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## **Harsh discipline in toddlerhood : A longitudinal study on maternal physiological and behavioral predictors**

Joosen, K.J.

### **Citation**

Joosen, K. J. (2012, November 22). *Harsh discipline in toddlerhood : A longitudinal study on maternal physiological and behavioral predictors*. Retrieved from <https://hdl.handle.net/1887/20154>

Version: Not Applicable (or Unknown)

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**Note:** To cite this publication please use the final published version (if applicable).

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**Author:** Joosen, Katharina Jacomina

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**Issue Date:** 2012-11-22

## 5 | General discussion

The overall aim of the studies presented in the current thesis was to uncover early predictors of harsh discipline to enhance the early identification of potential risk groups for this form of inadequate parenting and related problematic child outcomes. More specifically, we studied early maternal behavioral and physiological indicators of harsh discipline in toddlerhood. We examined the influence of early maternal sensitivity as a behavioral predictor of harsh discipline. As physiological indicators we studied both the parasympathetic (PNS) and sympathetic (SNS) nervous systems responses to repeated infant crying. First, we examined the cross-sectional relation between the two predictors by investigating whether highly sensitive mothers have a significantly different heart rate (HR) reactivity and respiratory sinus arrhythmia (RSA) withdrawal in response to repeated infant crying as compared to less sensitive mothers. Second, we investigated longitudinally whether maternal sensitivity in early infancy, as measured in a variety of settings, is a significant predictor of harsh discipline in toddlerhood. Furthermore, we focused on the question whether a stronger sympathetic reactivity to repeated infant crying at 3 months predicts harsh discipline in toddlerhood. In this chapter the results are summarized and discussed, followed by a discussion on the study's limitations and some suggestions for future research.

### *Physiological reactivity to repeated infant crying among highly sensitive mothers*

Our cross-sectional results showed that highly sensitive mothers responded to infant crying with a greater HR increase as well as a greater RSA withdrawal compared to less sensitive mothers. This greater physiological reactivity of highly sensitive mothers was more related to the initial presentation of cry sounds than to the repeated exposure to cry sounds, since their elevated physiological reactivity was found directly after presentation of the first cry sounds and remained at similar levels throughout the cry paradigm until the recovery phase. From a polyvagal perspective this greater HR reactivity to infant crying among highly sensitive mothers is likely to be related to their greater RSA withdrawal. Among highly sensitive mothers greater HR reactivity to infant crying (as compared to less sensitive mothers) would be the result of a more efficient vagal brake in response to the external demands of infant crying. The stronger RSA withdrawal of highly sensitive mothers equips them with a more efficient behavioral and emotional regulation by enabling rapid mobilization as well as calm and self-soothing behaviors in response to external demands such as infant crying (Porges, 1996, 2011).

Theoretically, it is also possible that a release from the vagal brake reflects an influence of the SNS on HR changes, since one of the functions of the vagal

brake is the suppression of sympathetic innervation of the heart. Following this line of reasoning, RSA withdrawal would imply that HR increases are the result of sympathetic activation rather than of parasympathetic activation. However, according to recent insights, the vagal system can also influence changes in HR *solely* through the right nucleus ambiguus (vagal brake). In other words, an efficiently working vagal brake enables rapid responsiveness to external demands by innervation of the heart without the activation of the phylogenetically older and biologically more taxing sympathetic (SNS) fight-flight system (Porges, 2011).

In a previous study on infant resilience to stress, greater maternal RSA withdrawal during the reunion episode of the Still Face Paradigm (SFP) was found especially for those mothers who managed to effectively sooth their infant (Ham & Tronick, 2006). This seems to be in line with our results since soothing behaviors that effectively calm a distressed infant can be considered a sensitive maternal response (Ainsworth, Bell, & Stayton, 1974). In addition, another study examining physiological correlates of maternal responsiveness during the SFP reunion episode found that mothers with high levels of cortisol were more intrusive in response to their infants during the SFP reunion, and that this relation was only found for mothers who also showed less RSA withdrawal during the SFP reunion (Mills-Koonce et al., 2009). Cortisol is generally used as a measure of an individual's HPA-axis activity and is involved in the physiological regulation of stress as is the SNS (e.g., El-Sheikh, Erath, Buckhalt, Granger, & Mize, 2008; Gordig, Granger, Susman, & Trickett, 2008; Van Stegeren, Wolf, & Kindt, 2008). With cortisol as a correlate of sympathetic activation, the results of Mill-Koonce et al. (2009) suggest that mothers with a *compromised* vagal brake, shown by less RSA withdrawal, respond to external demands by activation of the sympathetic system, because it is not efficiently suppressed by the vagal system.

Furthermore, our results also showed that highly sensitive mothers had lower mean HR and higher mean RSA levels than less sensitive mothers in general from the baseline onwards until the end of the recovery. Concerning RSA, this effect was mainly due to differences in resting RSA levels between the highly sensitive and less sensitive mothers. Therefore, this effect is in line with the idea that the higher *resting* RSA levels signal a greater capacity for emotional regulation in general (e.g., Beauchaine, Gatzke-Kopp, & Mead, 2007; Fabes & Eisenberg, 1997; Porges, 2011). For example, a study on the association between attachment to a romantic partner and resting RSA levels showed that men who experienced higher levels of security in their relationship also had higher resting RSA levels. Men with more experiences of attachment anxiety regarding their current partners had lower resting RSA levels. More importantly, when the experimenters induced anger in the men during a laboratory task, the more effective recovery found among securely attached men was mediated by higher resting RSA levels (Diamond & Hicks, 2005). Thus, these results suggest that the higher resting RSA levels of securely attached men are related to a more effective regulation of negative emotions.

However, higher resting RSA levels are not solely related to the regulation of negative emotions. As higher resting RSA also indexes the effective expression

of positive emotions from later infancy and toddlerhood onwards, Beauchaine concludes (2001) that higher resting RSA signals appropriate regulation of positive *and* negative emotions, and that this is true at all ages. Thus, it seems that individuals with higher resting levels of RSA are better equipped to regulate their emotions effectively in general regardless of the valence of the emotions, resulting in the expression of *appropriate* emotions in a given context. This line of reasoning also relates to the specific link between maternal sensitivity and (resting) RSA levels. The same brainstem nuclei that are involved in the regulation of the myelinated vagus (which is responsible for RSA levels), are also linked neuroanatomically as well as neurophysiologically to the neural regulation of the muscles that control eye gaze, facial expressions, listening ability, and prosody (Porges, 2007, 2011). These facets of social communication in combination with an effective regulation of emotions are necessary for a mother to respond sensitively to her infant's signals by, for example, making eye contact, smiling, listening or talking in a '*motherese*' tone of voice.

In addition to the link between maternal sensitivity and physiological responsiveness to infant signals, the development of systems underlying stress reactivity in infants themselves is also relevant. For example, Hane and Fox (2006) have shown that low levels of maternal caregiving behavior were related to greater right frontal electroencephalographic (EEG) asymmetry among their infants compared to infants receiving high-quality maternal caregiving. This result was not due to infant differences in temperament and supports Porges' (2011) suggestion that especially the right hemisphere has a role in the regulation and expression of (negative) emotions or in his words: "*Since cardiac vagal tone is neurophysiologically linked to the right hemisphere regulation of autonomic activity, it might index the individual's functional capacity to regulate autonomic function and to express emotion (p.140)*". Thus, a more efficient responsive vagal brake in mothers is related to higher levels of maternal sensitivity, which in turn positively influences the development of physiological systems underlying emotion regulation in their infants as well.

#### *Early maternal sensitivity predicting harsh discipline use in toddlerhood*

Lower levels of maternal sensitivity at 3 months were found to predict more harsh discipline use during toddlerhood. Furthermore, this relation was fully mediated by maternal sensitivity at 6 months in that less sensitivity at 3 months predicted less sensitivity at 6 months which in turn predicted more use of harsh discipline during toddlerhood. Concerning the assessment of maternal sensitivity we found that maternal sensitivity across various settings measured the same underlying construct. In addition maternal sensitivity showed significant stability from 3 to 6 months. Maternal sensitivity and intrusiveness predicted harsh discipline independently. Also, both sensitivity and intrusiveness loaded on the same underlying factor, suggesting a strong overlap between these constructs. Due to this strong overlap we did not further investigate whether either maternal sensitivity or intrusiveness uniquely predicted harsh discipline. However, this does not eliminate the potential importance of separate subscales for the measurement of maternal sensitivity. Although highly intrusive mothers will

never score very highly on a sensitivity scale, a low score on maternal sensitivity does not automatically indicate high levels of intrusiveness. Lower scores on maternal sensitivity can also be due to an overall absence of responses to infant signals, which would indicate low intrusiveness and a passive kind of maternal insensitivity.

Given the overlap in underlying behavioral style, especially intrusive-insensitive parenting seems likely to predict harsh discipline. Intrusive insensitivity as well as the use of harsh discipline seems to be the result of a lack of respect and/or empathy for the child's autonomy and behavioral motivations. Mothers who do not perceive or even ignore their infants' signals and interfere (physically) with their infants' behavior would also be more likely to misread their children's motivations during toddlerhood due to a lack of empathy and child-blaming attributions, leading to harsh discipline (Dadds, Mullins, McAllister & Atkinson, 2003; Dopke & Milner, 2000; Milner 1993, 2003; Milner, Halsey, & Fultz, 1995). Following this line of reasoning, harsh discipline as measured in this thesis may be indicative of a more global intrusive-insensitive parenting style, which can already be observed in early infancy. Furthermore, this global intrusive insensitivity describes exactly the link between Milner's social information processing (1993, 2003) model and the lack of maternal behaviors described by Ainsworth's et al. (1974) concept of maternal sensitivity.

*Physiological reactivity to repeated infant crying among mothers using harsh discipline*

A stronger activation of the SNS in response to repeated cry sounds in early infancy predicted the use of harsh discipline in toddlerhood. Mean SCL of mothers using harsh discipline continued to rise across the cry paradigm, while the mean SCL of mothers not using harsh discipline declined after an initial increase in response to the first block of cry sounds. Without significant difference in mean SCL baselines between the two groups, mothers in the harsh group continued to show increased SCL leading to significant mean level differences between groups from the second block of crying onwards.

It was not the immediate activation of the SNS in response to infant crying that differentiated between the two groups of mothers, but the enduring activation of the SNS in response to repeated cry sounds appeared to be linked to later observations of harsh parenting. This could be explained by the fact that especially harsh parents are ill-equipped already in early infancy to cope effectively with the psychological stress that is provoked by prolonged exposure to infant crying. These results are in line with a study that found a later peak for Shaken Baby Syndrome hospitalizations (10-13 weeks of age) than for the peak of the crying curve (5-6 weeks of age). This delay in peak for Shaken Baby Syndrome hospitalization could be due to the stress that some (at-risk) parents experience when they are confronted with persistent high crying levels that endure beyond the peak of the normal crying curve (Barr, Trent, & Cross, 2006). In addition, a study on potentially damaging parenting reactions in response to infant crying showed that 5.6% of Dutch parents of a 6-month old infant had responded abusively at least once due to their infant's crying (Reijneveld, Van der Wal, Brugman, Hirasing, Verloove-Vanhorick, 2004).

These results seem to be in direct contradiction to the evolutionary hypothesis which states that excessive early infant crying signals vigor in the infant and has evolved with the function to prevent a reduction or withdrawal of parental care (Soltis, 2004). At least for infants of harsh or abusive parents it seems that the goal of receiving parental *care* is not best obtained by excessive crying. Alternatively it could be that these infants signal other negative emotions than distress, such as fear or anger, which are less successful in eliciting empathy from adult caregivers, but instead could provoke harsh responses (Mesman, Oster, Camras, 2012). According to Porges (2011) some individuals indeed experience a ‘mismatch’ between environmental cues and the physiological response of the ANS, causing an inappropriate appraisal by the ANS of the environment as being dangerous, resulting in fight-flight behaviors; translated to the case of harsh and abusive parents as behavioral overreactivity to (negative) infant signals. Heightened perceptions of danger and threat have been found in parents at risk for abuse, as evidenced by more hostile interpretations of child behaviors, often in combination with feelings of powerlessness (e.g., Bugental & Happaney, 2004; Leung & Slep, 2006; Lin, Bugental, Turek, Martorell & Olster, 2002; Smith & O’Leary, 1995). Thus, in the words of Porges (2011): *“It is not just the stimuli that elicit a response; rather, the response is determined by a complex system of behavioral-physiological responses that involve perception of the stimulus, afferent feedback, and the regulation of approach-withdrawal behaviors via the vagal system.”*(p.143)”

The results of our study did not confirm the hypothesis of a weaker RSA withdrawal in response to infant crying among mothers using harsh discipline compared to mothers who did not. One of the reasons for the lack of confirmation could be that we used very short segments as measurement of RSA levels. RSA estimates in general have been found to be less reliable when measurement intervals are short (Berntson et al., 1997). Furthermore, varying levels of maternal sensitivity in the course of the second year after birth may have dampened the association. We did control for maternal sensitivity levels at the 3-month home visit, which did not influence the lack of group differences on RSA reactivity in response to infant crying. However, even though our results also showed significant stability in maternal sensitivity during early infancy and similar stability has been found in other studies over longer time periods (Lohaus, Keller, Ball, Voelker, & Elben, 2004; Kempainen, Kumpulainen, Raita-Hasu, Moilanen, & Ebeling, 2006), it is unlikely that scores on maternal sensitivity would be completely fixed over time. Since we did not include later levels of maternal sensitivity (during the second year) when creating the two groups, we cannot eliminate the possibility that the mothers in the non-harsh group included highly sensitive mothers as well as mothers with (at a later point in time) medium or low levels of sensitivity. In a larger sample one could distinguish between highly sensitive and moderately sensitive non-harsh groups to find out whether mothers showing harsh discipline show significantly less RSA withdrawal compared to highly sensitive mothers who do not show harsh discipline.

In sum, mothers who are less sensitive in the interaction with their infant during the first 6 months after birth, have a less efficient vagal brake, shown by less RSA withdrawal in response to infant crying. Furthermore, mothers who are

less sensitive during early infancy are also more likely to employ harsh discipline strategies with their toddlers. Last, the small group of mothers that eventually was observed to use harsh discipline with their toddlers at 12 months after birth indeed seemed to rely more strongly on the defensive strategies of the SNS in response to external demands, shown by their greater SNS reactivity in response to repeated infant crying compared to the non-harsh group of mothers.

### *Limitations*

Several limitations of the current study should be mentioned. First, overall sample sizes were quite small. This holds especially for the first and third chapter on physiological responsiveness to infant crying, which featured small subgroups of highly sensitive and harsh discipline using mothers respectively. In Chapter 4 the small subsample of the mothers using harsh discipline could explain the unexpected lack of significant results on RSA withdrawal in response to infant crying when comparing the harsh and non-harsh group of mothers. Analyses on a larger sample would be less affected by the larger standard deviations found for RSA, which could have dampened a potential effect. Nonetheless, in both chapters data was rigorously checked for outliers to ensure valid conclusions.

Second, we did not control for respiration rate in our estimation of RSA. Some studies have shown that RSA magnitude can be altered purely as a function of respiratory changes, even in conditions of mental activation or emotion (Grossman & Taylor, 2007). However, in a comparative study between different quantification methods for RSA using data collected with a similar ambulatory device, RMSSD levels were indicated as a reliable and valid estimate of RSA (Goedhart, Van der Sluis, Houtveen, Willemsen, & De Geus, 2007). Since all participants were seated during the entire cry paradigm (including baseline measurement), and did not speak during cry presentations, changes in respiration rate due to physical activity or talking could only have had a minimal effect on our estimation of RSA.

Third, continuing challenges in the search for accurate baseline measurements, especially concerning RSA estimates, complicate the interpretation of physiological reactivity. There has been a debate in literature whether RSA resting levels should be measured during paced breathing tasks or not. Some argue that RSA is best measured when HR, respiration rate, and respiration volume are kept under control. It is argued that this would eliminate the possibility that RSA levels are caused by breathing parameters instead of a vagal influence on the heart (e.g., Butler, Wilhelm & Cross, 2006; Grossman, Karemaker, & Wieling, 1991). However, Porges (2007) has responded to this argument with the notion that RSA should not be interpreted as an equivalent of 'total' cardiac vagal tone, but is merely used as an index that should be studied uncorrected, especially, since the validity of these adjusted RSA measures has yet to be adequately proven.

Fourth, we used different measures to rate maternal sensitivity during the SFP on the one hand and during the bath and free play sessions on the other hand. There were no separate subscales for sensitivity and intrusiveness in the bath and free play sessions, which were used to rate the mothers during the SFP. This may have limited the comparability of the different settings. Nevertheless, a single underlying factor was shown for all included sensitivity measures at both

time points. Fifth, within time points sensitivity during bath and free play were rated by the same coder, as were the baseline and reunion of the SFP. Therefore, it is possible that mean levels of sensitivity within time points were influenced by intracoder stability. Furthermore, significant mean-level differences in maternal sensitivity at a certain age could be less reliable due to the use of one coder for both settings. However, intracoder stability would have sooner resulted in a lack of significant mean-level differences between the settings. This was not the case; we found significant mean-level differences between bath and free play sessions as well as between the baseline and reunion of the SFP within time points.

Last, it should also be noted that concurrent maternal stress was not measured. Stress levels may affect both physiological baseline values (Thayer, Friedman & Borkovec, 1996), maternal sensitivity (Belsky, Crnic & Woodworth, 1995; Van IJzendoorn, Bakermans-Kranenburg & Mesman, 2008), and the use of harsh discipline (Pinderhughes, Dodge, Zelli, Bates, & Pettit, 2000).

#### *Clinical implications and future directions*

The set of studies presented in the current thesis has shown that the use of harsh discipline in toddlerhood can be predicted from maternal sensitivity in infancy and maternal physiological reactivity to infant crying. Uncovering these potential risk factors for harsh discipline is of great importance for mental health care professionals since early identification of at risk parents creates the opportunity for early intervention strategies in breaking an otherwise continuing pattern of maladaptive parenting. Observation of maternal sensitivity during early infancy has a great potential for the identification of parents that are at risk for harsh parenting. These observations do not have to be time consuming and as this thesis has shown can be done in a variety of settings. Therefore, it would be a valid method to identify (extremely) insensitive parents who might profit most from a more intensive parenting support program.

However, we do not suggest that both behavioral and physiological predictors should be used in a similar way for the identification of at-risk parents by health care professionals. Since functioning and reactivity of both branches of the ANS are complex and multifaceted, the use of physiological markers of ANS reactivity to negative infant signals as identifier for parents at risk for harsh parenting or abuse is not advisable. Nonetheless, physiological markers are valuable in providing a more thorough understanding of the (neuro)biological underpinnings of ineffective parenting behaviors. In knowing more of the (neuro)biological mechanisms that influence parenting behaviors, health care professionals gain more insight into the challenge that is formed by striving for behavioral changes in intervention programs. Therefore, to increase this understanding future research should also aim to further unravel the underlying (neuro)biological mechanisms of parenting behaviors.

Furthermore, it would be especially interesting to study whether physiological reactivity of harsh parents differs in response to their own infant crying as opposed to their reaction to standardized infant cries. Some recent studies, for example, have used infant dolls, that can be programmed according to the amount of time the doll cries during a 24-hour observation period. These dolls are also equipped

with a device which registers various parenting behaviors (e.g., Bruning & McMahon, 2009; Roberts, Wolman, & Harris-Looby, 2004). With the existing ambulatory devices to record physiological reactivity continuously during longer periods, it should be no problem to simultaneously measure physiological data during the 24 hours that study subjects would take care of such a doll. In fact, such a study is already ongoing at the Centre for Child and Family Studies of Leiden University. Additionally, future studies could use similar dolls programmed with either standardized cry sounds or their own infant cry sounds to compare the influence of these different cry sounds on both behavioral and physiological reactivity of harsh or abusive parents. As maternal behaviors can even affect an infant's physiological lay-out for stress regulation (Hane & Fox, 2006), early identification of maladaptive parenting strategies could create the opportunity to break the intergenerational transmission of physiological vulnerability.

### *Conclusions*

In sum, we found that highly sensitive mothers in dyadic interactions with their 3-month old infants showed greater HR reactivity and RSA withdrawal in response to cry sounds when compared to less sensitive mothers. The construct of maternal sensitivity proved to be stable over time, with the same construct underlying observations of maternal sensitivity across various settings. Furthermore, mothers who displayed less sensitive behavior in response to their infants at 3 months were also less sensitive during interaction at 6 months, which in turn predicted more harsh discipline use during the second year after birth. Last, our results showed that mothers who were observed to be harsh with their infants at 12 months showed a stronger sympathetic activation in response to repeated infant crying at 3 months. This seems to suggest that harsh parents are behaviorally as well as physiologically overreactive to negative infant signals. Early identification of maladaptive parenting strategies could open the way for prevention of the adverse consequences for parent and child.