

What Drives Developmental Change in Adolescent Disclosure and Maternal Knowledge? Heterogeneity in Within-Family Processes

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This study aimed to gain a better understanding of the normative declines in adolescent disclosure and maternal knowledge over the course of adolescence, by assessing the underlying monitoring processes. Multilevel structural equation models were applied to 15 assessments among 479 families across 5 years (13 years at T1, 57% boys, 11% low socioeconomic status). Developmental declines in mother-perceived disclosure and knowledge were observed, which were partially explained by processes operating at the level of the family unit. On average, mothers were more knowledgeable in weeks with more disclosure and more solicitation, and adolescent disclosure was higher in weeks with more maternal solicitation and less control. The effect sizes and even the directions of these within-family correlations varied between families, however. This heterogeneity was partially explained by the level of maternal control and adolescent disclosure, and by the families' socioeconomic status. Within-family fluctuations in knowledge and disclosure were also correlated with fluctuations in relationship quality and adolescent and mother mood. Overall, these within-family processes explained up to 14% of the normative developmental decline in disclosure and 19% of the decline in knowledge. This study thus suggests that a wide variety in monitoring processes may drive normative declines in adolescent disclosure and maternal knowledge.

Keywords: parental monitoring, adolescent disclosure, longitudinal, within-person, heterogeneity

Supplemental materials: <http://dx.doi.org/10.1037/dev0000220.supp>

Parents' knowledge regarding leisure time activities, companionships, and whereabouts may prevent adolescents from experimenting with minor delinquency and substance use (Dishion & McMahon, 1998). Rather than stemming from active monitoring attempts by parents (i.e., parental control and solicitation), how-

ever, parental knowledge seems to be predominantly rooted in adolescent disclosure (Smetana, 2008; Stattin & Kerr, 2000). In fact, the positive effect of parental monitoring practices on later problem behaviors may be indirect, through the promotion of adolescent disclosure (e.g., Soenens, Vansteenkiste, Luyckx, &

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The RADAR project has been financially supported by main grants from the Netherlands Organisation for Scientific Research (GB-MAGW 480-03-005, GB-MAGW 480-08-006), Stichting Achmea Slachtoffer en Samenleving (SASS) (March 2004 and July 2008) to RADAR Principle Investigators, and a Gravitation grant from the Netherlands Organisation for Scientific Research to the Consortium Individual Development (CID) (024.001.003). This study was further supported by a research fellowship awarded to Loes Keijsers from the Alexander von Humboldt Foundation.

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Goossens, 2006; Willoughby & Hamza, 2011). It may therefore have important practical implications to unravel which processes drive a developmental decline in disclosure and knowledge over the course of adolescence (Keijsers & Poulin, 2013; Laird, Pettit, Bates, & Dodge, 2003; Masche, 2010).

In the broader framework of developmental psychopathology (Cicchetti & Rogosch, 2002), longer term developmental changes result from an accumulation of real-life interactions between the person and his or her own environments (e.g., interactions of a child with family members or peers). In this study, we attempted to get a more in-depth understanding of underlying mechanisms in the family that drive normative declines in disclosure and knowledge. As these processes operate within, rather than across, families, we studied the correlates of parental knowledge and adolescent disclosure at the level of the family unit. For instance, focusing on mothers' perceptions, we addressed the question whether a mother is more knowledgeable in weeks when she perceives her own child more open in terms of disclosure, and labeled this concept the within-family correlation. Moreover, differential susceptibility accounts (Pluess & Belsky, 2010) argue that a parenting environment that is positive for one child may lead to adverse outcomes for another. Hence, rather than a uniform monitoring process, there may be heterogeneity in how monitoring operates, which we have described and attempted to explain. Finally, we have tested the extent to which these underlying within-family processes explain normative longer-term developmental changes in disclosure and knowledge.

Developmental Declines in Adolescent Disclosure and Maternal Knowledge

Over the course of adolescence, the monitoring process between parents and their children needs to be realigned, to meet the child's increasing autonomy and privacy needs (Finkenauer, Engels, & Meeus, 2002; Keijsers & Poulin, 2013; Petronio, 2012). For instance, with increasing age, children are less tempted to disclose information regarding their leisure time to their parents, and parental knowledge decreases (e.g., Laird, Pettit, Bates, et al., 2003; Masche, 2010). The most pronounced changes in this respect, can be observed in the mother-child dyad (Keijsers, Branje, VanderValk, & Meeus, 2010). Although several studies have described these normative developmental changes in parent-child communication (Keijsers & Poulin, 2013; Laird, Pettit, Bates, et al., 2003; Masche, 2010), little is known about the explanatory mechanisms of change.

This study departs from the theoretical viewpoint that behaviors tend to stabilize around regularly occurring patterns in the lives of individuals, and processes at the level of the individual person - or family - may thus give rise to longer-term developmental change at the population level (Branje, Keijsers, Van Doorn, & Meeus, 2012; Molenaar, 2004). Likewise, it is feasible that the shorter-term within-family monitoring processes between parents and their own children explain normative longer-term developmental changes in disclosure and knowledge. This paper will test this theoretical idea.

The Level of the Within-Family Processes

Methodologically, to assess monitoring processes within families, this paper tests theoretical ideas at the level of the family unit

(see also, Aunola, Tolvanen, Viljaranta, & Nurmi, 2013; Villalobos, Smetana, & Comer, 2015), operationalized in terms of the mother's perception of the mother-child dyad. For instance, if adolescent disclosure is indeed an important source of parental knowledge (Stattin & Kerr, 2000), we would not only expect that mothers with more knowledge have children who disclose more (i.e., an effect at the between-family level described in earlier literature), we would also expect to observe that natural overtime fluctuations in the level of maternal knowledge within a family (i.e., temporal deviations of a person from her of his own expected score) are related to fluctuations in adolescent disclosure in the same family (see Hamaker, Kuiper, & Grasman, 2015 for a technical explanation). In other words, if knowledge and disclosure are truly causally linked, parents should have more knowledge in periods when adolescents disclose more. Moreover, if these shorter-term processes indeed accumulate, these linkages at the level of individual families should partially explain normative declines in disclosure and knowledge over the course of adolescence.

To test these ideas, we have isolated the within-family process in this study, which has an important advantage of removing confounding influences from third factors at the between-family level, such as genetic endowments and socioeconomic status. To illustrate the theoretical importance, Figure 1 provides a hypothetical example, in which three families (Anne, Peter, Karen) report five times on their solicitation (x axis) and disclosure (y axis). The differences in solicitation in Peter's, Karen's and Anne's families correspond to differences in disclosure by Peter, Karen, and Anne, resulting in a positive between-family correlation ($n = 3$). At the same time, in most families, children disclose less in periods when mother ask more questions (i.e., most within-family correlations are negative).

This hypothetical example illustrates that between- and within-family estimates answer a different research question, by tapping into different layers of information, that are not necessarily linked (Kievit, Frankenhuis, Waldorp, & Borsboom, 2013; Voelkle, Brose, Schmiedek, & Lindenberger, 2014). Between-family statistics (e.g., an effect in regression model, or a predictor of a random slope in a growth model) are valuable to understand for whom

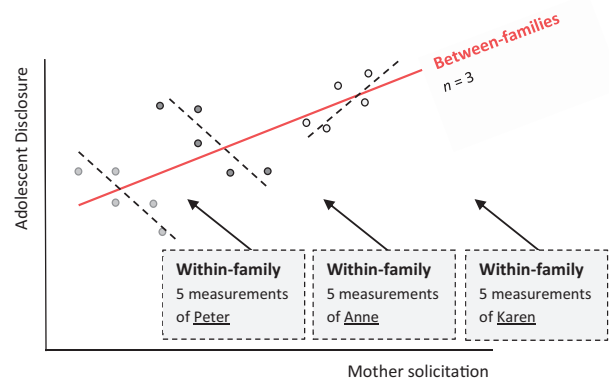


Figure 1. Theoretical example of how between-family differences (solid line) may not be linked to the average in within-family associations, nor capture the heterogeneity therein (dashed lines). See the online article for the color version of this figure.

disclose and knowledge are lower or decrease more strongly. The within-family level, in contrast, may help to better understand *how* these changes take place. It has been argued that the within-family level, compared with the between-family level, may provide more accurate estimates for questions regarding the parenting effects as they occur within a family unit. One reason is that all confounding factors at the between-family level are automatically taken into account (e.g., Hamaker et al., 2015; Molenaar, 2004).

Some empirical studies on parental monitoring further underscore the theoretical importance of distinguishing the within-family effects from between-family differences. In one study, parental control was negatively correlated at the between-person level with spending time in criminogenic settings, but not at the within-person level (Janssen, Deković, & Bruinsma, 2014). Hence, although more controlling parents had children with lower levels of delinquency, children were not less delinquent during periods when their own parents were more controlling. Likewise, linkages between parental monitoring and adolescent problem behaviors that were found in a standard cross-lagged model, did not show up at the within-family level (Keijsers, 2016). Finally, in a diary study, relationship quality differed meaningfully between youths who kept many or few secrets, but relationship quality was not linked to day-to-day fluctuations in secrecy within the average family (Smetana, Villalobos, Rogge, & Tasopoulos-Chan, 2010).

These three studies, examining somewhat different research questions compared with the present study, hint that monitoring processes operating within families cannot be accurately inferred from studying between-family statistics (as is the case in many fields in psychology: Molenaar, 2004; Voelkle et al., 2014). By predominantly focusing on the level where the actual parenting effects on a child take place—the within-family level—this study aims to better assess the within-family processes that accumulate into normative declines in disclosure and knowledge.

Moreover, families differ. Whereas Anne in Figure 1 discloses more when her mother asks fewer questions, there is no such correlation in Karen's family. This heterogeneity in how parents and children affect each other is at the heart of many theories on parenting (Bronfenbrenner, 1986; Grusec, 2011; Steinberg & Silk, 2002), and can be more directly observed when the processes are studied within families. By directly focusing on the level of within-family correlations, in this study, we thus could also assess how the within-family monitoring processes that keeps, or fails to keep, parents informed may vary from family to family.

Within-Family Monitoring Processes as the Motor of Developmental Change

Because longer term developmental changes in knowledge and disclosure, may result from the accumulation of periods in which parents are better or less well-informed, we aimed to identify normative change as well as the family processes related to periods of decreased communication. As described in their conceptual framework, successful monitoring requires “a sense that parents are aware of the emotional atmosphere of the family and the child, and modulate behavior, activities, and communication accordingly” (Dishion & McMahon, 1998, p. 68). Derived from this framework, the correlates that were examined in this study are monitoring behaviors, relationship quality, and the emotional climate, operationalized in terms of mother and adolescent mood.

First, we focused on parental monitoring behaviors and adolescent disclosure, thereby extending the literature on parental monitoring (review: Racz & McMahon, 2011; Smetana, 2008). We examined how maternal solicitation, maternal control, and adolescent disclosure would be related to within-family over time fluctuations in maternal knowledge, and how solicitation and control would be linked to within-family over time fluctuations in adolescent disclosure (Soenens et al., 2006). In earlier studies examining mainly between-family differences, parental knowledge was correlated strongly with adolescent disclosure, moderately strongly with parental solicitation, and inconsistently with parental control (e.g., Keijsers, Branje, VanderValk, et al., 2010; Soenens et al., 2006; Stattin & Kerr, 2000; Willoughby & Hamza, 2011). Regarding adolescent disclosure, parental solicitation was correlated with higher levels of disclosure (e.g., Keijsers & Laird, 2014; Kiesner, Dishion, Poulin, & Pastore, 2009; Willoughby & Hamza, 2011). It is largely unknown whether between-family correlations also describe the patterns underlying fluctuations over time in knowledge and disclosure within a family. A recent daily diary study indicated that day-to-day fluctuations in solicitation are linked to the level of adolescent disclosure (Villalobos et al., 2015); this suggests that similar processes take place within-families. In this study, we have tested these within-family fluctuations over a much more extended period of several years.

Relationship quality may be second crucial factor in the monitoring process (Dishion & McMahon, 1998), explaining how parents know more at some times than other times, and how children's disclosure varies over time within a family. At a sample level, it is well-established that relationship quality and adolescent disclosure are positively related (Kerr, Stattin, & Trost, 1999; Smetana, Villalobos, Tasopoulos-Chan, Gettman, & Campione-Barr, 2009; Soenens et al., 2006). However, it is largely unknown how fluctuations in the experienced relationship quality may correlate with lower levels of parental knowledge or disclosure at the level of family unit (but see: Smetana et al., 2010; Villalobos et al., 2015 examining this question at the day-to-day time scale), and how these within-family processes may explain longer term developmental change.

Third, although it has been long hypothesized that the “emotional atmosphere of the child” is an essential fundament of the monitoring process (Dishion & McMahon, 1998), research on this aspect is scarce. Part of the storm and stress adolescent go through in their development are an increase in mood liability and conflicts with parents (Arnett, 1999), which is confirmed by recent empirical work (Maciejewski, van Lier, Branje, Meeus, & Koot, 2016). A negative mood can color the world and subtly affect an individual's experiences, cognitions, and behaviors (Wilhelm & Schoebi, 2007). Adolescent's family experiences are on average characterized by more negative emotions and less openness, compared with, for instance, interactions with friends (Larson & Richards, 1991; Larson, 1983) and research among adults indicates that more negative experienced emotions are linked to a tendency to engage in fewer social interactions (Vittengl & Holt, 1998). Specifically, when it comes to parent-child communication during adolescence, mother's negative mood may take away parent's attention from the child, and lead to decreased effectiveness of the monitoring process (Dishion & McMahon, 1998). Likewise, adolescent negative mood may be related to a tendency to avoid disclosure (e.g., not being in the mood for talking). Although

theoretically, both adolescent and mother positive mood may be a crucial fundament under effective parent–child communication (Dishion & McMahon, 1998), to the best of our knowledge, this research question has not been addressed at the within-family level.

Heterogeneity in Within-Family Processes

Rather than assuming there is “one monitoring process that fits all”, another objective of this study was to study heterogeneity in the monitoring process. Ecological theories (Bronfenbrenner, 1986), socialization accounts (Grusec, 2011) and adolescent parenting literature (Steinberg & Silk, 2002) all describe important variation between families in how parenting behaviors affect a child. There are ample illustrations of such moderated effects in the monitoring literature. Moderators of the effect of parental monitoring on child problem behavior range from structural factors, such as gender and socioeconomic status (e.g., Jacobson & Crockett, 2000; Laird, Pettit, Dodge, & Bates, 2003; Willoughby & Hamza, 2011), the relationship context (e.g., Darling & Steinberg, 1993; Laird, Marrero, & Sentse, 2010), to the level of parental monitoring itself (e.g., Kakihara & Tilton-Weaver, 2009; Mason, Cauce, Gonzales, & Hiraga, 1996). The factors that promote disclosure and knowledge may also be moderated, for instance by gender (e.g., Keijsers, Branje, Frijns, Finkenauer, & Meeus, 2010) or socioeconomic status. Moreover, when levels of monitoring are too high, or in highly supportive parent–child relationships, adolescents seem more likely to experience monitoring attempts as a form of overcontrol or privacy invasion (Hawk, Keijsers, Hale, & Meeus, 2009; Kakihara & Tilton-Weaver, 2009; Kerr & Stattin, 2000), which may indirectly link parental monitoring to lower levels of disclosure and knowledge (Hawk et al., 2013). As such, previous research confirms theoretical ideas that there is heterogeneity between families in the correlations between parental monitoring, adolescent disclosure, and parental knowledge, which may be explained by structural factors, relationship quality, and the level of parental monitoring itself.

Aims and Hypotheses

This study departed from the theoretical viewpoint that longer term developmental changes in knowledge and disclosure may result from the accumulation of periods in which parents are better or less well-informed. We therefore aimed to identify normative change as well as the within-family processes related to periods of decreased communication. To add an important layer to earlier work, we explicitly studied these within-family processes at the level where they are assumed to take place—the level of the family unit. Although this may ultimately yield the same conclusions as the large amount of earlier studies answering this same question with between-family correlations, methodological accounts indicate this is highly unlikely (Kievit et al., 2013; Molenaar, 2004; Voelkle et al., 2014). In fact, empirical studies on parenting effects confirm that within- or between-family estimates are distinct, and may lead to substantially different conclusions regarding the processes at the level of a family unit (e.g., Aunola et al., 2013; Hamaker et al., 2015; Janssen et al., 2014; Keijsers, 2015; Smetana et al., 2010). Because there are very few studies observing the

within-family monitoring processes (Smetana et al., 2010; Villalobos et al., 2015), hypotheses were derived from theories that are predominantly built on studies of between-family differences (reviews: Keijsers, 2016; Racz & McMahon, 2011; Smetana, 2008).

At the within-family level, we expected that maternal knowledge would be lower in periods when mother-perceived disclosure and, to a lesser extent, maternal solicitation and control would be lower. Likewise, we expected within-family overtime co-fluctuations in disclosure and solicitation (but not control). We further hypothesized significant heterogeneity between families in these within-family correlations and we explored whether structural factors, adolescent gender or socioeconomic status, could explain this heterogeneity. It was further hypothesized that maternal monitoring would less strongly co-fluctuate with knowledge and disclosure in higher-quality relationships and with higher overall levels of control. Additionally, we hypothesized strong within-family correlations between adolescent disclosure and maternal knowledge on the one hand, and relationship quality and adolescent and mother mood on the other hand. The overarching hypothesis of the study was that these overlapping over time fluctuations at the level of the family unit, as indicative of within-family monitoring processes, would explain part of the normative developmental decreases in adolescent disclosure and maternal knowledge between ages 13 and 18.

Method

Sample and Procedure

As part of the Research on Adolescent Development and Relationships (RADAR) study, 479 mothers and 484 adolescents participated in 15 online assessments spanning five years. The participants were visited yearly in February, and in addition, adolescents and mothers participated in three online assessments weeks per year, taking place in June, September, and December. The data of these online assessments were used in this study (an elaborate description of the procedures can be found in: Maciejewski et al., 2014). Prior to the start of the study, adolescents and their parents provided written informed consent and the study was approved by the medical ethical committee of the University Medical Centre Utrecht (the Netherlands).

Each online assessment week was composed of a larger questionnaire and a 6-day daily diary study. For the latter, e-mail invitations were sent at approximately 5:30 p.m. each day, after which adolescents logged in at the project’s website. When adolescents had not completed the questionnaires 1.5 hr after the initial e-mail, they received reminder e-mails. After an additional 1.5 hr, adolescents received text messages and, in case adolescents did not respond, phone calls were made.

At the first assessment, adolescents were on average 13.3 ($SD = .46$) years old, and 56.9% were male. Most had a Dutch-Caucasian background (96.6%). In this sample, 27.8% of the mothers and 14.8% of the fathers was unemployed or held an elementary job (e.g., truck driver). In 10.8% of the families, both father and mother fit this criterion and these families were classified as low socioeconomic status (SES).

Measures

Maternal monitoring and adolescent disclosure. As part of the weekly online questionnaire, mothers filled out shortened versions of the [Stattin and Kerr \(2000\)](#) monitoring scales. Based on confirmatory factor analysis (CFA) models ([Frijns, Keijsers, Branje, & Meeus, 2010](#); [Hawk et al., 2009](#)), maternal knowledge was composed of 5 items, adolescent disclosure of 2 items, maternal solicitation of 3 items, and maternal control of 3 items. An example is, “The last 3 months, did you know what [name child] did in [his or her] leisure time?” All items can be found in Appendix 1 in the online supplemental material. The scales ranged from 1 (*never*) to 5 (*always*). The average reliabilities across the 15 measurement waves were .762 for adolescent disclosure, .749 for solicitation, .902 for control, and .801 for knowledge. The within-family reliabilities, computed using the `GmeanRel` function of the multilevel package in R ([Bliese, 2013](#)), were .937 for adolescent disclosure, .911 for solicitation, .948 for control, and .948 for knowledge.

Relationship quality. A shortened version of the Network of Relationship Inventory support scale ([Furman & Buhrmester, 1985](#)) was used to tap mother- and adolescent-perceived quality of their relationship. Two items were answered each day with answer categories from 1 (*not at all*) to 7 (*very much*): “How pleasant was the relationship with your mother today?” and “Did your mother show you today how much she cares about you?” (Please see Appendix 1 in the online supplemental material.). Mothers filled in items with adjusted wording. The question could be skipped if no interaction took place that day. The reliability within days ranged between .65 and .87. For this study, we used week averages of the scores, provided at least 3 days were filled in. Within-family reliabilities of these scores were .896 for adolescent-reports and .943 for mother-reports.

Adolescent and mother mood. Adolescents and mothers rated the intensity of their daily mood (“Today I feel . . .”) using the Daily Mood Device ([Hoeksma et al., 2000](#)). To assess overall positive mood, three happiness items (e.g., “glad,” reliability between .877 and .958 for adolescents and between .950 and .978 for mothers) were combined with three reverse coded anger items (e.g., “angry,” reliability between .903 and .950 for adolescents and between .866 and .949 for mothers). All items were scored on a 9-point Likert scale (e.g., 1 = *not happy*, 9 = *happy*; Appendix 1 in the online supplemental material provides overview of all items). For participants with three or more valid scores, we computed the week average. The within-person reliabilities were .951 for mother-reports and .941 for child-reports.

Structural characteristics. Gender was coded as 0 = *boy* versus 1 = *girl*. Socioeconomics status (SES) was coded as 0 = *normal/high* (89%) versus 1 = *low* (i.e., both parents being unemployed or holding an elementary job, 11%).

Missing Data

Of the 15 possible measurements, mothers had on average 11.47 ($SD = 4.19$) valid assessments for the parental monitoring scales, 12.21 ($SD = 4.41$) for mood, and 11.36 ($SD = 4.42$) for relationship quality, adolescents, had on average 11.77 ($SD = 4.42$) valid scores for their mood and 8.41 ($SD = 4.88$) for relationship quality. Except for relationship quality as reported by adolescents (59%), between 79% and 85% of all possible observations were

collected. If adolescents did not have an interaction with mothers that day, they could skip the question, which some of them perhaps did strategically. In the last wave 373 mothers participated and 344 adolescents. Little’s Missing Completely At Random (MCAR) test yielded no indication of a significant deviation from a completely random missing data pattern ($\chi^2 = 13045.244$, $df = 22462$, $p = 1.000$), suggesting that the attrition in this study is nonselective. In the multilevel models, all available data were included. Descriptive statistics can be found in [Table 1](#). The correlation matrices at the between- and within-family level are provided in Appendix 2 in the online supplemental material.

Strategy of Analyses

Two series of multilevel structural equation models ([Heck, 2001](#)) were specified in *Mplus 7.3* ([Muthén & Muthén, 2007](#)): one series for predicting parental knowledge (Model K1 to Model K4; see Appendix 3 in the online supplemental material for a graphical overview) and one series for predicting adolescent disclosure (Model D1 to Model D4). We used raw data structured in a long format. Estimates were obtained using a Full Information Maximum Likelihood estimator. All time-constant predictors were grand-mean centered and time-varying predictors were person-mean centered. Input and output files are available upon request.

Baseline model for normative development. For both series, a baseline developmental model was specified to assess normative change. These models included a random intercept and fixed linear and a quadratic terms for measurement occasion at the within-person level (labeled Model K1 for knowledge and Model D1 for disclosure). In the multilevel models, fixed effects have no variance around them, and random effects allow variance in the estimates. Conceptually, this model thus splits the total variance in the observed scores into (a) stable trait-like between-family differences (the random intercept), (b) normative nonlinear change with age (fixed within-family effects assessing mean level within-person change), and (c) and within-family overtime fluctuations that were not expected based on the individual family’s relative position in the sample and the estimated normative developmental

Table 1
Descriptive Statistics

| Measure (respondent) | Observations | <i>M</i> | <i>SD</i> | Min | Max |
|--|--------------|----------|-----------|------|------|
| Maternal knowledge (mother-report) | 5762 | 4.09 | 0.50 | 1.40 | 5.00 |
| Adolescent disclosure (mother-report) | 5703 | 3.74 | 0.73 | 1.00 | 5.00 |
| Maternal solicitation (mother-report) | 5702 | 4.00 | 0.61 | 1.00 | 5.00 |
| Maternal control (mother-report) | 5760 | 2.83 | 1.27 | 1.00 | 5.00 |
| Relationship quality (adolescent-report) | 4309 | 5.52 | 0.91 | 2.20 | 7.00 |
| Relationship quality (mother-report) | 5782 | 5.34 | 0.84 | 1.83 | 7.00 |
| Adolescent mood (adolescent-report) | 5968 | 7.37 | 1.21 | 1.53 | 9.00 |
| Mother mood (mother-report) | 6156 | 7.55 | 1.07 | 1.80 | 9.00 |

Note. Total number of 7,185 possible observations for mothers ($n = 479 \times 15$ measurements) and 7,260 for adolescents ($n = 484 \times 15$ measurements).

change (values above and beyond the individual's expected developmental trend; please see Hamaker et al., 2015, for a technical explanation).

Models 2a–c. Average within-family effects. To address within-family effects in the average family, we added predictors of the within-family fluctuations in disclosure and knowledge, in the form of fixed effects at the within-family level (i.e., one estimate for the whole sample). Specifically, in two separate main models, within-family fluctuations in maternal knowledge were predicted by the other monitoring factors (disclosure, solicitation and control; Model K2a), and within-family fluctuations in disclosure were predicted by solicitation and control (Model D2a). In additional models these predictors were replaced by mother- and adolescent-perceived relationship quality (Models 2b) and mother and adolescent mood (Models 2c), respectively.

Model 3. Heterogeneity in within-family effects. In a next step, heterogeneity was tested between families in the within-family monitoring effects by extending Model K2a en D2a with variances around the estimated effects (Model K3 and Model D3). For instance, instead of considering the within-family effect of adolescent disclosure on knowledge to be the same across families, we modeled it as a random effect, that is, an effect that varies between families.

Model 4a–c. Predictors of Heterogeneity. If such heterogeneity between families was found in Model K3 and D3, we predicted the variance around the random effects in subsequent models, by adding structural characteristics (gender, SES; Model 4a), stable levels of parental monitoring and adolescent disclosure (Model 4b), relationship quality (Model 4c). For instance, to test whether the within-family effects of disclosure on knowledge would be different for boys and girls, we added gender as a predictor of the random effect of disclosure on knowledge in Model 4a. Appendix 4 in the online supplemental material provides fit statistics of all models.

Explaining normative change. To answer our overarching question, how these within-family processes may drive normative developmental change, we determined how much of the overtime within-family change in disclosure and knowledge (determined in Model K1 and D1) was explained by the (heterogeneous) within-family processes in Models K2–4 and Models D2–4. Specifically, we examined whether adding the within-family effects to the multilevel equation reduced the size of the estimated normative developmental change. The conceptual rationale behind this statistical approach is based on a multilevel mediation model, where

adding a mediator is expected to reduce the estimated effect size of the predictor on the outcome (*c–c'* approach: Krull & Mackinnon, 2001).

Results

Maternal Knowledge

Model K1. Normative development. Model K1 was specified to split the variance in mother-reported knowledge into stable differences between families (i.e., random intercept), mean level developmental change (i.e., linear and quadratic effect of time) and within-family fluctuations around the expected scores. Between ages 13 and 18, a developmental decline in mother-reported knowledge was found (Table 2 left side & Figure 2). The intraclass correlation was .585, indicating that 58.5% of the variance in maternal knowledge was due to stable between-family differences, and 41.5% due to within-family fluctuations above and beyond the stable difference and mean level developmental change. These within-family fluctuations were predicted in subsequent models.

Models K2a–c. Average within-family effects. To capture the within-family linkages between adolescent disclosure, maternal solicitation, and maternal control with maternal knowledge, we specified Model K2a (Table 3, left side). For the average family, fluctuations in mothers' knowledge were significantly linked with fluctuations in adolescent disclosure ($\beta = .268$) and maternal solicitation ($\beta = .069$), but not with fluctuations in control. Compared with Model K1, the linear effect of age decreased with 14.9% in this model (from $B = -.021$ in Model K1, to $B = -.018$ in Model K2a), indicating that this part of mean level change in maternal knowledge was explained by these within-family monitoring correlates. In Model K2b, only mother-reported relationship quality was positively linked to fluctuations in knowledge (mother: $\beta = .135$). On average, in weeks when mothers reported more knowledge, they also reported a better relationship quality, explaining 11.5% of the linear mean level change in maternal knowledge. In Model K2c, both mother and adolescent positive mood were added. Only adolescent-reported mood related to knowledge ($\beta = .053$). Adding mood explained 4.2% of mean level change in mother-reported knowledge described in Model K1.

Model K3. Heterogeneity in within-family effects. In Model K3 (Table 3, right side), variation was allowed around the within-family effects, to assess heterogeneity between families. This improved the model fit compared with fixed effect Model K2a (see

Table 2

Baseline Models to Assess Normative Change for Maternal Knowledge and Adolescent Disclosure (Graphically Depicted in Figure 2)

| Predictor | Model K1: Baseline model for maternal knowledge | | | | Model D1: Baseline model for adolescent disclosure | | | |
|--|---|-----------|----------|-----------|--|-----------|----------|-----------|
| | <i>B</i> | <i>SE</i> | <i>p</i> | Model ICC | <i>B</i> | <i>SE</i> | <i>p</i> | Model ICC |
| Intercept | 4.083 | .018 | .000 | .618 | 3.729 | .028 | .000 | .585 |
| Time (linear, 3-month interval) ^a | –.021 | .001 | .000 | | –.014 | .001 | .000 | |
| Time (quadratic, 3-month interval) | .001 | .000 | .000 | | .000 | .000 | .097 | |

Note. 95% confidence interval = $B \pm 1.96 \times SE$. Maternal Knowledge: $n = 479$ clusters; average cluster size = 11.91. Adolescent disclosure: $n = 479$ clusters, average cluster size = 12.03. ICC = intraclass correlation.

^a Reference value to the estimated linear effect of time in Models 2–4.

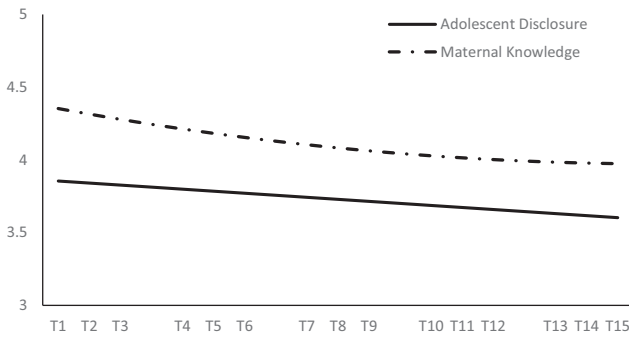


Figure 2. Average mean level developmental change in maternal knowledge and mother-perceived adolescent disclosure over 15 measurement waves (between ages 13 and 18).

Appendix 4 in the online supplemental material), suggesting that this model provide a more accurate description of the data patterns. Across families, significant variance was found around each effect on parental knowledge, $\sigma^2 = .027$ for the effect of adolescent disclosure, $\sigma^2 = .011$ for the effect of parental control, and $\sigma^2 = .014$ for the effect of parental solicitation on knowledge. Adding the heterogeneity to within-family monitoring processes explained 19.0% of the mean level developmental change in maternal knowledge.

An emergent methodological concern is that between-family statistics may not have captured within-family effects. Therefore, to interpret these heterogeneous within-family effects, and to assess the extent to which they could also have been derived by applying between-family models on the same data, we also estimated between-family estimates in a multiple linear regression model, using the lme4 package in R (Bates, Maechler, Bolker, & Walker, 2015). The outcome was the family mean of parental knowledge, and the predictors were the family mean of adolescent

disclosure, parental solicitation, and parental control (Table 4; between-family reference model). At the between-family level, parental knowledge was significantly related to adolescent disclosure ($\beta = .620$) and to parental solicitation ($\beta = .098$), but not to parental control. Figures 3 to 5 (see Appendix 5 in the online supplemental material for Figures 4 and 5) display the unstandardized between-family estimates (left panels) and the estimated effects for a random subset of families (right panels).

Regarding the unstandardized effect of adolescent disclosure on knowledge, 2.9% of the estimated within-family effects in Model K3 fell within the 95% confidence interval of the between-family estimate. The within-family effect was smaller in 96.0% of the families. For the link of parental solicitation with knowledge, 71.0% of the within-family estimates fell inside the between-family confidence interval (23.7% smaller), and for parental control, 42.6% of the families had an estimated effect within the between-family confidence interval (24.6% smaller, 32.4% larger). This indicates that testing the within-family linkages and acknowledging heterogeneity between families therein, yields a pattern of results that could not have been obtained by applying a between-family data-analytically approach. Specifically, comparing this reference model to Model K3 indicates that confidence intervals of the between-family estimate captures what occurs in only a specific group of families.

To get an idea of heterogeneity in the effect sizes in Model K3, we computed an effect size per family. The effect of disclosure on knowledge ranged between $-.221$ and $+.908$. Applying Cohen's (1992) criteria for effect size interpretation, the effect was strong in 6.1% of the families ($r > .50$), moderately positive in 30.4% ($.30 < r < .50$), weakly positive in 49.1% ($.10 < r < .30$), trivial in 14.3% ($r < .10$), and weakly negative in 0.2% ($r < -.10$). The effect of parental solicitation on parental knowledge ranged between $-.500$ and $+.561$, was moderately negative in 0.2% of the families, weakly negative in 2.4%, not meaningfully related in 66.5%, weakly positive in 19.3%, and moderately positive in 1.3%

Table 3
Within-Family Prediction of Maternal Knowledge

| Predictor | Model K2a, K2b, K2c: Within-family effects on maternal knowledge | | | | | Model K3: Heterogeneity in within-family effects on maternal knowledge | | | | |
|--|--|------|------|---------|----------------------|--|------|------|---------------------------|----------------------|
| | B | SE | p | β | Model R ² | B ^a | SE | p | β (SD) ^a | Model R ² |
| Time (linear, 3-month interval) | -.018 | .001 | .000 | | | -.017 | .001 | .000 | | |
| Adolescent disclosure (mother report) | .198 | .009 | .000 | .268 | | .170 | .012 | .000 | .253 (.162) | |
| Maternal solicitation (mother report) | .056 | .010 | .000 | .069 | | .052 | .011 | .000 | .071 (.093) | |
| Maternal control (mother report) | -.008 | .006 | .144 | -.017 | | .001 | .008 | .855 | -.005 (.155) | |
| σ^2 around effect disclosure | | | | | | .027 | .004 | .000 | | |
| σ^2 around effect maternal solicitation | | | | | | .014 | .003 | .000 | | |
| σ^2 around effect maternal control | | | | | | .011 | .002 | .000 | | |
| | | | | | 9.8% | | | | | 25.0% |
| Time (linear, 3-month interval) | -.018 | .001 | .000 | | | | | | | |
| Relationship quality (mother-report) | .091 | .011 | .000 | .135 | | | | | | |
| Relationship quality (adolescent-report) | .008 | .009 | .370 | .015 | | | | | | |
| | | | | | 9.8% | | | | | |
| Time (linear, 3-month interval) | -.020 | .001 | .000 | | | | | | | |
| Mother mood (mother-report) | .010 | .007 | .159 | .018 | | | | | | |
| Adolescent mood (adolescent-report) | .025 | .006 | .000 | .053 | | | | | | |
| | | | | | 3.3% | | | | | |

Note. The quadratic effect and intercept term are omitted from the table. 95% confidence interval = $B \pm 1.96 \times SE$.

^a In Model 3 an effect is estimated for each family separately; The beta represents the average standardized effects across families.

Table 4

Between-Family Prediction of Maternal Knowledge and Adolescent Disclosure (Reference Models for Interpreting Within-Family Effects)

| Predictor | Between-family prediction of maternal knowledge | | | | Between-family prediction of adolescent disclosure | | | | | |
|---------------------------------------|---|-----------|----------|---------|--|----------|-----------|----------|---------|-----------------------------|
| | <i>B</i> ^a | <i>SE</i> | <i>p</i> | β | Model <i>R</i> ² | <i>B</i> | <i>SE</i> | <i>p</i> | β | Model <i>R</i> ² |
| Adolescent disclosure (mother report) | .414 | .024 | .000 | .620 | | | | | | |
| Maternal solicitation (mother report) | .086 | .032 | .007 | .098 | | .253 | .060 | .000 | .193 | |
| Maternal control (mother report) | -.006 | .014 | .666 | -.016 | | -.066 | .027 | .013 | -.114 | |
| | | | | | 41.6% | | | | | 4.1% |

Note. 95% confidence interval = $B \pm 1.96 \times SE$.

of the families. The correlation of parental control with parental knowledge ranged between $-.800$ and $+.698$ and was moderately negative in 5.6% of the families, weakly negative in 15.7%, not meaningfully related in 58.6%, weakly positive in 17.6%, and moderately to strongly positive in 2.6% of the families.

Model K4a–c. Predictors of Heterogeneity. Finally, in a fourth set of models, we aimed at explaining this heterogeneity, by adding gender and SES (Model K4a), average level of parental monitoring and disclosure (Model K4b), and the average relationship quality (Model K4c). Each addition improved the model fit (see Appendix 4 in the online supplemental material), but only two significant effects were found. In families with higher mean levels of parental control ($B = .047$, $SE = .009$, $p = .000$) and lower mean levels of disclosure ($B = -.038$, $SE = .013$, $p = .004$) the within-family effect of parental control on knowledge was more positive. The predictors in this model explained 18.2% of the variance between families in how parental control and parental knowledge are linked.

To sum up, we found a steady decrease in mother's knowledge with age, but also within-family fluctuations indicative of periods with increased or decreased knowledge (Model K1). These within-family overtime fluctuations in knowledge were, on average, related to fluctuations in disclosure and to a lesser extent to solicitation (Model K2a), fluctuations in mother-reported support (Model K2b), and fluctuations in adolescent mood (Model K2c). The monitoring process, as indicated by the links of solicitation, control, and adolescent disclosure with maternal knowledge, varied significantly between families (Model K3) and this was reflected in a large range of effect sizes of these estimates. Moreover, estimates at the within-family and between-family level differed meaningfully, especially for the link between adolescent disclosure and parental knowledge. In families with higher average levels of parental control and lower levels of adolescent disclosure (Model K4b), the within-family effect of parental control on knowledge was more positive. Overall, assessing these heterogeneous processes at the within-family level explained 19.0% of the linear decrease in maternal knowledge between ages 13 and 18.

Adolescent Disclosure

Model D1. Normative development. A similar series of models were then estimated with adolescent disclosure as the outcome (labeled Model D1 to Model D4). The first model (Table 2, right side, and Figure 2) revealed a linear over time decline in disclosure. The intraclass correlation was .618, indicating that 61.8% of the variance in disclosure was due to the between-family

differences, and 38.2% due to within-family fluctuations over time.

Models D2a–c. Average within-family effects. When parental monitoring factors, relationship quality, and adolescent and mother mood were added, this significantly improved the model fit (see Appendix 4 in the online supplemental material). In Model D2a (see Table 5), both parental solicitation and control were significantly linked to fluctuations in disclosure at the within-person level ($\beta = .135$ and $\beta = -.045$, respectively). That is, in weeks when mothers reported more solicitation and/or lower levels of control, they also experienced more adolescent disclosure, and adding these factors explained 12.6% of the mean level change in disclosure (i.e., a reduction in the effect from $-.014$ to $-.012$). In Model D2b, higher levels of both mother- and adolescent-reported relationship quality were significantly related to higher levels of disclosure at the within-family level ($\beta_{\text{mother}} = .161$, $\beta_{\text{adolescent}} = .041$), explaining 8.5% of the mean level linear change in disclosure. In Model D2c, mother and adolescent positive mood in a given week were both positively related to the levels of mother-reported disclosure that week ($\beta_{\text{mother}} = .038$, $\beta_{\text{adolescent}} = .045$), explaining 2.2% of the mean level change.

Model D3. Heterogeneity in within-family effects. Subsequently, the within-family effects of parental monitoring on adolescent disclosure were allowed to vary between families (Table 5 right side), which further improved the model (see Appendix 4 in the online supplemental material). Significant heterogeneity was found in the effect of solicitation on disclosure ($\sigma^2 = .036$) and in the effect of control on disclosure ($\sigma^2 = .007$). This model, in which heterogeneous within-family effects were allowed, explained 14.1% of the mean level change in disclosure.

As a reference to the interpretation of these within-family effects, we again specified a linear regression model at the between-person level (as this is more similar to the analytical approach in other studies, answering the same research question). This model indicated that adolescent disclosure was significantly predicted by higher levels of parental solicitation ($\beta = .193$) and lower levels of control ($\beta = -.114$). The estimates can be found in Table 4 and Figure 5 and 6 in Appendix 5 in the online supplemental material. Comparing the unstandardized within-family statistics to the between-family reference model, 58.9% of the within-family estimates of the link of parental solicitation and disclosure fell within the 95% between-family confidence interval (in 39% of the families the within-family effect was smaller). For the link of parental control with adolescent disclosure, 64.5% of the within-family estimates fell within the between-family confidence interval (for

Table 5
Within-Family Prediction of Adolescent Disclosure

| Predictor | Model D2a, D2b, D2c: Within-family effects on adolescent disclosure | | | | | Model D3: Heterogeneity in within-family effects on adolescent disclosure | | | | |
|--|---|-----------|----------|---------|-----------------------------|---|-----------|----------|------------------------------------|-----------------------------|
| | <i>B</i> | <i>SE</i> | <i>p</i> | β | Model <i>R</i> ² | <i>B</i> ^a | <i>SE</i> | <i>p</i> | β (<i>SD</i>) ^a | Model <i>R</i> ² |
| Time (linear, 3-month interval) | -.012 | .001 | .000 | | | -.012 | .001 | .000 | | |
| Maternal solicitation (mother report) | .153 | .015 | .000 | .135 | | .154 | .018 | .000 | .147 (.115) | |
| Maternal control (mother report) | -.029 | .009 | .001 | -.045 | | -.023 | .010 | .020 | -.039 (.074) | |
| σ^2 around effect maternal solicitation | | | | | | .036 | .008 | .000 | | |
| σ^2 around effect maternal control | | | | | | .007 | .002 | .001 | | |
| | | | | | 2.4% | | | | | 7.8% |
| Time (linear, 3-month interval) | -.013 | .001 | .000 | | | | | | | |
| Relationship quality (mother-report) | .159 | .017 | .000 | .161 | | | | | | |
| Relationship quality (adolescent-report) | .035 | .014 | .015 | .041 | | | | | | |
| | | | | | 5.4% | | | | | |
| Time (linear, 3-month interval) | -.014 | .001 | .000 | | | | | | | |
| Mother mood (mother-report) | .030 | .009 | .001 | .038 | | | | | | |
| Adolescent mood (adolescent-report) | .030 | .011 | .005 | .045 | | | | | | |
| | | | | | 1.9% | | | | | |

Note. The quadratic effect and intercept term are omitted from the table. 95% confidence interval = $B \pm 1.96 \times SE$.
^a In Model 3 an effect is estimated for each family separately; The beta represents the average standardized effects across families.

32.9% of the families the estimate was less negative). Again, this indicates that within-family versus between-family estimates tap into a different layer of information, and the confidence interval of the between-family estimates only captured the within-family processes in a subset of families.

The estimated effect sizes in Model D3 were heterogeneous between families, moreover. The within-family effect of solicitation on disclosure ranged between $-.250$ and $+.805$. It was weakly negative in 1.1% of the families, trivial in 34.2%, weakly positive in 55.2%, and moderately or strongly positive in 9.4%. The effect of parental control on disclosure ranged between $-.364$ and $+.204$, and was moderately negative in 1.1% of the families, weakly negative in 13.7%, trivial in 82.7%, and weakly positive in 2.4% of the families.

Model D4a–c. Predictors of Heterogeneity. Finally, in a fourth set of models on disclosure, we added predictors of this heterogeneity. Adding SES and gender (Model D4a) significantly

improved model fit (see Appendix 4 in the online supplemental material) and explained 16.7% of the variation between families in the solicitation-disclosure link. One effect was significant: parental solicitation and adolescent disclosure were significantly more positively linked in low SES families (i.e., both parents being unemployed or holding an elementary job) compared with medium or high SES families ($B = .147, SE = .060, p = .015$). Adding the person-mean of solicitation and control did not significantly improve the fit of the model (Model D4b). Moreover, although adding relationship quality (Model D4c) improved the overall model fit, none of the individual terms was significant.

In sum, mother-reported disclosure decreased with age, and also fluctuated within-families over time (Model D1). Higher levels of solicitation, lower levels of control (Model D2a), higher levels of mother and adolescent perceived support (Model D2b), and better mood of the adolescent and the mother (Model D2c) were associated with these within-family overtime fluctuations in adolescent

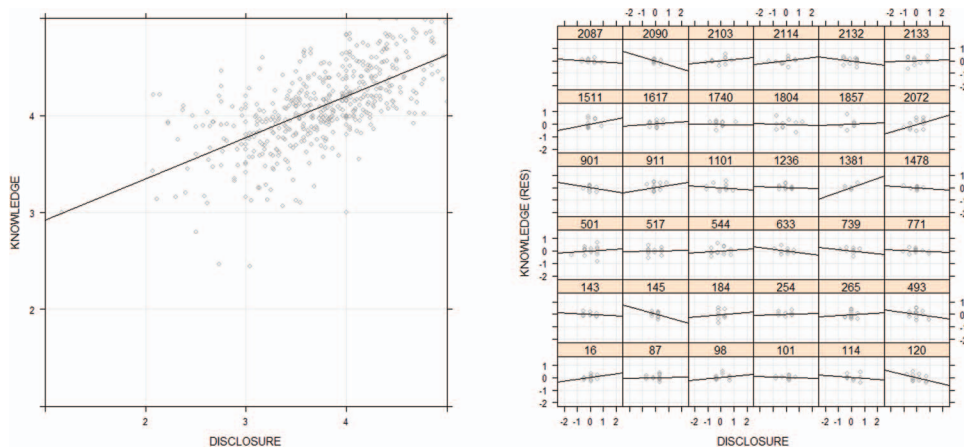


Figure 3. Adolescent disclosure as predictor of maternal knowledge: Left between-family estimates (each dot is one family) and right the within-family estimates (one family per panel, each dot is a measurement point). Figures 4–7 can be found in the online Appendix 5. See the online article for the color version of this figure.

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disclosure. These linkages of solicitation and control with disclosure were found to be heterogeneous across families (Model D3). The range of effect sizes in the within-family processes was large. In families with lower SES, the within-family link of solicitation with disclosure was stronger (Model D4a). Overall, the model in which heterogeneous within-family monitoring processes were added, explained 14.1% of the mean level linear decrease in mother-perceived adolescent disclosure.

Discussion

This two-informant 15-wave study aimed to contribute to a better understanding of the processes that underlie normative developmental declines in parental knowledge and adolescent disclosure, by studying the underlying processes at the level of the family unit. Within the average family, mothers were more knowledgeable in weeks when they reported more disclosure, more solicitation, and a higher quality relationship, and in weeks when the adolescent reported a better mood. Moreover, the average mother perceived more adolescent disclosure in weeks when she reported more solicitation and less control, and in weeks when both mothers and adolescents reported better relationship quality and a more positive mood. The within-family effect of disclosure on knowledge was much smaller than expected or detected in the between-family reference model. Moreover, unique correlations per family were found, both in terms of effect sizes and in terms of the direction of effects. Contrary to our expectations, in families with more parental control and less adolescent disclosure, parental control was more likely to be positively linked to fluctuations in knowledge. In families with a lower socioeconomic status, solicitation was a stronger correlate of fluctuations in adolescent disclosure. Tapping into this layer within-family processes that keep, or fail to keep, mothers informed, as well as the heterogeneity between families therein, explained up to 19% of the longer-term normative declines in knowledge and up to 14% of the declines in disclosure. The discussion focusses on the theoretical implications, the methodological need, and practical implications of studying the monitoring processes at the within-family level as a driving force behind longer term developmental change.

The Within-Family Processes That Drive Developmental Change in Disclosure and Knowledge

This study departed from the viewpoint that the actual monitoring processes, as they take place within families, may help to explain normative developmental changes. To better understand these within-family processes, we addressed the methodological concerns related to between-family studies in general (Kievit et al., 2013; Molenaar & Campbell, 2009; Voelkle et al., 2014) and parenting research in specific (Aunola et al., 2013; Hamaker et al., 2015; Janssen et al., 2014; Keijsers, 2016; Smetana et al., 2010). Within-family monitoring processes explained up to 19% of the mean level change in knowledge and up to 14% of the mean level change in disclosure. As such, this provides some of the first indications that parts of the normative developmental trends in parent-child communication spanning over the course of adolescence, are driven by an accumulation of within-family processes.

Zooming in on these processes, mother's knowledge was higher in weeks when she also reported more disclosure, more solicitation

(not control), and a higher relationship quality. Moreover, adolescent disclosure was higher in weeks when mothers reported higher levels of solicitation, yet lower levels of control. Although for the average family, mother-reported relationship quality and monitoring factors both explained a similar amount of variation in knowledge, fluctuations in adolescent disclosure were better explained by fluctuations in the relationship quality than by fluctuations in maternal monitoring. Ultimately, fluctuations in parental knowledge may be rooted not only in child disclosure, but also in the larger context of a good relationship quality that enables children to disclose information (Keijsers, Branje, Frijns, et al., 2010; Kerr et al., 1999; Laird, Pettit, Dodge, et al., 2003; Soenens et al., 2006). Thus far, these factors that explain within-family fluctuations in knowledge and disclosure seem to overlap the factors in earlier studies of between-family differences (e.g., Soenens et al., 2006; Stattin & Kerr, 2000).

The within-family link of adolescent disclosure with maternal knowledge, however, was much weaker within families than expected from earlier work on between-family differences. Whereas we found a strong bivariate correlation between mother-reported disclosure and knowledge at the sample level ($\beta = .62$, which is comparable to other studies: Keijsers, Branje, VanderValk, et al., 2010; Soenens et al., 2006; Stattin & Kerr, 2000), they were only weakly to moderately related in most families. A strong link was found in only 6% of the families. Apparently, the fact that adolescents who disclose more have parents who know much more does not imply an equally strong effect of adolescent disclosure on parental knowledge within families. This discrepancy may very likely be due to the fact that this study is among the first to control for all confounding factors that may have inflated this estimated effect.

In line with theoretical formulations of parental monitoring as a process that is strongly tied to the overall relationship quality and mood in families (Dishion & McMahon, 1998), this study also examined how the experienced quality of the relationship and the mother and adolescent mood may explain fluctuations in disclosure and knowledge at the within-family level, and ultimately developmental declines in disclosure and knowledge. In line with our expectations, we found a cross-reporter association of maternal knowledge and disclosure with adolescent daily mood. In fact, the strength of the effects of adolescent mood on knowledge seems stronger than the effects of a positively experienced relationship quality. Adolescent mood fluctuates strongly and may be especially low in the presence of parents (Larson, 1983; Larson & Richards, 1991) and individuals engage in more social interaction when they feel well (Vittengl & Holt, 1998). Although this study did not test for the direction of effects, we suggest that in periods when an adolescent's mood is more negative, they may also not be in the mood for social interactions with their parents, let alone talking. Moreover, disclosure of adolescents (not knowledge) also was related to mother mood, suggesting that disclosure is more of a dyadic process that takes place only in a context when both experience the relationship as supportive and warm, when the mother is in the mood for listening and the adolescent is in the mood for talking. Although these factors played a role in the within-family monitoring process (Dishion & McMahon, 1998), they explained less of the longer-term developmental declines compared with the actual monitoring behaviors.

Heterogeneity Between Families

Rather than assuming there is one monitoring process that applies to every family, we aimed to dig one layer deeper. Each of the estimated within-family effects between parental monitoring, adolescent disclosure and parental knowledge varied significantly between families, not only in the strength of these effects, but also in the direction. For instance, although parental control was not correlated with parental knowledge within the average family, the link of parental control with parental knowledge was negative in 21% of the families, and positive in another 20%. This strongly supports the theoretical idea that parenting may work differently in each family (e.g., Bronfenbrenner, 1986; Pluess & Belsky, 2013; Sameroff, 2010) and warns us against translating research findings to a parenting advice, when this is not tailored to the specific processes within a family.

Methodologically, our discrepant findings at the between- and within-family level hint that studies on between-family differences may yield estimates that only describe the actual parenting processes in some or even a minority of families. Although this concern has been expressed before in conceptual-methodological accounts (Molenaar, 2004; Voelkle et al., 2014), and has been shown in other empirical studies on parental monitoring (Hamaker et al., 2015; Keijsers, 2016), this study further stresses the need to differentiate the two level of theoretical inference. Whereas the between-family level is extremely valuable in determining for whom parenting processes may function suboptimal, for whom disclosure and knowledge decrease, and whom is at risk for offending, the level of the family unit, may help to understand the underlying within-family processes related to suboptimal communication patterns and adolescent delinquency.

Regarding the possible explanations for this heterogeneity in parenting processes, it was striking that many of the moderated effects ran against our hypotheses (which were based on the earlier literature, predominantly studying between-family effects). Although, on average, parental control had the hypothesized adverse effect on disclosure (Hawk et al., 2013), the link of control with knowledge was more negative for families characterized by overall lower maternal control and more adolescent disclosure. Based on earlier between-family studies (Hawk et al., 2009, 2013; Kakihara & Tilton-Weaver, 2009; Mason et al., 1996), we had expected the opposite, namely that increased control would be related to decreased knowledge, in families where levels of control were high. The moderation by disclosure was unforeseen. Perhaps, these findings suggest that mothers learn to rely on strategies that are successful in their own families. If parents know more in periods when they are more controlling, they may rely on such monitoring rules more often, rather than relying on disclosure. Moreover, based on earlier empirical work, we had hypothesized that parental control would have a more negative impact on disclosure and knowledge in higher quality relationships (Hawk et al., 2000, 2013). This was not supported in within-family models. Finally, solicitation was a stronger correlate of adolescent disclosure in 11% of the families with a low socioeconomic status. The benefits of monitoring were thus more pronounced in families in which both parents were unemployed or with elementary job (which is in contrast to the hypotheses of Darling, 2007). Perhaps in these families, which may be characterized by less involved parenting

and lower disclosure, solicitation may be a trigger for adolescents to disclose what they would not do without prompting.

In sum, when it comes to understanding moderated effects, between-family statistics obtained in earlier work did not help to predict heterogeneity in within-family level correlations. Whereas between-family models are valuable in understanding *who* decreases in disclosure and knowledge, this study tapping into within-family processes, adds a layer of understanding *when* this may be the case. Hence, when between-family models are used for studying within-family processes, the substantial conclusion may reverse (Kievit et al., 2013). Future research studying the underlying within-family processes is needed to determine how parenting works out in such different ways for some families, compared with others, what moderates these effects, and how this may ultimately accumulate into development for better or worse.

Methodological and Practical Implications

When it comes to dice, throwing one die 200 times is likely to result in the same average as throwing 200 dice once. It is this underlying probabilistic assumption that is at the heart of using between-family statistics in our current research paradigm for understanding within-family processes. However, unlike dice, families are all unique entities, making it improbable that studying samples versus repeatedly studying one family would yield the same results. In fact, especially when there is meaningful heterogeneity in the processes or when processes change with time (that is, the stationarity and homogeneity principles are violated; and the system is nonergodic), between-unit estimates may not capture what is truly going at the level of an individual units (Molenaar, 2004). Given the unique and dynamic circumstances in a family (Branje et al., 2012; Laursen & Collins, 2009), both assumptions are likely violated, and likewise, parenting effects found in between-family designs may thus not accurately capture causal processes within family units.

Hence, a crucial step to improve our theoretical understanding of unique processes within each family is combining the unique strengths of between-family and within-family research paradigms (Voelkle et al., 2014). We did so by studying 479 families 15 times. This indeed shows that both levels of observation yield unique portions of information that are not necessarily linked (see also, Janssen et al., 2014; Keijsers, 2016). The most striking example, perhaps, was that the between-family estimate for the correlation of adolescent disclosure and parental knowledge did not apply to 97% of the family units. However, at the same time, this study indicates that within-family processes can help to explain the mechanisms behind normative developmental changes in family systems.

Moreover, tapping into the within-family level helped to quantify theoretical ideas that parenting may function in a family specific way (Bronfenbrenner, 1986; Sameroff, 2010). For instance, although maternal control was negatively linked with disclosure in the average family, a meaningful negative correlation was found in only 14.8% of the families. As such, studying within-family dynamics for each family separately may add an important layer to our theories: It makes explicit in how many families the average applies, and in how many the same parenting practice may have an unforeseen effect, perhaps even in an opposing direction.

In terms of the explanatory factors of these moderated effects, we did not replicate earlier findings. In fact, some of our findings were the reverse of our hypotheses. Statistically, it makes sense that these interactive effects found at the between-family level (e.g., using multigroup models, or interaction terms) are not similarly found at the within-family level. When dice are dissimilar, the results are substantially different if one die is thrown 200 times (a within-dice estimate), or if 200 dice are thrown once (a between-dice estimate). As such, inspired by others (Hamaker et al., 2015; Molenaar, 2004; Voelkle et al., 2014), we propose that it is quite a risky strategy to draw inferences of moderated effects and apply these to the individual family in the subgroup. This study is an empirical illustration of this broader methodological concern, that valid theoretical conclusions regarding human development are strongly dependent on the match between the statistical model, and substantial theory about the level of the processes (Molenaar, 2004; Voelkle et al., 2014).

The suggestion in this paper that statistics at the group level (e.g., regression models or cross-lagged panel models on between-family differences) may not describe the average within-family processes in that group (see also: Hamaker et al., 2015; Keijsers, 2016) may also have important implications for practice and for the development of interventions. For instance, this study illustrates that it is quite likely that an average group-level estimated effect applies only to a limited number of families. Moreover, even though the average effect of monitoring may be positive and significant, it may only be meaningfully related in a small subset of families, or even work out negatively. Identifying this subset, by zooming in on the level where the causal processes take place—the level of the family unit - may be crucial step in the route toward more personalized care.

Strengths and Limitations

Although this two-informant 15-wave study is among the first to focus explicitly on the within-family level of parenting processes (see also: Aunola et al., 2013; Hamaker et al., 2015; Keijsers, 2016; Smetana et al., 2010; Villalobos et al., 2015), there are several methodological limitations. The sample in this study was rather homogeneous because only families of which both parents had a good understanding of the Dutch language were included. Moreover, only 11% of the youths came from families with low SES. From the perspective of ecological models of development, these contexts may moderate how parenting functions (Bronfenbrenner & Morris, 2006), and empirical studies also hint at important differences (e.g., Cottrell et al., 2003). Hence, whether or not these findings generalize to more ethnically and economically diverse samples is unknown, and an important direction for future research. For the assessment of monitoring, we relied on mother-reports only, as information regarding father- and adolescent-perception was not available for the monitoring scales. Although previous studies have indicated that mother's perception of knowledge and disclosure may differ from the perception of fathers and adolescents, the structural relationships of monitoring with parental knowledge measures may be quite similar (Keijsers, Branje, VanderValk, et al., 2010). Whether this is also true for the within-family monitoring effects studied here, needs to be assessed in future research. Regarding the assessment of mood, we relied on daily assessments, which do not accurately tap into mood swings

occurring during the day (Wilhelm & Schoebi, 2007). Moreover, with 15 measurement waves, the study had enough power to detect heterogeneity, but it was less optimally powered for detecting sources of heterogeneity. Partially, this could have been also caused by the sample composition, with only 11% low SES families. Finally, because the time-interval between measurement waves was quite large, and within-family causal effects of parenting probably take place on a much smaller time scale, we did not examine the lagged within-family associations, as would be done in a daily diary design (e.g., Villalobos et al., 2015). This leaves important questions unanswered regarding the direction of effects. Future research using more measurement points and smaller time intervals will help to detect the unique lagged effects within families.

Conclusion

Notwithstanding these limitations, we believe this study has three major conclusions. First, normative developmental decreases in adolescent disclosure and maternal knowledge seem to be partially explained by the accumulation of shorter-term processes at the level of a family unit. Specifically, within-families, parental knowledge and adolescent disclosure not only fluctuated along with the level of solicitation and control, but also with the experienced mood and relationship quality by both mother and the child. These within-family processes explained up to 19% of the declines in knowledge and up to 14% of the declines in disclosure. Second, large variation was found in the effect sizes and directions of the within-family correlations of knowledge with disclosure and parental monitoring, and parental monitoring with adolescent disclosure, indicating heterogeneity in the monitoring processes across families. In families with higher levels of control and lower levels of disclosure, the within-family link of control with knowledge was more positive. Solicitation was more positively linked to disclosure in families with low SES. Third, at a methodological level, we have argued that studying how processes operate within families is a promising approach to better assess the underlying mechanisms that drive longer-term developmental change. Digging deeper to the level of the family unit and assessing the heterogeneity between families in how parent-child processes operate, may potentially open up possibilities to tailor parenting support to the unique monitoring process in each family.

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Received July 23, 2015

Revision received August 2, 2016

Accepted August 10, 2016 ■