father in same family</td>
<td>Bivariate multilevel model (level 1 day: skill use; level 2: couple) or other bivariate coupling model</td>
</tr>
<tr>
<td>(G) Does the direct intervention effect on daily conflict intensity mediate/ explain the intervention effect on lower daily child stress?</td>
<td>Intensity of conflict</td>
<td>Variable across interactions or days</td>
<td>Event-contingent interaction surveys</td>
<td>Multilevel mediation model (level 2 week/person: intervention, level 1 day: conflict, level 1 day: child stress)</td>
</tr>
<tr>
<td></td>
<td>Child stress</td>
<td>Variable across days</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>Research question</td>
<td>Construct</td>
<td>Construct variability</td>
<td>Example sampling protocol</td>
<td>Examples of appropriate analytical techniques</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td>-----------------------</td>
<td>--------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>(H) On days when parenting skills are used more, is closeness of parent-child relationship higher?</strong></td>
<td>Skill use</td>
<td>Variable across interactions</td>
<td>3x daily; averaged by day</td>
<td>Multilevel model (level 1 day: skills and closeness, level 2 person: skills)</td>
</tr>
<tr>
<td></td>
<td>Level of parent-child closeness</td>
<td>Variable across days</td>
<td>Daily</td>
<td></td>
</tr>
</tbody>
</table>

Note. All constructs measured on ratio/interval scales 0-100. Level of maximum construct variability is assumed for each construct, but this can be determined empirically. Additional analytical techniques may be appropriate. Decisions among analytical techniques should be based on sampling protocol and the research question, and may depend on patterns visualized in the raw data.
Figure 3-1. Measurement timing and frequency impact the accuracy of the assumed/modeled trajectory of change or variability in the micro timescale.
Chapter 4

Family change with exposure to a prevention program: Smooth improvement or homeostasis-disruption in intensively assessed day-to-day functioning

Substance-misuse interventions along the spectrum from family therapy to family-based preventive interventions posit improvements in family functioning over the course of the intervention, which in turn, are considered a mediating mechanism that reduce risk for youth substance misuse. Yet, there is little empirical knowledge about the process of change in family functioning in response to interventions. Specifically, what participants in family interventions experience day-to-day as they attend an intervention has not been studied. Different initial patterns of change constitute different experiences for families and may influence the permanence of change.

This study uses intensive longitudinal data (ILD) on parenting and family functioning collected daily from parents during their participation in the Strengthening Families Program for Parents and Youth Ages 10-14 (SFP 10-14). SFP 10-14 is a family preventive intervention that targets family, parenting, and child risk factors, including affective quality of parent-child relationship and parenting skills to prevent youth substance use and other adverse child outcomes. The ILD will be modeled to evaluate the day-to-day experiences of families during the beginning of intervention impact—as the intervention is delivered. This analysis will provide unique insight into the process of change and offer a new approach to assessing how an intervention may induce change.
**Rationale for Intensive Longitudinal Methods**

Intensive Longitudinal Methods (ILM) assess participants repeatedly and *in situ*, as participants go about their lives. Because these assessments occur frequently and soon after each experience, the ILD they produce are temporally rich and specific. As Bamberger (2016) notes:

“ILM have three main advantages compared with retrospective self-report: (1) avoidance or minimization of retrospective recall bias (Stone, Shiffman, Atienza, & Nebeling, 2007), which is especially important for behaviors that are frequent and/or irregular and for assessing intensity of experience (Schwarz, 2007), (2) ecological validity of the assessment context, which is a benefit over laboratory task-oriented observational methods (Stone et al., 2007), and (3) specificity of temporal events, which allows the study of dynamic within-subject processes (Collins, 2006; Stone et al., 2007; Stone & Shiffman, 1994).”

Because of these advantages, ILM, when used to capture family members’ experiencing self (Conner and Barrett, 2012) and family interactions that occur within a day, allow an in-depth perspective on families’ lives (Larson & Almeida, 1999). That is, ILM can capture those interactions that both directly contribute to development and are targeted in family interventions (Bai & Repetti, 2015; Bronfenbrenner & Morris, 1997; Sameroff & MacKenzie, 2003; Smyth & Heron, 2014).

When change over time is of interest (i.e., in the evaluation of intervention effects), retrospective questionnaires are not ideal because family interactions recur with variation many times within the usual time frames specified for traditional questionnaires. Summaries over many interactions draw heavily on heuristics that family members have of their typical interaction (Schwarz, 2007). Information about each interaction is lost. This is problematic because (1) interactions may change before family members’ heuristics about their interactions, and (2)
developmental theory emphasizes the influence of interactions on development (not heuristics of interactions).

ILM can increase our knowledge of intervention effects by testing for intervention effects on dynamic outcomes such as variability in those behaviors, feelings, and interactions that occur in daily family life (Robbins & Kubiak, 2014). Second, ILM can chart the rapid fluctuation or the functional shape of change over the micro timescale (the within-person or within-family change process; Bamberger, 2016). Third, ILM allow researchers to investigate which factors influence this change, including stable trait characteristics, and time-varying/dynamic characteristics and processes (Bamberger, 2016).

In this study, I use ILM to chart the rapid fluctuation and functional shape of change over the micro timescale for parent reports of parenting and family interaction outcomes of the SFP 10-14 intervention program.

**Micro Timescale Change Processes**

Prior researchers have focused on macro timescale change—improvements over months, from baseline to post-intervention assessments. This research has been conducted to the exclusion of micro timescale change occurring over days in the time period between baseline and post intervention. Through choices of assessment timing and statistical models that ignore the time period between baseline and post intervention, researchers either have assumed a near-linear micro timescale trajectory or assumed that micro timescale trajectories of change are inconsequential (Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007). Neither of these assumptions has been tested with more frequent measurement. More sophisticated statistics that allow for curves and individual trajectories (e.g., multi-level modeling) rely on the assumption that it is the smooth shape of change rather than any relapse or fluctuation that is meaningful in determining the ultimate level of macro timescale change (e.g., Kahn & Schneider, 2013). Our
thinking has been limited by our methods. Some perspectives on change intimate that different micro timescale trajectories may reflect different micro timescale change processes.

\textit{Intervention Change from a Behavior Change Perspective}

A behavior change perspective may theoretically support a near-linear (i.e., smooth curve) trajectory of improvement on behavioral outcomes. Throughout the duration of the intervention, participants change each behavior taught that session and then build incrementally on their learning to add on new skills at the next session. Participants enact behavior change (i.e., action stage; Prochaska, 2008) for each skill as it is introduced through practice and improvement, building upon prior skills. Thus, parents may be achieving incremental improvement as new skills are incorporated into daily life. For example, when a mother adds new parenting strategies as they are learned in the intervention, she becomes more and more thorough at monitoring her teen, and her knowledge of her teen’s behavior and her level of monitoring increase with each skill learned. Thus, from a behavioral change perspective, little or no fluctuation might be expected. Any setbacks that the participant experiences are reflected in the slope of the trajectory of change. If there is a stepwise nature of change, according to this perspective, it is the smoothed curve that is ultimately associated with the changes the parent makes.

\textit{Intervention Change from a Family System Theory Perspective}

In contrast, from a family systems perspective, families at homeostasis operate in predictable and relatively consistent self-perpetuating patterns of interaction among family members and subsystems (Cox & Paley, 1997; Hill, 1971). Homeostasis is sustained by negative feedback processes, and these patterns of interaction are unthinking and automatic (i.e., the way the family works, the way family members always act), and are sometimes beyond interrogation.
of the family members. Homeostasis can be held at all levels of functioning from adaptive to maladaptive.

Effective family interventions, from this perspective, must be designed in a way that disrupts or unbalances homeostasis in order to allow novel ways of interacting and, ultimately, create more permanent changes in family interaction patterns. Family therapy is designed to “unbalance” family systems in order to allow room for change (Minuchin & Fishman, 1981). Family systems theory suggests that in the disruption period—at the beginning of change—the intervention has introduced less predictability in family members’ interactions by introducing new possibilities of interaction for the family. This results in fluctuation in the adaptive level of the family’s functioning as family members interact in a variety of new ways, attempt to interact in ways that work well, and fall back into old patterns of interaction (Cox & Paley, 1997; Minuchin & Fishman, 1981). This period of fluctuation before a new homeostasis is reached is consistent with theories of advancement in functioning in any complex system (Thelen, 1995).

Therefore, change in a family’s functioning is not likely to be a smooth curve of improvement; instead, families are likely experiencing good and bad days and more fluctuation in functioning than usual as their normal patterns of interaction are disrupted. The eventual incorporation of a parenting behavior into daily life or a parent’s repertoire may require adaptation and reorganization of the family system (Cox & Paley, 1997). Over the course of the intervention, at baseline, family systems theory predicts little day-to-day fluctuation reflective of a family at homeostasis; during intervention, family systems theory predicts high day-to-day fluctuation reflective of a disrupted family system exploring new ways of interactive; after consolidation of changes and some time after the intervention has ended, family systems theory predicts low day-to-day fluctuation reflecting a family that has reached a new homeostasis. Family systems theory implies a mean level change from baseline to post-intervention, but it is not entirely clear when this mean shift ideally would occur. Family systems theory would suggest
that the speed of a family moving from disruption to homeostasis should depend on the family’s level of adaptability.

For example, when a mother uses a new parenting strategy learned at the intervention meeting, asking where the teen is going with friends, the teen may rebel at the unexpected way her mother is behaving. Over time, the teen may become acclimated to her mother asking and respond in a predictable way. The mother may fall back into old patterns sometimes, but less often as this becomes an automatic behavior and expected pattern of interaction. Although the new parenting technique is ultimately effective at giving the mother information about the teen’s whereabouts and activities, when the strategy was first introduced, it may induce greater fluctuation in the family’s functioning, occasionally resulting in negative interactions between mother and teen. If new parenting behavior is successfully incorporated into the system following this disruption, self-stabilization principles of the family system will promote the long-term maintenance of this change (Cox & Paley, 1997).

**Intensive Longitudinal Methods in Family Prevention Evaluation**

Intensive repeated measure studies assess participants repeatedly, often multiple times per day, conducting assessments in situ, as participants go about their lives (i.e., they use intensive longitudinal methods, ILM). High-density measurement can inform family interactions that happen in real-time and may fluctuate or change rapidly (Smyth & Heron, 2014). Thus, ILM allow a new perspective on families’ lives through valid capture of the mundane or unusual microprocesses, which elude measurement conducted through retrospective reports. Intensive repeated measure studies are better-equipped to address research questions involving processes and change at a micro timescale (Collins, 2006). ILM has been used to study families’ daily lives (c.f., Larson & Almeida, 1999; Repetti, Reynolds & Sears, 2015) and has advanced the field’s knowledge of family processes such as transfer of conflict and distress among family members (e.g., Chung, Flook & Fuligni, 2009). Applied to families participating in an intervention
evaluation study, ILM can be leveraged to provide insight into the patterns of change that family members experience day-to-day in the duration of the intervention (Bamberger, 2016).

**Integrating Perspectives on Intervention Change**

Whole-family and dyadic functioning outcomes that reflect the interactions among multiple family members, for example family cohesion or a parent’s emotional awareness of the child, may be more subject to the principles of family systems theory. Thus, these outcomes may be more likely to show disruption than outcomes reflecting single family members’ behavior, for example a child’s coping strategies. Family members’ behavioral outcomes may be more likely to show incremental (smooth) change when these outcomes are taught directly as behavioral skills and compounded over the duration of the intervention. Yet, these outcomes may show disruption because each family member’s behavior is subject to the regulatory functions of the family system, according to family systems theory.

**SFP 10-14**

Strengthening Families Program for Parents and Youth Ages 10-14 (SFP 10-14) is a family-based intervention that targets youth substance use initiation (Spoth et al., 2009; Spoth et al., 2004) by teaching parents new skills appropriate for the teen years such as monitoring, how to communicate expectations about risk behaviors, and selecting appropriate consequences, while allowing parents to spend time with their youth and strengthen family relationships (Molgaard, Spoth, & Redmond, 2000). The program teaches youth peer-resistance, friendship and stress management skills, along with information to promote understanding of parents (Molgaard et al., 2000). The program has a separate parent component and youth component where individual skills are taught, discussed, and practiced, and a family component where the youth and parents/caregivers come together to interact and practice skills with the guidance of group leaders.
Mindful Parenting

Mindfulness is an ancient eastern practice that has recently been incorporated into western behavioral medicine and science. Integrating theoretical perspectives, mindfulness is open-hearted attention and awareness in the present moment; practice of which, allows the steady increase in clarity and equanimity in daily life (Shapiro et al., 2006; Young, 2006; 2013).

Mindfulness is often thought of as an intrapersonal practice with intrapersonal benefits (e.g., a calm mind, acceptance of current experience). Yet, a person with high mindfulness also interacts with mindfulness (e.g., compassion and acceptance of others, decreased reactivity to others), which is where mindfulness becomes interpersonal. Duncan and colleagues (2009) conceptualize mindful parenting as an intra- and interpersonal construct: intrapersonal in the aspects of nonjudgmental acceptance, emotional awareness, and compassion for the self; interpersonal, for example, in listening with full attention in the present moment, and decreased automatic reactivity to the child (Dumas, 2005).

SFP 10-14 teaches self-control in parenting with love and limits but does not teach mindfulness practices, and is not based in the mindfulness tradition. Mindfulness practices and a mindfulness perspective have been incorporated into an adaptation of SFP 10-14 (Mindfulness-enhanced Strengthening Families Program; MSFP). Parents who participated in the current study were assigned to either the SFP or MSFP condition.

Current Study

In a skills-based family intervention, outcomes assessed on a micro timescale with ILM may show either smooth increase, fluctuation, or evidence of both patterns of change. This study uses data collected through ILM to test—over a micro timescale—the incremental skill acquisition hypothesis against the homeostasis disruption hypothesis. These hypotheses are informed by behavior change and family systems perspectives, respectively. Figure 1 depicts
these hypotheses and shows how either pattern of change may occur in the duration of the intervention even given the same baseline and post-intervention estimates of functioning.

In the current study, SFP 10-14 is delivered as a skills-based intervention, and parent skills are taught and practiced throughout the intervention period, which points to a pattern of change supporting the incremental skill acquisition hypothesis. At the same time, change in family members’ behavior and interactions among family members may require disruption and reorganization of the family system, which points to a pattern of change supporting the homeostasis disruption hypothesis.

This study examines patterns of change in daily mindful parenting and daily parent-to-youth affective quality as outcomes of the intervention program. Mindful parenting was taught as a skill, is in some respects intrapersonal, and is measured as a single family member’s (parents’) behavior; this points to mindful parenting following the skills acquisition pattern of change. Yet mindful parenting is also interpersonal (i.e., dyadic) behavior that is directed toward and in many ways is an interaction with the child. Changing parents’ mindfulness, in addition to advancing skills that support mindfulness, also involves changes in interpersonal interactions (Duncan, Coatsworth, & Greenberg, 2009). For these reasons, mindful parenting may be a practice or behavior that is subject to the family system and therefore may follow the homeostasis disruption pattern of change. Affective quality of the parent-youth relationship is more obviously a dyadic outcome and therefore likely to follow the homeostasis disruption pattern of change. However, affective quality is still measured as a single family member’s (parents’) behavior, so our measurement may be capturing a behavior or skill that improves incrementally, not capturing the dyadic part of affective quality which may show disruption. Because there are reasons to predict patterns of change that support either skill acquisition or homeostasis disruption for each of these outcomes, the goal of this study is to examine which pattern of change each outcome follows – the incremental skill acquisition hypothesis, the homeostasis disruption hypothesis or both.
Hypotheses

Although each outcome may show both patterns of change, mindful parenting is taught as a skill and affective quality is not taught directly and is conceptually more dyadic. Based on these considerations, I hypothesize that mindful parenting will show a linear trend in level of daily mindful parenting over time and will not show increased variability with higher intervention exposure, indicating that mindful parenting is a skill that is built upon consistently or incrementally over the intervention. I hypothesize that affective quality of the parent-child relationship will show greater day-to-day variability with greater intervention exposure, indicating that the intervention induces disruption of the homeostasis of affective quality in the beginning of the change process. Models testing both hypotheses were fit to affective quality and mindful parenting. Families in this sample are likely to vary in their need for change in each outcome based on their baseline functioning. As a result, I expect families to differ in the degree of change that they experience. High-functioning families may not change as a result of the intervention. To isolate intervention effects, baseline indicators of family functioning (indexing need for change; i.e., mindful parenting and affective quality) are included in the models. Underlying these hypotheses is the assumption that families’ baseline level of variability in these outcomes does not vary with parents’ attendance.

By examining micro change processes from two theoretical perspectives, these analyses will enhance knowledge about the processes by which SFP 10-14 improves parenting quality and thereby prevents youth substance use (e.g., Riesch et al., 2012). Furthermore, these analyses will provide insight into families’ experiences of change during the intervention.
Methods

Study Design

Data for the present analysis were collected as part of a micro longitudinal sub-study embedded in the Strengthening Families in Pennsylvania Project (SFP in PA; Coatsworth et al., 2015). In brief, the SFP in PA project is a randomized control trial (RCT) that evaluated (a) the Strengthening Families Program for Parents and Youth Ages 10-14 (SFP 10-14) intervention, (b) a modified version of the intervention that incorporated mindfulness principles (the Mindfulness-enhanced Strengthening Families Program, MSFP; Coatsworth et al., 2014), and (c) a home study control condition. Baseline, post-test (i.e., post-intervention) and one-year follow-up assessments were obtained from six cohorts of families over three years, tracking intervention effects on parent, youth, and family outcomes as well as examination of hypothesized mechanisms and contextual factors.

Participants

Families from the sixth cohort that were assigned to the intervention conditions (SFP 10-14 or MSFP) were approached for possible participation in a micro longitudinal sub-study. This study was designed to obtain further insight into how the intervention influenced the day-to-day experience of parenting, engagement with the intervention, and practice of the skills being taught. Of the 96 parents eligible, 50 parents agreed to complete daily web-based surveys throughout the 7 weeks of intervention delivery.

Of the 50 parents who agreed to participate on the micro longitudinal sub-study, N = 33 completed met the minimum requirements for inclusion in analysis by completing at least seven daily surveys (of a possible 49 total surveys).³ The majority (70%) of these parents were mothers (30% fathers); 75% were married; 97% reported their race as white, 3% as Native American, and

³ Thirty-three parents from 23 families
0% as black; 6% reported their ethnicity as Hispanic/Latino); and all had graduated high school or earned a GED (12% high school/GED, 24% partial college, 36% college graduate, and 27% graduate training). Average family income was $84,021 (SD = 50,615, median = 72,000), with 70% of these parents working full time (36 work hours per week, on average). The children (49% boys) with whom they participated were, on average age 12.56 years, in 6th or 7th grade (67% 7th grade).

Measures

Treatment Condition

Upon entry into the larger study, families were assigned to one of three conditions (SFP 10-14, MSFP, control). Working from the official records of condition assignment, and logs of which sessions the families actually attended, the 33 parents in the micro longitudinal study were relatively evenly split between the typical SFP 10-14 intervention (n = 15, 45.45%) and the MSFP intervention (n = 18, 54.55%).

Intervention Exposure

Total exposure to the intervention was operationalized as the number of intervention sessions a parent attended (i.e., attendance), and measured using parent sign-in and practitioner reports. Attendance ranged from 1 to 7, with parents attending an average of 5.73 (SD = 1.74) of the 7 weekly sessions.

Compliance

On average, parents completed 23.76 (SD = 12.15) of the 49 daily surveys. For simplicity, compliance was operationalized as low or high using a median split, so that the half who completed the most surveys (> 22 surveys) were considered as having high compliance and the other half as having low compliance.
**Mindful Parenting**

Mindful parenting was measured on two timescales. On the macro timescale, mindful parenting was measured first at baseline using the Interpersonal Mindfulness in Parenting scale (IM-P; Duncan, 2007; Duncan, Coatsworth, & Greenberg, 2009). The 31 items tap five subscales: present-centered attention (5 items, e.g., “I find myself listening to my child with one ear because I am busy doing or thinking about something else at the same time,” reverse-scored), emotional awareness of self and child (6 items, e.g., “I am aware of how my moods affect the way I treat my child”), self-regulation in the parenting relationship (6 items, e.g., “When I am upset with my child, I notice how I am feeling before I take action”), non-judgmental acceptance of self and child (7 items, e.g., “Even when it makes me uncomfortable, I allow my child to express his or her feelings”), and compassion for self and child (7 items; “I tend to be hard on myself when I make mistakes as a parent,” reverse-scored). After reverse coding negative items, responses on a 0 = never true to 4 = always true scale were averaged to obtain the five subscale scores, and the subscale scores then averaged to obtain an equally weighted total mindful parenting score (Cronbach’s α: items = .92, subscales = .87). Total scores ranged from 1.47 to 3.28 (M = 2.46, SD = 0.43).

On the micro timescale, mindful parenting was assessed daily during the seven-week intervention using four items adapted from the baseline measure that specifically assessed parents’ use of the child-oriented aspects of mindful parenting: present-centered attention (“I was able to be present and really listen to [my child]”), emotional awareness of child (“I could easily tell what [my child] was feeling”), self-regulation in the parenting relationship (“I remained patient and did not react too quickly to what [my child] said or did”), non-judgmental acceptance and compassion of child (“I really tried to understand [my child’s] point of view”). Parents indicated how much they had behaved in each way that day using a slider with anchors at 0 = very little and 100 = very much. Responses were averaged to obtain a daily mindful parenting
score (Cronbach’s $\alpha = .85$), where higher values indicate being more mindful. Across all days, parents’ mindfulness ranged from 0 to 100 (M = 79.88, SD = 18.47). The right panel of Figure 2 shows that there is a high degree of day-to-day variability in parents’ reports of mindful parenting (M iSD = 12.14; variance: 53.66% within; 46.34% between parents). Additionally, there is individual variation in the degree of day-to-day variability in parents’ reports (iSD range for mindful parenting: 4.29 – 36.68). Some parents report consistent family functioning from day to day (homeostasis, near-zero variability, e.g., min Mindful iSD = 4.29) and other parents report inconsistent levels of family functioning from day to day (disruption, high variability, e.g., max Mindful iSD = 36.68). The top panel of Figure 3 shows the individual variation in day-to-day variability of mindful parenting based on different levels of attendance.

**Affective Quality of the Parent-Child Relationship**

Affective quality of the parent-child relationship was also measured on macro- and micro-timescales. On the macro-timescale, first, the affective quality of the parent-child relationship was measured at baseline using a nine-item questionnaire that asked parents how often in the past month they had engaged in a variety of parenting behaviors, including criticizing, lecturing, helping, showing affection, caring, anger, or appreciation of the child, shouting, and insulting or swearing at the child (Spoth, Redmond & Shin, 1998). For example, parents were asked “…how often did you… get angry at [this child]?” Parents rated each item on a 0 = never to 6 = always scale. After reverse-coding negative items, the nine items were averaged to obtain a baseline affective quality scale score (Cronbach’s $\alpha = .83$), where higher values indicate more positive affective quality of the parent-child relationship. Total scores ranged from 3.44 to 5.78 (M = 4.64, SD = 0.64).

On the micro timescale, affective quality of the parent-child relationship was assessed daily during the seven-week intervention using four-items from the baseline measure, and adapted for daily use. Specifically, these four items asked parents how much they were irritated
by the child, were loving and caring to the child, appreciated the child, and yelled or raised their voice at the child. Each day parents indicated how much they had done each behavior that day using a slider with anchors at $0 = \text{very little}$ and $100 = \text{very much}$. After reverse coding negative items, the responses were averaged to obtain a \textit{daily affective quality} score (Cronbach’s $\alpha = .70$), where higher values indicate days with more positive affective quality of the parent-child relationship. Across all days, parents’ daily affective quality ranged from 17.5 to 100 ($M = 83.81$, $SD = 16.03$). The left panel of Figure 2 shows that there is a high degree of day-to-day variability in parents’ reports of affective quality ($M$ iSD = 11.33; variance: 57.03% within, 42.97% between parents). Additionally, there is individual variation in the degree of day-to-day variability in parents’ reports (iSD range for affective quality: 0.93 – 26.69). Some parents report consistent family functioning from day to day (homeostasis, near-zero variability, e.g., min AffectQual iSD = 0.93) and other parents report inconsistent levels of family functioning from day to day (disruption, high variability, e.g., max AffectQual iSD = 26.69). The bottom panel of Figure 3 shows the individual variation in day-to-day variability of affective quality based on different levels of attendance.

\textbf{Time in Intervention}

Time was in the intervention period was measured in days. Because groups of parents attended sessions on different weekdays, parents’ data were aligned so that the first intervention day occurred at day 0. Time was then centered at the middle of the intervention period ($M = -0.69$, $SD = 13.30$; day 24 is time 0).

\textbf{Data Analysis}

Our main interests were to test the skills acquisition hypothesis and the homeostasis disruption hypothesis. The nested nature of the data (repeated measures nested within persons)
and the hypotheses were both accommodated using a multilevel modeling framework (Snijders & Bosker, 1999). The skills acquisition hypothesis was articulated using a model of the form,

\[ Y_{it} = \pi_0i + \pi_1i \text{time}_{it} + e_{it} \] (1)

where the outcome of interest, \( Y_{it} \), is a daily family functioning variable at time \( t \) for person \( i \), daily affective quality or daily mindful parenting, that is modeled as a function of a person-specific intercept coefficient, \( \pi_0i \), and a person-specific slope coefficient, \( \pi_1i \), that indicates the rate of increase in daily family function in relation to time (number of days) spent in the intervention period, and residual error, \( e_{it} \), that has variance \( \sigma_e^2 \). Person-specific intercepts and slopes (from the Level 1 model given in Equation 1) were in turn modeled as:

\[ \pi_0i = \gamma_{00} + \gamma_{01} \text{attendance}_i + \upsilon_{0i} \] (2)

\[ \pi_1i = \gamma_{10} + \gamma_{11} \text{attendance}_i \] (3)

(i.e., Level 2 model) where \( \gamma_{00} \) and \( \gamma_{10} \) are sample means and \( \upsilon_{0i} \) is individual deviation from \( \gamma_{00} \) assumed to be uncorrelated with the residual error, \( e_{it} \). To examine whether the between-person variance in daily family functioning outcomes was associated with exposure to the intervention (attendance), attendance (\( \gamma_{01} \)) and its interaction with time (\( \gamma_{11} \)) were included as between-person predictors. Of greatest interest is whether the \( \gamma_{11} \) parameter is positive and significantly different than zero, an indication that parents’ daily family functioning increased during the intervention for parents who attended more sessions. For the daily mindful parenting outcome, parents’ treatment condition was controlled.

The disruption hypothesis was articulated by expanding this model to accommodate heterogeneous variances (Hedeker & Mermelstein, 2007). Specifically, the hypothesis that differences in exposure to the intervention would be related to the degree of day-to-day variability in family functioning was articulated by allowing for individual differences in residual day-to-day variability, \( \sigma_{e,i}^2 \) (note the addition of the \( i \) subscript) and testing whether those differences in intraindividual variability were related to attendance. The expanded model was:

\[ Y_{it} = \pi_0i + \pi_1i \text{time}_{it} + e_{it} \] (1)
\[ \pi_{0i} = \gamma_{00} + \gamma_{01} \text{attendance}_i + \nu_{0i} \]  
\[ \pi_{1i} = \gamma_{10} + \gamma_{11} \text{attendance}_i \]  
\[ \sigma_u^2 = \alpha_0 \exp(\text{attendance}_i \cdot \tau) \]  

where \( \alpha_0 \) is the expected intraindividual variability of the average parent, and, most importantly, \( \tau \) is the expected increase (or decrease) in variability associated with more attendance. When \( \tau \) is positive and significant, I would infer that exposure induces variability. That is, parents who attended more sessions have more variable family functioning.

A variety of follow-up analyses were conducted to further parse how intervention exposure was related to family system change; in particular I investigated whether families in need (i.e., indicated by lower baseline functioning) experienced more change. In a universal prevention program, some families may be doing well at baseline and have little need for immediate change; these families may not undergo a disruption and reorganization of the family system. Thus, in a follow-up analysis, I considered whether the effect of attendance depended on baseline level of family functioning as an indicator of need for change. Perhaps families who started off with lower levels of functioning changed more in response to the intervention; if so, parents who had lower levels of baseline functioning would have a higher positive association between attendance and variability compared to parents who had higher levels of baseline functioning and/or higher variability regardless of attendance.

Because mindful parenting was incorporated into the MSFP condition but not the SFP 10-14 condition, I included condition and its interactions in the follow-up analysis of the mindful parenting outcome. If parents in the MSFP condition experienced more family system change in mindful parenting than parents in the SFP condition, the association between attendance and variability in mindful parenting would be more positive for parents in the MSFP condition and/or the variability in mindful parenting would be higher for parents in the MSFP condition regardless of attendance. Condition was not investigated as a predictor of the variability in affective quality.
because there were no differences in the portions of the curricula that were expected to impact affective quality.

Because completion of more surveys (i.e., higher compliance with the survey protocol) gives more data points and therefore opportunity for higher day-to-day variability, and because compliance was correlated with attendance ($r = 0.33^*$), I included compliance as a control variable in the final models for mindful parenting and affective quality. See Table 1 for correlations among study variables. In addition to equations 1-3, above, these models include compliance, baseline, and, for the mindful parenting outcome, treatment condition and its one-way interaction with attendance, as main effect predictors of fixed effects. In addition to equation 4, above, these models include compliance, baseline, and, for the mindful parenting outcome, treatment condition and their one-way interactions with attendance predicting the variability of the level 1 random effect.

All models were fit using SAS 9.4 (proc mixed; Littell, Milliken, Stroup, & Wolfinger, 1996) with incomplete data accommodated through analysis with attrition informative variables (e.g. attendance) under missing at random assumptions. All predictor variables were mean-centered to facilitate interpretation of parameters as applying to the average parent in the sample.

**Results**

**Incremental Skill Acquisition**

For these models, of primary interest is the trend over time on the level of mindful parenting and affective quality (fixed effects of time). Also of interest is whether this trend over time is more pronounced for parents who attended more sessions (fixed effects of the attendance and time interaction).
Mindful Parenting

Results of the multilevel models of daily mindful parenting are shown in Table 2. Model 1 tests the incremental skill acquisition hypothesis alone. In the model of daily mindful parenting, time was not a significant fixed effect predictor. This was also true of the model that accounted for treatment condition and its interaction with time. This suggests that mindful parenting did not increase gradually over the intervention duration for parents in either condition; the pattern of change of mindful parenting did not support the incremental skill acquisition hypothesis.

Affective Quality of the Parent-Youth Relationship

Results of the multilevel models of daily affective quality are shown in Table 3. Model 1 tests the incremental skill acquisition hypothesis alone. Time was a significant predictor of affective quality for parents who attended more than the average number sessions (γ11 = 0.10, p < 0.05). Although this is a statistically significant effect, at its maximum, for parents who attended the maximum seven sessions, this effect represents an 8.2-point increase over 49 days, which is a small increase compared to the day-to-day variability of affective quality: specifically, this increase over time that occurred for some parents is smaller than the sample’s mean iSD over the same period and is not apparent in the visualization of the affective quality data. The small magnitude of increase on the 0-100 scale and its comparison with the mean iSD indicates that the increase may not be as meaningful as the fluctuation.

Homeostasis Disruption Hypothesis

These models examine whether parents who attend more sessions experience more day-to-day variability in mindful parenting and affective quality (random effects of attendance). Day-to-day variability for parents who attend more sessions may increase over time (random effects of attendance and time interaction), and may be higher for parents with a low baseline score (random effect of attendance and baseline interaction). For mindful parenting, day-to-day...
variability for parents who attend more sessions may be higher for parents in the MSFP curriculum condition (random effect of attendance and curriculum interaction).

**Mindful Parenting**

The multi-level heterogeneous variance model of mindful parenting builds on Model 1 to test the homeostasis disruption hypothesis (Table 2, Model 2). Looking at the random effect predictors, there was no main effect of attendance (tau = 0.00) and there was a negative attendance* time interaction (tau = -0.01). Charting day-to-day variability in mindful parenting ($\sigma^2_{\epsilon_{u_2}}$), for parents who attended six or seven sessions, there was no difference in variability across time. For parents who attended fewer sessions, variability was low and then increased over time. I tested this model further because I hypothesized that attendance may be a significant predictor of variability in mindful parenting among parents who were more likely to change: that is, those parents in the MSFP condition or parents with low levels of baseline mindful parenting.

In a follow-up heterogeneous variance model accounting for treatment condition and baseline level of mindful parenting in addition to attendance (Table 2, Model 3), results were contrary to our hypotheses. Parents who attended more had lower day-to-day variability in mindful parenting (tau = -0.20, $p < .05$) with a small interaction effect of decreasing variability over time for parents who attended more (tau = -0.01, $p < .05$). Parents who were in the MSFP condition did not reach the same high levels of variability as parents who were in the SFP condition (tau = -0.91, $p < .05$). The interaction of curriculum with attendance (tau = 0.39, $p < .05$) shows that attendance mattered more for SFP parents than for MSFP parents: SFP parents with low attendance had high variability in mindful parenting and SFP parents with high attendance had low variability; the same was true for MSFP parents but to a lesser degree. Parents who had lower baseline mindful parenting had higher variability regardless of attendance or curriculum condition (tau = -0.57, $p < .05$).
Accounting for compliance (Table 2, Model 4), the main effect and interactions of attendance became non-significant. The effects of curriculum version and of baseline remained. There was a significant interaction of attendance with compliance (\(\tau = -0.32, p < .05\)) that shows that for high-attending parents, compliance was negatively related to variability whereas for low-attending parents, compliance was positively related to variability. Figure 4 shows the day-to-day variability predicted by this model. Thus, the correlation between compliance and attendance may have impacted the model but did not necessarily cause the relation between attendance and variability in mindful parenting to be over-estimated (N.B., these effects were already not significant in model 2, before compliance was added).

**Affective Quality of the Parent-Youth Relationship**

In the multi-level heterogeneous variance model of affective quality, attendance was a significant predictor of day-to-day variance in affective quality (\(\tau = 0.14, p < .05\)), and there was a small significant interaction of attendance and time (\(\tau = -0.01, p < .05\)). That is, attending seven sessions as opposed to four sessions was associated with higher day-to-day variability in reports of affective quality (\(\sigma^2_{\varepsilon_i.\tau}\)) at the middle of the intervention period: the day-to-day variance of scores being 166 as opposed to 135 (which can be compared to a between-person variance of 103.51). But, for parents with low attendance, variability was low in the beginning of the intervention period and later increased to a moderate level. For parents with high attendance, variability was high in the beginning of the intervention period then decreased to a moderate level.

In a follow-up heterogeneous variance model accounting for baseline level of affective quality in addition to attendance (Table 3, model 3), the relation between attendance and variability was attenuated. Instead, parents who had a higher baseline level of affective quality had lower day-to-day variability in affective quality during the intervention compared to parents.
with lower baseline levels of affective quality (tau = -0.77, \( p < .05 \)). There was no interaction between attendance and baseline levels of affective quality.

Accounting for compliance (Table 3, model 4), the direction and magnitude of the effects of attendance and baseline remained similar to the direction and magnitude of the effects of attendance and baseline in model 3. However, an interaction between attendance and baseline (tau = 0.58, \( p < .05 \)) indicated that the relation between attendance and day-to-day variability in affective quality was only positive for parents with high baseline. For parents with low baseline, the relation between attendance and variability was negative, yet their day-to-day variability was higher than for parents with high baseline. These effects on variability in affective quality are depicted in Figure 5. There was also a main effect of compliance (tau = 0.42, \( p < .05 \)) and an interaction of compliance and attendance (tau = -0.60, \( p < .05 \)). For parents who attended more sessions, compliance was negatively related to variability in affective quality and variability was low compared to parents who attended fewer sessions. For parents who attended fewer sessions, compliance was positively related to variability in affective quality. Thus, although there is some evidence that the correlation between compliance and attendance caused the relation between attendance and variability in affective quality to be over-estimated, the relation between attendance and variability in affective quality remains positive.

**Discussion**

This study was a first look into the micro timescale change processes in intervention-targeted outcomes that occur during exposure to a universal family intervention. I investigated day-to-day change and variability in outcomes that were expected to change with exposure to the intervention, which can only be done with intensive longitudinal methods such as this protocol of daily surveys during the intervention delivery period.

Using a multi-level model, I found that exposure to the intervention (attendance) was not related to a higher level of mindful parenting or an increase in mindful parenting over the
intervention period, contrary to our hypothesis. However, for affective quality, exposure to the intervention (attendance) was related to increase in affective quality over the intervention period. This supports the incremental skill acquisition hypothesis for the affective quality outcome. The skill acquisition hypothesis was based on the behavior change perspective. This pattern of change may be characteristic of skills that can be learned in stages or improved upon gradually by an individual. Yet, it is possible that not all individual outcomes are improved upon gradually or step-wise.

Using a multi-level heterogeneous variance model, I found that day-to-day variability in mindful parenting showed some relation with exposure to the intervention. Although the relation between exposure to the intervention and fluctuation in mindful parenting did not support the homeostasis disruption hypothesis, the results are interesting and, because patterns of change differed by outcome, they tend to differentiate outcomes and shed light on which types of outcomes may show certain patterns of change. Indeed, mindful parenting showed a pattern of change inconsistent with the skill acquisition and the homeostasis disruption hypotheses. Instead, consistency across days in mindful parenting may be the pattern that can be expected of parents who are changing their thoughts and behaviors to reflect mindful parenting. This is what was found for parents in the MSFP condition, who had higher consistency in daily reports of mindful parenting compared to parents in the SFP condition across all levels of intervention exposure. On the other hand, as there was no attendance or time effect in the final model, perhaps the effect of curriculum condition on day-to-day variability in mindful parenting does not reflect change but rather unmeasured baseline differences beyond the baseline mindful parenting differences in the sample. Here, I found evidence that mindful parenting does not follow either proposed pattern of change. Other perspectives on change related to family interventions may reveal additional hypotheses about patterns of change at this micro timescale.

Using a multi-level heterogeneous variance model, I found that affective quality of the parent-child relationship showed increased day-to-day variability with increased exposure to the
intervention, which was consistent with the homeostasis disruption hypothesis, although this effect was attenuated in the final model. Further, accounting for baseline, parents who had high baseline levels of affective quality showed increased variability in affective quality with greater exposure to the intervention. This finding was consistent with the homeostasis disruption hypothesis—specifically indicating that higher exposure to the intervention was related to disruption. In the final model, variability decreased over time. Because we collected these data during intervention delivery, this is a pattern was not necessarily expected: adaptation to disruption is most likely to occur, according to family systems theory, after the intervention is no longer disrupting families. We would expect to see for families that are high in adaptability, and this pattern is consistent with the design of the SFP 10-14 curriculum, which focuses on practice and integration of skills rather than introducing new skills during the final session.

Parents who had low baseline levels of affective quality showed more variability compared to parents who had high baseline levels of affective quality across all levels of exposure to the intervention. This finding was consistent with the homeostasis disruption hypothesis—parents who were most likely to change their affective quality, those with lower baseline (i.e., those who had more room to improve), showed higher disruption. Unexpectedly, for parents who reported low baseline affective quality, although their variability was high across levels of exposure, more exposure to the intervention was not associated with higher variability. Perhaps this occurred because even low amounts of exposure disrupted their family homeostasis.

The homeostasis disruption hypothesis was based on the family system theory of change: that the family homeostasis must be disrupted before reorganizing into a new homeostasis. This theory should be most applicable to family-level constructs involving interactions between multiple family members. For outcomes of individual behavior, it is not likely that the same degree of family reorganization would be necessary for change as compared to family-level outcomes.
There was a range of compliance in parents’ survey completion and survey compliance was moderately correlated with attendance ($r = 0.221, p < .05$) indicating that without accounting for compliance, our estimates of the relation between attendance and day-to-day variability could be overestimated. In Model 4 for both outcomes, I accounted for the effect of compliance and its interaction with attendance. I was also cautious to ensure that day-to-day variability was reliably observed for parents who completed few surveys; keeping just 7 randomly selected surveys from all parents, the rank-order of individual variability in outcomes (iSD) was reliable with the rank-order of individual variability in the full dataset ($r = .805$). That is, seven observations must remain for the same rank-order of people by iSD. This gives us confidence in the estimates of within-person variability and the between-person differences in within-person variability in this sample (min 7 observations).

**Limitations**

My sample (N=33) was small, so the subsample of participants recruited into the daily survey protocol may represent a restricted range in between-person predictor variables or unique relations among predictors and variability in outcomes. Thus, further work should investigate the change processes induced by exposure to interventions with larger samples that are more likely to be fully representative of parents who participate in interventions.

Also because of the small sample size in this study, I was not able to include other possible influences on change processes in these analyses. Other influences on the change experienced from the intervention may include perceived need for change (parents who do not see problems in their family may not change their behavior during the study period), youth age (change in parenting may not be needed until developmental changes occur in the youth’s behavior or needs, so families with younger children may not realize change during the study period), proportion of parents attending (if a parent is not exposed to intervention content but is influencing the family, less change may be realized by the family as a whole), and amount of
practice (parents who do not implement new skills may not realize family change). These covariates were not included and should be noted as a future direction for research.

The generalizability of the findings may be limited. I expect that the overall patterns of change processes that I found here are related generally to family-based interventions in which youth and parents attend and can be extended to the particular outcomes that are targeted. It is the exact parameters relating exposure and variability that are most likely to be specific to the intervention that was delivered in this study. Change processes of particular outcomes can be expected to depend on intervention format and content (e.g., level on spectrum of intervention, frequency of sessions, during which sessions outcomes are targeted) because “exposure” may accumulate and impact variability in outcomes at different rates based on these factors.

This study also did not include a comparison group that completed fewer daily surveys by design, although I did control for compliance. Inclusion of a fewer-surveys comparison group would help to determine whether completion of the study protocol had any effect on variability beyond the statistical association between number of surveys/data points and variability, such as routinization of survey responses, which could serve to decrease day-to-day variability.

This study did not have a control group that did not receive the intervention. According to family systems theory, families that are not undergoing intervention should show less day-to-day variability because they are at homeostasis. Thus, day-to-day variability in families in a control group and families prior to intervention would help when considered alongside the attendance/exposure effect in deducing whether the day-to-day variability I observed in this sample during intervention delivery is both different from non-intervention samples and time periods and also caused by the intervention.

Families at homeostasis or baseline status differ in the amount of day-to-day variability in functioning. This may be related to characteristics of the family. For example, families that are more chaotic may operate at high variability. In addition, certain developmental periods may disrupt homeostasis naturally, causing more variability. For example, when a child starts puberty,
families may operate at high variability, which may also be the impetus for higher attendance at the intervention. A burst of intensive surveys at baseline would provide data about the family’s variability in affective quality and mindful parenting prior to the start of the intervention. Baseline data would allow a direct test of the within-person change process that this study approaches. This study did not measure daily affective quality and daily mindful parenting at baseline. This limitation makes it uncertain whether variability differed at baseline among families or increased with the onset of the intervention compared to baseline. The hypothesis specified homeostasis (low variability) at baseline and disruption (high variability) during intervention delivery.

Furthermore, reorganization and formation of a new homeostasis post-intervention would be consistent with decreased day-to-day variability after the end of the intervention program, yet post-intervention variability is also unknown for this sample. Future studies should extend the intensive longitudinal study design to include bursts of daily surveys at baseline and post-intervention. This would aid in further testing of the hypotheses about change, especially in affective quality, which so far has shown to be consistent with the homeostasis disruption hypothesis in its patterns of change within the intervention period.

Summary

In this study, I found that affective quality of the parent-child relationship may change by disruption of the family system’s homeostasis. Because the patterns of change in mindful parenting did not support either the skill acquisition hypothesis or the homeostasis disruption hypothesis, other patterns of change at this micro timescale should be investigated. This study is among the first to investigate intervention change processes on a micro timescale using intensive longitudinal methods and the first of which I am aware to do so in a family-based intervention. Because intervention theories of change can be tested with these methods, I encourage researchers to apply intensive longitudinal methods to their own intervention evaluation designs.
References


Young, S (2006). – What is Mindfulness?
www.shinzen.org/Retreat%20Reading/What%20is%20Mindfulness.pdf


Table 4-1. Pairwise correlations among all analysis variables

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<th>compl.</th>
<th>cond.</th>
<th>Daily</th>
<th>MndfPar</th>
<th>PYAffQu</th>
<th>Daily</th>
<th>PYAffQu</th>
<th>time</th>
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Table 4-2. Results from Multilevel models of Mindful Parenting

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<tr>
<th>Fixed effects</th>
<th>Model 1: Skills Acquisition</th>
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<th>Model 3: Baseline</th>
<th>Model 4: Compliance</th>
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<td>Est.</td>
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<td>Random effects</td>
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<tr>
<td>Level 2 (person)</td>
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<td></td>
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<td>Variance intercept, ( \sigma^2_{\nu_{j0}} )</td>
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<td>46.26</td>
<td><strong>177.15</strong>*</td>
<td>48.14</td>
</tr>
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<td>Level 1 (day)</td>
<td>Model 1: Skills Acquisition</td>
<td>Model 2: Homeostasis Disruption</td>
<td>Model 3: Baseline</td>
<td>Model 4: Compliance</td>
</tr>
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<tr>
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Note. Unstandardized estimates and standard errors. Effects are scaled in units of mindful parenting (1-6). Model based on up to 45 occasions nested within 33 participants for a total of 667 observations with mindful parenting scores; 658 observations with all predictor variables (Model 4). –2 LL = –2 Log Likelihood; AIC = Akaike Information Criterion, relative model fit statistics. Model 2 parameters sometimes indicate higher variance than Model 1 parameters because of change in centering location caused by the interaction term in Model 2.

* Positive effects should be interpreted for more sessions attended, later time in days, MSFP, higher baseline mindful parenting, and more surveys completed/more data provided. Intercept represents time 0 (day of first session) for the average participant.

* p < .05
Table 4-3. Results from Multilevel models of Affective Quality

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<tr>
<th></th>
<th>Model 1: Skills Acquisition</th>
<th>Model 2: Homeostasis Disruption</th>
<th>Model 3: Baseline</th>
<th>Model 4: Compliance</th>
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<tbody>
<tr>
<td></td>
<td>Est</td>
<td>SE</td>
<td>Est</td>
<td>SE</td>
</tr>
<tr>
<td>Intercept, $\gamma_{00}$</td>
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<td>82.78*</td>
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Random effects

Level 2 (person)

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<td>AIC</td>
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**Note.** Unstandardized estimates and standard errors. Effects are scaled in units of affective quality (1-6). Model based on up to 45 occasions nested within 33 participants for a total of 666 observations with affective quality scores; 666 observations with all predictor variables (Model 4). –2LL = –2 Log Likelihood; AIC = Akaike Information Criterion, relative model fit statistics. Model 2 parameters sometimes indicate higher variance than Model 1 parameters because of change in centering location caused by the interaction term in Model 2.

*a Positive effects should be interpreted for more sessions attended, later time in days, higher baseline affective quality, and more surveys completed/more data provided. Intercept represents time 0 (day of first session) for the average participant.

* \( p < .05 \)
Figure 4-1. Illustration of the incremental skills acquisition (top) and homeostasis disruption (bottom) hypotheses.
Figure 4-2. Raw (unprocessed) affective quality data (left) and mindful parenting data (right) plotted by individual over time in days.
Figure 4-3. 30 days of actual data sampled with or without replacement to demonstrate day-to-day variability, controlling for compliance. Data from six parents who attended four or five sessions (left panels) and six parents who attended seven sessions (right panels) are shown for Mindful Parenting (top panels) and Parent-Youth Affective Quality (bottom panels).
Figure 4-4. Day-to-Day Variability in Reports of Mindful Parenting controlling for survey compliance
Figure 4-5. Day-to-Day Variability in Reports of Affective Quality controlling for survey compliance
Chapter 5

Conclusion

In Chapter 2, I examined mothers’ data from a randomized controlled trial on SFP 10-14 and MSFP to examine whether mothers’ attendance and engagement predicted program benefit, and whether this relation depended on fathers’ attendance. I had predicted that mothers’ attendance and engagement would predict program benefit. In addition, I predicted the program benefit would be more related to these factors for families where mothers and fathers both attended and work together to benefit from the program. I predicted less benefit in families where fathers attended few sessions or not at all, because in these cases mothers’ attendance is not bolstered by fathers’ attendance. In general, there were no significant effects of mothers’ attendance or engagement and this did not depend on fathers’ attendance. The exception was that for intervention-targeted parenting, there was less effect of mothers’ attendance in families where fathers attended few sessions. This study leaves unanswered questions about why attendance and engagement were not related to program benefit, which may be the focus of future studies. For example, could these attendance and engagement variables be unrelated to program benefit in intervention-targeted parenting and affective quality because the threshold of exposure needed for change is different for each parent? Could attendance and engagement be related to different measures of change, perhaps measures of change that detect attempts at change at a more micro timescale?

In Chapter 3, I present a rationale for the utility of more intensive assessment of both outcomes and other factors that might influence change in family-based preventive interventions. I discussed the rationale and advantages of intensive longitudinal methods (ILM) to evaluate
family interventions, and I emphasized new research questions that begin to address how interventions work in a much more time-specific and nuanced way than is possible with less frequent assessment.

In Chapter 4, I used daily surveys (an ILM protocol) to answer one of these research questions—what is the micro timescale change process that the SFP 10-14 and MSFP intervention versions induce? I sought to differentiate whether the change process could be described as smooth improvement or as disruptive change, and for which outcomes. This study found that affective quality showed evidence of both smooth improvement and disruption, whereas mindful parenting did not show strong evidence of either pattern of change at this micro timescale. Model 2 suggested that parents’ attendance was related to higher day-to-day variability in outcomes, more so for affective quality than for mindful parenting. There was some evidence in Model 1 for an increase in affective quality over the intervention period for parents who attended more sessions. For affective quality, these effects remained significant or were explained further in Model 3, which accounted for baseline scores, and Model 4, which also accounted for compliance.

Integration Among the Studies

In the Discussion of Chapter 2, I concluded that investigating attitudes or behaviors that may moderate the effects of attendance and engagement could be fruitful to explain why attendance and engagement were not directly related to program benefit. For example, parents’ motivation to change, their practice and use of new parenting skills, or their evaluation/appraisal of new parenting strategies may be more closely related to program benefit. This would mean, for example, that a subsample of parents who both attend and practice may benefit from the intervention, but not all parents who attend benefit. Besides parent characteristics, children or family characteristics may also impact program benefit and the relation between parent
attendance and program benefit. For example, families that are highly adaptable may show greater benefit because they are more malleable and the family system more easily reorganizes to incorporate changed behavior. Children are also part of the family and interact with parents to impact parenting; parents of children who respond positively to changed parenting and parents of children who receive these changes easily may be more likely to change their behavior, so these parents may show greater benefit and a stronger relation between attendance and program benefit compared to parents of children who respond negatively to changed parenting. In Chapter 3, I suggested that ILM can be used to assess these and other attitudes and behaviors related to the intervention change process. In this period of rapid change, these constructs should be assessed daily, or at least weekly. The implication is that ILM would allow us to further probe the findings of Chapter 2 by testing whether these variables moderate attendance and engagement in their relation with program benefit.

Because Chapter 2 indicated no relation between attendance and change whereas Chapter 4 showed a positive relation between attendance and change, it is clear that the results of these studies do not map directly onto each other. The differences in results may be based on the outcomes that represented change in each study: post-intervention level, degree of day-to-day variability, or daily outcomes over time.

The results of Chapter 4 suggest that attendance and engagement may be more closely related to daily outcomes than to program post-intervention outcomes. Although a previous study has shown that there is sample-level improvement at post-intervention in this RCT (Coatsworth et al., 2015), attendance and engagement did not explain this effect in Chapter 2. Because attendance and engagement are related to day-to-day variability and improvement but not to broader post-intervention outcomes, I conclude that daily outcomes and post-intervention outcomes may not map directly onto one another. That is, there may be a mediating process of consolidation in which daily experiences are translated into development. A direct translation of
daily experiences to post-intervention scores would result in similar relations to attendance and engagement. Future studies should explore the relation of daily experiences to post-intervention scores and longer-term follow-up scores (1-year post intervention), which could illuminate the consolidation process and explain why attendance and engagement are not related to post-intervention outcomes. Perhaps daily experiences do not consolidate into change until after our post-intervention assessments. In this case, attendance and engagement would predict follow-up scores, and perhaps daily experiences would mediate this relation. In this case, post-intervention reflects a stage of flux in which functioning/outcomes are randomly related to intervention exposure.

Chapter 4 was designed as a test of the principles laid out in Chapter 3—that ILM may advance our understanding of how interventions work. In Chapter 4, I investigated just one of many research questions proposed in Chapter 3 that can be addressed with ILM. The results of Chapter 4 show that something besides the assumed linear change process is happening in this period where intervention-induced change begins. The amount of day-to-day variability in reports of mindful parenting and affective quality was not trivial (greater than 50% of all variability in reports on both outcomes). Interestingly, day-to-day variability in affective quality was positively related to the number of sessions that the parent attended in Model 2, possibly indicating that exposure to the intervention induced the variability and the variability is a pattern of change. We investigated these findings further using subsequent models, but generally, these results support the notion that exposure to the intervention is associated with increased disruption of parenting. This finding demonstrates the utility of ILM in understanding how interventions induce change in families.
**Broader Connections**

The results of these studies suggest that there is more about micro timescale change processes that needs to be understood. The possibility that the intervention may be inducing disruption in family functioning during implementation requires further exploration: is disruption related to improvement in the traditional post-intervention assessment of family relationships and child outcomes? Are families that show this disruption doing well day-to-day later on? How does baseline level of functioning affect these processes of disruption and change? Given that SFP 10-14 is not designed based on family systems theory or family therapy, the finding that the intervention may be disrupting the family homeostasis is compelling. These findings seem to indicate that the intervention successfully disrupts homeostasis for some families. Although, there may be other theoretical or clinical explanations for the observed fluctuation.

Applying intensive longitudinal data collection to other interventions samples will require an examination of the family’s developmental status and other family characteristics that may impact the amount of baseline variability. Because variability changes and differs among families, some families may require more frequent assessment to accurately capture their variability. For example, these studies used a sample of families of 6th and 7th graders; some of these children may have recently initiated puberty whereas others had not. Families undergoing this developmental transition may have experienced more rapid fluctuation than day-to-day, and our daily survey methods may have underestimated their fluctuation.

As a practical implication, further support in the transition from disruption to adaptation could help families to incorporate new behaviors long-term and improve families’ outcomes. Practitioner support of families’ process of consolidation may ensure that the change that is started crystallizes and stabilizes before the intervention ends. Further research is needed to determine what practitioner support might be effective in this consolidation and adaptation process, but for example, beyond SFP 10-14’s family practice in the session, practitioners might
reframe the goals of the intervention: instead of setting an expectation that each week builds on the change initiated in the previous week (implying that families should be seeing improvements), practitioners might instead tell parents and children that they will be seeing and trying new behaviors and patterns of interaction, which will be unexpected and may not go well at first. This expectation may help families stick with the attempts to try the behaviors and perspectives introduced in the intervention until the disruption begins to give way to improvement. Indeed, some behavioral parent training programs do tell parents that children’s problem behaviors often get worse before they get better because of short-term resistance (e.g., Multidimensional Treatment Foster Care). These programs expect a mean level worsening and fluctuation in children’s behavior before improvement and stabilizing, but they do not explain this fluctuation using family systems theory.

Examining these micro timescale processes of change and examining their associations with long-term change may ultimately help researchers to identify successful micro timescale change processes that do consolidate into long-term change. Once this relation between micro timescale processes and macro timescale change is better understood, micro trials could be one effective way to test whether particular supplemental motivational or learning strategies might impact the micro timescale change processes.

ILM can provide rapid feedback about each family’s micro timescale change process, alerting practitioners and researchers to which families may need this support. The current model evaluates families after the intervention is over whereas ILM could provide some information about whether the family is showing a more immediate response to the intervention while there is time to support families who are doing less well. ILM can also help to evaluate the effectiveness of these strategies as they are implemented; answering whether the families that receive support then follow a trajectory of micro timescale change that is more likely to lead to improvement. This may allow researchers to change or supplement interventions to boost their long-term effects
and support families in the process of consolidation. Chapter 2 findings indicate that such improvement is needed because the effect of attendance is not reflected in post-test outcomes.

Chapter 3 discusses various theories related to micro timescale processes. These theories point to compelling reasons why micro timescale processes of change are more complicated than they are straightforward, and especially more so for family interventions because they involve the family as a system. Uncovering what factors in the intervention may influence the process of change, describing this process of change, and connecting these micro timescale process to other timescales and moments of change is important to fully elaborating a process model of intervention change. Our model and understanding should be sufficiently thorough to ensure that we can ascertain whether interventions are promoting healthy adaptations at all timescales.

Significance

In sum, this research explores the process of change resulting from a family EBI and the role of parents as participants in intervention uptake and effecting change. More broadly, this dissertation focuses on understanding how EBIs induce change, which involves more frequent assessment during the period of intervention-induced change and allows for integration of the role of participant-driven processes in intervention effects. This line of inquiry can build knowledge about (a) behaviors that can be targeted to optimize the effect of already evidence-based interventions and (b) optimal and suboptimal patterns of fluctuation and change for families attending EBIs. Scientific knowledge about micro timescale change processes garnered through ILM might substantially impact the way we design interventions, when new behaviors or cognitions are introduced, the way we deliver interventions, the ways we recruit or motivate families, and the way we support (and bolster) families’ change processes. These further uses of ILM have the potential to improve interventions’ impact at the level of the individual and family and population.
Future Research

Future research in this line of inquiry should both address the questions that I have attempted to answer here with SFP 10-14 using other programs, and continue in the line of inquiry that I outlined in Chapter 3 using ILM to understand how programs work. Unanswered questions of Chapter 2 include: What aspects of parents’ effort is related to program benefit (e.g., motivation, skill practice, cognitively relating/applying intervention content to personal situations and problems)? Can these important aspects of engagement be measured by observation or self-report of engagement with sufficient predictive variability? Whose attendance and engagement in family programs is important for which outcomes, and how should this be measured?

Other important questions relating to within-person micro timescale processes of change were raised in Chapter 3 and can be addressed by ILM because of its temporal specificity and measurement of experiences: does the family treatment program stabilize within-day variability in outcomes such as distress, affect, and internalizing symptoms compared to control families? Does the program disrupt homeostasis and increase variability in family outcomes such as affective quality, positive/constructive communication, permeability of subsystem and system boundaries? Within the coparenting subsystem, does the father’s change in parenting such as beginning to enforce rules calmly influence or elicit the mother’s use of that skill on the following day, or vice versa?

Inherent in these research questions is an underlying question: for each construct, what is the timescale of variability and change at baseline, and during a particular intervention? Measurement must capture variability and change and thus be on the correct timescale/frequency to be unbiased. Another underlying question is: What constitutes change at each timescale: change in mean levels, change in variability, or something else?

Although Chapter 4 begins to address the question of what constitutes change on a daily timescale, and the research question: does SFP 10-14 induce variability in certain outcomes or
induce mean-level change at the daily timescale?, it is important to answer these questions with
other intervention models. It will also be important for future research to further investigate the
question that Chapter 4 does not address: does variability and change in mean level at the daily
timescale relate to mean level change at a macro timescale (i.e., baseline to post-intervention
assessments)? What is the process of consolidation of micro timescale change into more
permanent macro timescale change?

Future research should use ILM, perhaps with assessment that is more frequent than
daily, with larger samples to continue this line of inquiry.
Appendix

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