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Brief Report: The Development of Compliance in Toddlers at-Risk for Autism Spectrum Disorder

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Abstract

Parents of children with autism spectrum disorder (ASD) report concerns with child compliance. The development of compliance in 24-, 30-, and 36-month-old high-risk children with ASD outcomes ($n=21$), high-risk children without ASD ($n=49$), and low-risk children ($n=41$) was examined. The High-Risk/ASD group showed greater passive noncompliance at 24-months than the non-ASD groups and a smaller increase in compliance than the High-Risk/No ASD group. The High-Risk/ASD group also showed a smaller decline in active noncompliance than the Low-Risk group. After controlling for receptive language, the passive noncompliance findings were nonsignificant whereas compliance and active noncompliance findings retained significance. The growth of compliance is attenuated in children with ASD, while changes in passive noncompliance are in part associated with language comprehension.

Keywords

autism spectrum disorder; longitudinal; infant siblings; compliance; restricted and repetitive behaviors

The ability to comply with parental requests is an important milestone in the toddler years. Compliance reflects an orientation to parents, internalization of parental requests and an ability to adhere to standards of conduct (Kopp, 1982). These abilities reflect early socialization and conscience development (Kochanska & Aksan, 1995), and predict empathy skills in childhood and adolescence (Feldman, 2007). Children with autism spectrum disorder (ASD) often exhibit low levels of compliance with parental requests, but it is not clear when these difficulties emerge (Arbelle, Sigman, & Kasari, 1994). To address this gap,

we examined the development of compliance in toddlers with and without ASD outcomes from two to three years of age.

Compliance to parental requests is frequently examined in the context of a parent asking the child to cleanup toys following a free play period (e.g., Kochanska, Coy, & Murray, 2001). Among typically developing children, compliance has been shown to increase from 14 to 33 months and remain stable after 45 months (Kochanska, Coy, & Murray, 2001), whereas passive noncompliance (e.g., ignoring the parent) decreases from 15 to 60 months (Kuczynski & Kochanska, 1990). Passive noncompliance during the toddler years was associated with later externalizing behavior problems (Kuczynski & Kochanska, 1990), which parents report to be one of the most distressing characteristics of ASD (Bauminger, Solomon, & Rogers, 2010; Ekas & Whitman, 2010). Active forms of noncompliance (e.g., overt resistance and defiance) were used less frequently than passive noncompliance during the toddler period, and are generally considered to be a more sophisticated form of noncompliance during this same period (Kuczynski & Kochanska, 1990).

Scientific understanding of compliance in children with ASD is limited, and it is unclear whether difficulties in compliance among children affected by ASD are due primarily to social deficits or language difficulties. Three- to six-year-old children with ASD, for example, were less likely to comply with a command than mental-age matched children with intellectual disability (Arbelle, Sigman, & Kasari, 1994) or children with intellectual or language delay (Lemanek, Stone, & Fishel, 1993). Children with ASD were also more likely to demonstrate noncompliance that consisted of ignoring or attempting to leave (as opposed to overt resistance) than were children with intellectual or language delay (Lemanek, Stone, & Fishel, 1993). These results suggest that intellectual and language abilities alone do not account for the differences in compliance behaviors observed in children with ASD. In contrast, Bryce and Jahromi (2013) found no significant differences in rates of compliance and noncompliance when comparing five-to six-year-old children with high-functioning ASD and typically developing children. The lack of differences seen with high-functioning children suggests that intellectual or language ability may be a factor in compliance behavior in the context of ASD. These studies involved children over three years of age, when levels of compliance are expected to be relatively stable (Kochanska et al., 2001). The paucity of research on the potential deficits in the *development* of compliance during the first years of life may be due to the relative difficulty of examining early ASD-relevant behavior prior to diagnosis.

The infant siblings of children with ASD provide a unique opportunity to examine the development of compliance. These siblings are at increased risk for developing ASD, with almost 20% having an ASD outcome and another approximately 20% evidencing sub-threshold symptoms and/or lower levels of developmental functioning (Messinger et al., 2013; Messinger et al., 2015; Ozonoff et al., 2011). The purpose of this study was to determine whether high-risk children later diagnosed with ASD have a different developmental trajectory of compliance and noncompliance behaviors than high-risk and low-risk children without ASD. A secondary goal was investigating whether ASD symptom severity was associated with compliance among high-risk children. Consistent with previous infant sibling studies (Campbell, Leezenbaum, Schmidt, Day, & Brownell, 2015; Gammer et

al., 2015), the role of receptive language ability was also examined. Specifically, each research question was first tested using only ASD group status as a predictor of compliance and then subsequently retested in a model controlling for receptive language. This strategy allowed us to first establish the presence of differences in the development of compliance related to ASD outcome, and then assess the extent to which these differences might be explained by variance in language comprehension. These goals were pursued in the context of a longitudinal analysis of compliance behaviors in an ecologically valid observational measure, a clean-up task, when children were 24, 30, and 36 months of age.

Method

Participants

Participants were part of a longitudinal study examining the development of infants at high- and low-risk for developing ASD. High-risk infants ($n = 70$) had one or more older siblings with an ASD diagnosis, confirmed by a licensed psychologist based on DSM-IV-TR criteria (American Psychiatric Association, 2000) and results from the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). Low-risk infants ($n = 41$) had no reported family history of ASD, and their older siblings did not evidence elevated ASD symptoms on the Social-Communication Questionnaire (Rutter, Bailey, & Lord, 2003). Demographic data are presented in Table 1.

Procedure

Children participated in assessments at 24, 30, and 36 months. Child compliance was measured at all ages and video-recorded for behavioral coding. At the 24- and 36-month visits, the Mullen Scales of Early Learning (MSEL; Mullen, 1995) were administered. The ADOS was administered at the 30-month visit and the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter, & LeCouteur, 1994) was administered at the 36-month visit.

Measures

Child compliance—Following a free play session, an experimenter entered the room with a bin for toys, and asked the parent to “clean up with [child's name] as you normally would at home.” This task continued until the toys were put away or five minutes had elapsed.

Coding: The Child Compliance subscale of the Clean-Up Task Coding Manual (Guisti, Mirsky, Dickstein, & Seifer, 1997) was used to code the child's predominant behaviors in 15-second epochs. Codes included time out, overt resistance, overt defiance, committed compliance, situational compliance, or passive noncompliance. Time out was coded when the parent explicitly suspended the expectation that the child clean up and these epochs were removed from analyses. The proportion of time spent engaging in each behavior was calculated by dividing the observed number of epochs by the total number of episodes (Kochanska & Aksan, 1995). The possible range for each proportion was .00 – 1.00, as the behaviors were mutually exclusive (see Table 2). An overall compliance score was created by summing committed compliance (a wholehearted embrace of the parental agenda) and situational compliance (compliance with parental requests that required continued prompting). Passive noncompliance was coded when the child ignored parental directives.

The active noncompliance score was created by summing overt resistance (refusing to comply without co-occurring negative affect) and overt defiance (defying parent with accompanying anger) as these behaviors were relatively uncommon.

Research associates, blind to risk status and ASD outcome, coded child behavior during the clean-up task. One-third (33%) of the total compliance sample was double-coded with good inter-rater agreement between coders across observations (24 months: $\kappa = .67$, % agreement = 82.9; 30 months: $\kappa = .69$, % agreement = 81.3; 36 months: $\kappa = .65$, % agreement = 81.5).

ASD Outcome—At 36 months, children received a diagnostic evaluation from a licensed psychologist blind to risk group. Clinical best-estimate diagnosis was informed by the ADOS, MSEL (Mullen, 1995), and ADI-R (Lord et al, 1994). Additionally, ADOS severity scores (social affect, and restricted/repetitive behaviors) were calculated (Gotham, Risi, Pickles, & Lord, 2007; Hus, Gotham, & Lord, 2014). None of the 41 children in the low-risk group were diagnosed with ASD (*Low-Risk* group). Of the 70 children in the high-risk group, 21 were diagnosed with ASD (*High-Risk/ASD* group) and 49 were not (*High-Risk/No ASD* group).

Analytic Plan

To minimize the impact of attrition in this longitudinal study, we utilized Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002), which estimates differences in group means and rates of change using all available data. Using HLM 7.0, we specified separate level 1 equations for each compliance behavior as follows:

$$\text{ComplianceBehavior} = \beta_0 + \beta_1(\text{Time}) + \beta_2(\text{Time}^2) + e$$

where β_0 is an intercept representing compliance behavior at 24 months, β_1 is the slope representing linear change in compliance behavior from 24 to 30 to 36 months (coded as 0, 1, 2), and e is the within-subject error term. To test whether change over time was curvilinear, a quadratic term, $\beta_2(\text{Time}^2)$, was added as a level 1 predictor of compliance behavior and retained if significant.

To examine group differences in intercept, slope, and quadratic terms at level 2, two dummy codes were created to test whether High-Risk/No ASD and Low-Risk (each coded 1) differed from the High-Risk/ASD group (coded 0). The level 2 equations were as follows:

$$\begin{aligned}\beta_0 &= \gamma_{00} + \gamma_{01}(\text{High} - \text{Risk/NoASD vs. High} - \text{Risk/ASD}) + \gamma_{02}(\text{Low} - \text{Risk vs. High} - \text{Risk/ASD}) + u \\ \beta_1 &= \gamma_{10} + \gamma_{11}(\text{High} - \text{Risk/NoASD vs. High} - \text{Risk/ASD}) + \gamma_{12}(\text{Low} - \text{Risk vs. High} - \text{Risk/ASD}) + u \\ \beta_2 &= \gamma_{20} + \gamma_{21}(\text{High} - \text{Risk/NoASD vs. High} - \text{Risk/ASD}) + \gamma_{22}(\text{Low} - \text{Risk vs. High} - \text{Risk/ASD}) + u\end{aligned}$$

where γ_{00} is the average compliance behavior score at 24 months for children in the High-Risk/ASD group, γ_{01} represents the difference in compliance behavior at 24 months between children in the High-Risk/No ASD group and children in the High-Risk/ASD group, γ_{02} is the difference in compliance behavior at 24 months between children in the

Low-Risk group and children in the High-Risk/ASD group, and u is the between group error term. Similar interpretations are made for the remaining equations where γ_{10} , γ_{11} , and γ_{12} refer to the linear change in compliance behavior between 24 and 36 months, and γ_{20} , γ_{21} , and γ_{22} refer to the quadratic term. We conducted an additional set of analyses in which the MSEL receptive language score was included at level 2 as an additional predictor of the intercept, slope, and quadratic terms.

Results

Attrition Rates and Descriptive Information

In this longitudinal study, 48 (16.8%) of 333 ($n = 111 \times 3$ ages) total possible compliance behavior data points were missing. Eighteen children (19.4%) were missing compliance data at 24 months, 12 (12.1%) at 30 months, and 18 (19.4%) at 36 months. With regard to outcome, 10 (47.6%) of the children in the High-Risk/ASD group, 12 (24.5%) in the High-Risk/No ASD group, and 15 (36.6%) in the Low-Risk group were missing compliance data at one or two time points.

MSEL receptive language data were collected at 24 and 36 months. Receptive language data at 36 months was missing for three (14.3%) children in the High-Risk/ASD group, four (8.2%) in the High-Risk/No ASD group, and eight (19.5%) in the Low-Risk group at 36 months. Given the high correlation between 24- and 36-month receptive language scores, $r(80) = .60$, $p < .001$, we utilized 24-month receptive language data for three children in the High Risk/ASD group, four children in the High-Risk/No ASD group, and five children in the Low-Risk group. Three children were excluded from analyses that included receptive language due to missing data at both ages. Finally, ADOS severity scores were missing for four (19.0%) children in the High-Risk/ASD group, one (2.0%) in the High-Risk/No ASD group, and two (4.9%) in the Low-Risk group.

ASD outcome groups were comparable on child race/ethnicity, $\chi^2(8, N = 111) = 4.36$, $p = .82$ and maternal education, $\chi^2(4, N = 110) = 3.10$, $p = .54$ (see Table 1). Therefore, child race/ethnicity and maternal education were not included as covariates in subsequent analyses. There were significant group differences in receptive language, $F(2, 105) = 23.84$, $p < .001$. Children in the High-Risk/ASD group had significantly lower receptive language scores than children in the High-Risk/No ASD group ($M_{\text{diff}} = 12.87$, $SE = 2.55$, $p < .001$) who had significantly lower scores than the children in the Low-Risk group ($M_{\text{diff}} = 5.40$, $SE = 2.11$, $p < .05$). Given the potential relevance of receptive language for compliance, we conducted analyses with and without statistically controlling for this variable to ascertain the impact of receptive language on compliance behaviors. Descriptive statistics for compliance behaviors by ASD outcome group are reported in Table 2.

Change in Compliance Behavior

Compliance—The 24-month compliance intercept did not differ by ASD outcome (see Table 3). The High-Risk/No ASD group exhibited the highest growth in compliance over age, followed by the Low-Risk group, and the High-Risk/ASD group. The rate of change in compliance for the High-Risk/No ASD group was significantly greater than that of the High-

Risk/ASD group, $t(108) = 2.57, p < .05$. The Low-Risk group's increase in compliance over age was not significantly different from that of the High-Risk/ASD group, $t(108) = 1.52, p = .13$.

After covarying receptive language on the compliance intercept (24 months) and slope, ASD group results were unchanged. Receptive language was not a significant predictor of the compliance intercept, $t(104) = 1.01, p = .32$, or slope, $t(104) = .56, p = .58$ (see Table 3). In sum, high-risk children with ASD outcomes showed less growth in compliance from 24 to 36 months than high-risk children without ASD outcomes, even after covarying receptive language.

Passive noncompliance—The High-Risk/ASD group spent a greater proportion of time in passive noncompliance at 24 months than the High-Risk/No ASD group, $t(108) = -2.97, p < .01$, and the Low-Risk group, $t(108) = -4.01, p < .001$ (see Table 4). The linear slope of passive noncompliance for the High-Risk/ASD group was significantly lower than the Low-Risk group, $t(108) = 2.15, p < .05$, but not significantly lower than the High-Risk/No ASD group, $t(108) = 1.67, p = .10$. The quadratic rate of change of passive noncompliance for the High-Risk/ASD group was significantly greater than that of the Low-Risk group, $t(108) = -1.99, p < .05$, but only marginally greater than the High-Risk/No ASD group, $t(108) = -1.86, p = .07$. For the High-Risk/ASD group, rates of passive noncompliance declined from 24 to 30 months and then reversed direction to increase from 30 to 36 months. At 36 months, children in the High-Risk/ASD group spent more time in passive noncompliance than children in the High-Risk/No ASD group, $t(108) = -3.60, p < .001$, and children in the Low-Risk group, $t(108) = -3.06, p < .01$.

Receptive language was not a significant predictor of the 24-month passive noncompliance intercept, $t(104) = -1.67, p = .10$, slope, $t(104) = -.25, p = .80$, or quadratic rate of change, $t(104) = .14, p = .89$. When covarying the effects of receptive language on the passive noncompliance intercept (24 months), slope, and quadratic parameters, the High-Risk/ASD group continued to show greater passive noncompliance at 24 months than the Low-Risk group, $t(104) = -2.41, p < .05$. However, the intercept difference between the High-Risk/ASD and the High-Risk/No ASD groups was marginal, $t(104) = -1.88, p = .06$. Differences between the High-Risk/ASD and Low-Risk groups in the linear, $t(104) = 1.79, p = .08$, and quadratic, $t(104) = -1.58, p = .12$, rates of change were no longer significant when controlling for receptive language. In sum, initial differences between the High-Risk/ASD and Low-Risk groups in 24-month passive noncompliance remained significant when controlling for receptive language. In contrast, differences in the rate of change were no longer significant after controlling for receptive language.

Active Noncompliance—At 24 months, the High-Risk/ASD group engaged in less active noncompliance than the High-Risk/No ASD, $t(108) = 2.24, p < .05$, and Low-Risk groups, $t(108) = 3.06, p < .01$ (see Table 5). The linear slope of active noncompliance for the High-Risk/ASD group was marginally higher than the High-Risk/No ASD group, $t(108) = -1.75, p = .08$; however, the Low-Risk group displayed a greater decline in active noncompliance from 24 to 36 months than the High-Risk/ASD group, $t(108) = -2.46, p < .05$. After covarying the effects of receptive language on the 24-month active noncompliance intercept

and slope, the significance of ASD outcome group results were unchanged. Additionally, receptive language was not a significant predictor of the 24-month intercept, $t(104) = -.08$, $p = .93$, or slope, $t(104) = .26$, $p = .79$. In sum, high-risk children with ASD showed *lower* levels of active noncompliance at 24 months than the other groups. These results were unchanged when accounting for differences in receptive language.

ASD Symptom Severity and Compliance Behavior

To ascertain whether 30-month ASD symptom severity was associated with compliance behaviors at 36 months for the high-risk children, restricted and repetitive behavior and social affect severity scores were simultaneously entered as predictors in a multiple regression. Restricted and repetitive behavior was a significant predictor ($\beta = -.41$, $p < .01$) of compliance at 36 months, whereas social affect was not ($\beta = -.08$, $p = .56$). Similar results were found for passive noncompliance (restricted and repetitive behavior: $\beta = .47$, $p < .01$; social affect: $\beta = -.02$, $p = .87$). ASD symptom severity was not a significant predictor of active noncompliance (restricted and repetitive behavior: $\beta = .16$, $p = .33$; social affect: $\beta = -.04$, $p = .81$). Thus, symptoms indexing restricted and repetitive behaviors were predictors of both compliance and passive noncompliance behaviors. When covarying receptive language, the associations between restricted and repetitive behaviors and compliance were no longer significant, $\beta = -.23$, $p = .13$. However, the restricted and repetitive behavior score was a marginal predictor of passive noncompliance at 36 months, $\beta = .28$, $p = .07$.

Discussion

Difficulties with compliance are challenging for parents of children with ASD (Ekas & Whitman, 2010). The current results contribute to a scientific understanding of the early development of compliance during naturalistic parent-child interactions between 24 and 36 months of age in children affected by ASD. Although initial levels of compliance did not differ between groups, high-risk children with ASD outcomes showed lower levels of subsequent growth in compliance than high-risk children without ASD outcomes. By the same token, high-risk children with ASD outcomes showed higher levels of *passive* noncompliance but lower initial levels of *active* noncompliance than low-risk children. ASD outcome group differences in passive but not active noncompliance appeared to be due, at least in part, to receptive language difficulties. Overall, results suggest that the developmental trajectory of compliance is negatively impacted by the emergence of ASD, whereas the increase in rates of passive noncompliance in children with ASD may be attributable to receptive language difficulties.

Development of Compliance

Although there were not differences in initial levels of compliance, the increase in compliance in children in the High-Risk/ASD group was smaller than that of children in the High-Risk/No ASD group. However, there was not a significant difference in the rate of change of compliance from 24 to 36 months between the children in the High-Risk/ASD group and children in the Low-Risk group. The relative strength of the increase in compliance among high-risk children without emergent ASD may reflect strengths related to greater parental expectations of compliance, which may be associated with growing up in a

family with an older sibling with ASD. Children's receptive language did not impact group differences in the development of compliance, suggesting that the lower rates of compliance in children in the High-Risk/ASD group was unrelated to children's comprehension of parent requests.

Descriptively, patterns of change in compliance in the High-Risk/ASD group appear to be different from those in both non-ASD groups. All groups showed an increase in compliance between 24 and 30 months. However, while compliance continued to increase from 30 to 36 months in the High-Risk/No ASD and Low-Risk groups, the High-Risk/ASD group showed a decrease in compliance during this period. One potential contributor to this difference may be ASD symptom severity. As expected, high-risk children's ASD symptom severity was associated with decreased compliance. Restricted and repetitive behaviors, and not social communicative difficulties, were associated with compliance behaviors. Restricted and repetitive behaviors are a core ASD domain and include stereotyped speech and/or motor movements, restricted interests, stereotyped behaviors, and unusual sensory interests (APA, 2013; Hus et al., 2014). These restricted and repetitive behaviors appear to limit high-risk children's opportunities to engage in appropriate social behaviors (Wolff et al., 2014) and, in the present context, may interfere with the toddlers' abilities to engage with a social partner and comply with their requests. For example, toddlers may be engaged in repetitive play or be fixated on a particular toy, and unable to shift attention to respond to the parents' requests to clean up.

When controlling for receptive language, associations between symptom severity and compliance behaviors were no longer significant, suggesting that the children's language comprehension is a possible explanation for associations with symptom severity. Children with better understanding of language may be more capable of disengaging from restricted and repetitive behaviors in order to comply. These results suggest that improved receptive language abilities may ease the impact of restricted and repetitive behaviors on social compliance. Strategies to disengage from restricted and repetitive behaviors may be important to enhance children's success in early intervention programs that target the prevention of social difficulties in high-risk infants (Green et al., 2015).

Development of Noncompliance

High-risk children with ASD outcomes showed different patterns of noncompliance behaviors than comparison children. High-risk children with ASD outcomes exhibited more passive noncompliance than high-risk and low-risk children without ASD at 24 months. Passive noncompliance—behaviors such as not responding to social overtures and not attending to the parent—are commonly reported among children with ASD (Hanley et al., 2014). While the children without ASD outcomes displayed a decrease in passive noncompliance from 24 to 36 months, children in the High-Risk/ASD group showed a decline from 24 to 30 months and then increased from 30 to 36 months. Receptive language was not a significant predictor of passive noncompliance. However, after controlling for receptive language, the previously significant difference between the High-Risk/ASD and High-Risk/No ASD groups at 24 months and the linear slope difference between the High-Risk/ASD and Low-Risk groups were marginal, but nonsignificant. High-risk children's

level of restricted and repetitive behaviors during the ADOS at 30 months (e.g., visual inspection of toys, repetitive play) predicted increased passive noncompliance at 36 months. However, this association was marginal after covarying receptive language. Overall, these findings suggest that elevated noncompliance in children with emergent ASD may be related to receptive language difficulties.

High-risk children with ASD outcomes engaged in less active noncompliance (e.g., overtly refusing to follow parental requests) than high-risk and low-risk children without ASD at 24 months of age. Levels of active noncompliance were relatively stable between 24 and 36 months for children in the High-Risk/ASD group while active noncompliance declined among children without ASD outcomes. This is consistent with the only known study to examine active noncompliance in children with ASD (Bryce & Jahromi, 2013), in which high-functioning preschool-age children with ASD did not differ from typically developing children. This category of noncompliance behaviors always involved verbalizations that consisted of children actively defying parental commands (e.g., “No” or “I want to keep playing”) with or without negative affect and is generally considered to be a more sophisticated form of noncompliance than passive noncompliance (Kuczynski & Kochanska, 1990). Nevertheless, findings were unchanged after controlling for children's receptive language. It may be that higher levels of active noncompliance at 24 months is a developmentally appropriate phenomenon, reflecting a growing sense of self and testing of boundaries that the children with emerging ASD are not expressing. More research on the typical development of these behaviors during this time period is needed to help clarify whether the lack of change over time in the High-Risk/ASD group is maladaptive.

In sum, our findings suggest that noncompliance in children with ASD is more commonly passive than active. The higher rates of passive noncompliance may be partly explained by difficulties in receptive language among children with ASD. Among typically developing children, passive noncompliance during the toddler years is associated with later behavior problems (Kuczynski & Kochanska, 1990), suggesting that early intervention to decrease passive noncompliance may prevent later behavior problems. Given our findings, early interventions focused on improving compliance in children with emerging ASD may benefit from a more intensive focus on increasing children's understanding of spoken language and parental requests.

Limitations and Future Directions

Although the current study was the first to examine the development of compliance in children later diagnosed with ASD, several limitations and directions for future research warrant discussion. Missing data may have influenced findings in this longitudinal study. However, HLM's estimation of developmental trajectories uses all available data (Full Information Maximum Likelihood estimation), avoiding difficulties associated with listwise deletion (Raudenbush & Bryk, 2002; Warren, Fey, & Yoder, 2007). The current study focused on development between two and three years of age, extending our understanding of compliance in the emergence of ASD. Consequently, it remains to be determined whether ASD-related deficits in compliance behaviors are evident before 24 months and whether they persist beyond 36 months (Kuczynski & Kochanska, 1990). A particular strength of this

study is the use of an ecologically valid situation that families encounter regularly (Kochanska & Aksan, 1995). However, we focused on one measure (i.e., observation of a “do” task). Future studies might incorporate additional measures of compliance, such as performance during a “don’t” task (e.g., a prohibition task). Research with typically developing children has generally found that children find it easier to comply during a “don’t” task (Kochanska & Aksan, 2005), but it is not known whether the same is true for children with ASD.

Although the sample was diverse with respect to race/ethnicity, the mothers were highly educated on average. This limits the generalizability of the study findings. Additionally, since our groups differed in receptive language, it would be beneficial for future studies to include a control group of individuals matched on receptive language ability. This additional group would allow researchers to precisely test whether it is receptive language ability or ASD symptoms that contribute to the differences found. Unfortunately, the prospective design of this study prohibited the creation of such a group.

In the current study, each compliance behavior was a mutually exclusive coding category which, consistent with previous research, was analyzed in a separate model (e.g., Bryce & Jahromi, 2013; Kochanska et al., 2001; Kuczynski & Kochanska, 1990). Given the paucity of research on the development of compliance in children at risk for developing ASD, examining the developmental trajectories of each category of compliance behavior was an important first step toward understanding the strengths and weaknesses of these children.

The results of our study highlight the importance of examining the developmental trajectories of compliance in children at risk for ASD. Our sample contained a high proportion of Hispanic children, who are understudied in ASD research, increasing the generalizability of these findings. For children with emergent ASD, deficits in compliance behaviors appear to be present before diagnosis, at two years, and continue through three years of age. Our findings suggest that the lower rates of compliance found among High-Risk/ASD children may be directly associated with ASD, whereas the increased rates of passive noncompliance may be due in part to the receptive language impairments of High-Risk/ASD children.

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References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th. 2000. text rev
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th. Arlington, VA: American Psychiatric Publishing; 2013.
- Arbelle S, Sigman MD, Kasari C. Compliance with parental prohibition in autistic children. *Journal of Autism and Developmental Disorders*. 1994; 24:693–702. DOI: 10.1007/BF02172280 [PubMed: 7844094]

- Bauminger N, Solomon M, Rogers SJ. Externalizing and internalizing behaviors in ASD. *Autism Research*. 2010; 3:101–112. DOI: 10.1002/aur.131 [PubMed: 20575109]
- Bryce CI, Jahromi LB. Brief report: Compliance and noncompliance to parental control strategies in children with high-functioning autism and their typical peers. *Journal of Autism and Developmental Disorders*. 2013; 43:236–243. DOI: 10.1007/s10803-012-1564-2 [PubMed: 22688777]
- Campbell SB, Leezenbaum NB, Schmidt EN, Day TN, Brownell CA. Concern for another's distress in toddlers at high and low genetic risk for autism spectrum disorder. *Journal of Autism and Developmental Disorders*. 2015; 45:3594–3605. DOI: 10.1007/s10803-015-2505-7 [PubMed: 26093390]
- Ekas N, Whitman TL. Autism symptom topography and maternal socioemotional functioning. *American Journal on Intellectual and Developmental Disabilities*. 2010; 115:234–249. DOI: 10.1352/1944-7558-115.3.234 [PubMed: 20441393]
- Feldman R. Mother-infant synchrony and the development of moral orientation in childhood and adolescence: Direct and indirect mechanisms of developmental continuity. *American Journal of Orthopsychiatry*. 2007; 77:582–597. DOI: 10.1037/0002-9432.77.4.582 [PubMed: 18194038]
- Gammer I, Bedford R, Elsabbagh M, Garwood H, Pasco G, Tucker L, et al. The BASIS Team. Behavioural markers for autism in infancy: Scores on the Autism Observational Scale for Infants in a prospective study of at-risk siblings. *Infant Behavior and Development*. 2015; 38:107–115. DOI: 10.1016/j.infbeh.2014.12.017 [PubMed: 25656952]
- Gotham K, Risi S, Pickles A, Lord C. The autism diagnostic observation schedule: Revised algorithms for improved diagnostic validity. *Journal of Autism and Developmental Disorders*. 2007; 37:613–627. DOI: 10.1007/s10803-006-0280-1 [PubMed: 17180459]
- Green, J., Pickles, A., McConachie, H., Jones, E., Gliga, T., Charman, T., Johnson, MH. Responses to early intervention and mechanisms of change. Symposium conducted at the International Meeting for Autism Research; Salt Lake City: 2015 May. Early intervention for autism: Mechanism and developmental science.
- Guisti L, Mirsky E, Dickstein S, Seifer R. Clean-Up Task Coding Manual Version 1.0. 1997
- Hanley M, Riby DM, McCormack T, Carty C, Coyle L, Crozier N, et al. McPhillips M. Attention during social interaction in children with autism: Comparison to specific language impairment, typical development, and links to social cognition. *Research in Autism Spectrum Disorders*. 2014; 8:908–924. DOI: 10.1016/j.rasd.2014.03.020
- Hus V, Gotham K, Lord C. Standardizing ADOS domain scores: Separating severity of social affect and restricted and repetitive behaviors. *Journal of Autism and Developmental Disorders*. 2014; 44:2400–2412. DOI: 10.1007/s10803-012-1719-1 [PubMed: 23143131]
- Kochanska G, Aksan N. Mother-child mutually positive affect, the quality of child compliance to requests and prohibitions, and maternal control as correlates of early internalization. *Child Development*. 1995; 66:236–254. DOI: 10.2307/1131203
- Kochanska G, Coy KC, Murray KT. The development of self-regulation in the first four years of life. *Child Development*. 2001; 72:1091–1111. DOI: 10.1111/1467-8624.00336 [PubMed: 11480936]
- Kopp CB. Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*. 1982; 18:199–214. DOI: 10.1037/0012-1649.18.2.199
- Kuczyński L, Kochanska G. Development of children's noncompliance strategies from toddlerhood to age 5. *Developmental Psychology*. 1990; 26:398–408. DOI: 10.1037/0012-1649.26.3.398
- Lemanek KL, Stone WL, Fishel PT. Parent-child interactions in handicapped preschoolers: The relation between parent behaviors and compliance. *Journal of Clinical Child Psychology*. 1993; 22:68–77. DOI: 10.1207/s15374424jccp2201_7
- Lord C, Risi S, Lambrecht L, Cook EH, Leventhal BL, DiLavore PC, et al. Rutter M. The autism diagnostic observation schedule-generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism and Developmental Disorders*. 2000; 30:205–223. DOI: 10.1023/A:1005592401947 [PubMed: 11055457]
- Lord C, Rutter M, Le Couteur A. Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders*. 1994; 24:659–685. DOI: 10.1007/BF02172145 [PubMed: 7814313]

- Messinger D, Young GS, Ozonoff S, Dobkins K, Carter A, Zwaigenbaum L, et al. Sigman M. Beyond autism: A baby siblings research consortium study of high-risk children at three years of age. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2013; 52:300–308e1. DOI: 10.1016/j.jaac.2012.12.011 [PubMed: 23452686]
- Messinger DS, Young GS, Webb SJ, Ozonoff S, Bryson S, Carter A, et al. Zwaigenbaum L. Early sex differences are not autism-specific: A baby siblings research consortium study. *Molecular Autism*. in press.
- Mullen, EM. Mullen scales of early learning. Circle Pines, MN: American Guidance Service; 1995.
- Ozonoff S, Young GS, Carter A, Messinger D, Yirmiya N, Zwaigenbaum L, et al. Stone WL. Recurrence risk for autism spectrum disorders: A baby siblings research consortium study. *Pediatrics*. 2011; 128:e488–e495. DOI: 10.1542/peds.2010-2825 [PubMed: 21844053]
- Raudenbush, SW., Bryk, AS. Hierarchical linear models: Applications and data analysis methods. 2nd. Thousand Oaks, CA: Sage Publications; 2002.
- Rutter, M., Bailey, A., Lord, C. The social communication questionnaire: Manual. Los Angeles, CA: Western Psychological Services;
- Wan MW, Green J, Elsabbagh M, Johnson M, Charman T, Plummer F. the BASIS Team. Quality of interaction between at-risk infants and caregiver at 12-15 months is associated with 3-year autism outcome. *The Journal of Child Psychology and Psychiatry*. 2013; 54:763–771. DOI: 10.1111/jcpp.12032 [PubMed: 23227853]
- Warren SF, Fey ME, Yoder PJ. Differential treatment intensity research: A missing link to creating optimally effective communication interventions. *Mental Retardation and Developmental Disabilities Research Reviews*. 2007; 13(1):70–77. [PubMed: 17326112]
- Wolff JJ, Botteron KN, Dager SR, Elison JT, Estes AM, Gu H, et al. The IBIS Network. Longitudinal patterns of repetitive behavior in toddlers with autism. *Journal of Child Psychology and Psychiatry*. 2014; 55:945–953. DOI: 10.1111/jcpp.12207 [PubMed: 24552513]

Table 1
Sample Demographic Information by Child Diagnostic Outcome Group

	High-Risk/ASD	High-Risk/no ASD	Low-Risk
<u>Child Race/Ethnicity</u>	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
White	9 (42.9)	18 (36.7)	14 (34.1)
Hispanic/Latino	7 (33.3)	21 (42.9)	19 (46.3)
Black/African-American	0	1 (2.0)	1 (2.4)
Asian/Asian-American	1 (4.8)	0	2 (4.9)
Mixed Ethnicity/Other	4 (19.0)	9 (18.4)	5 (12.2)
<u>Maternal Education</u>			
High school	3 (14.3)	3 (6.1)	1 (2.4)
Some college	2 (9.5)	5 (10.2)	2 (4.9)
2-year college	1 (4.8)	8 (16.3)	5 (12.2)
4-year college	4 (19.0)	13 (26.5)	13 (31.7)
Advanced degree	11 (52.4)	19 (38.8)	20 (48.8)
<u>Child Gender</u>			
Male	16 (76.2)	30 (61.2)	21 (51.2)
Female	5 (23.8)	19 (38.8)	20 (48.8)
<u>ADOS Severity Scores</u>	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Overall	5.88 (1.76)	2.20 (1.52)	1.56 (1.33)
Social Affect	5.76 (1.64)	2.59 (1.78)	2.00 (1.57)
Restricted and Repetitive	6.59 (2.53)	3.55 (2.47)	2.38 (1.99)
<u>Child Developmental Level</u>	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Early Learning Composite	71.95 (18.89)	94.12 (15.74)	104.87 (13.74)
Receptive Language	32.33 (12.57)	45.20 (9.72)	50.61 (7.93)
Expressive Language	38.62 (14.20)	48.67 (9.11)	52.45 (8.28)
Visual Reception	34.90 (14.11)	51.20 (13.97)	56.26 (11.65)
Fine Motor	31.38 (12.31)	42.47 (10.35)	50.29 (11.47)

Note: Maternal education information was missing for one child in the High-Risk/No ASD group.

Table 2
Descriptive statistics for child compliance variables by ASD outcome

Compliance Behavior	Low-Risk			High-Risk/No ASD			High-Risk/ASD		
	<i>n</i>	<i>M (SD)</i>	Range	<i>n</i>	<i>M (SD)</i>	Range	<i>n</i>	<i>M (SD)</i>	Range
<u>24 Months</u>									
Overall Compliance	29	.51 (.31)	.00-1.00	45	.42 (.31)	.00-1.00	19	.43 (.30)	.00-.67
Passive Noncompliance	29	.22 (.24)	.00-.71	45	.30 (.25)	.00-1.00	19	.50 (.28)	.00-1.00
Active Noncompliance	29	.10 (.21)	.00-.89	45	.20 (.28)	.00-1.00	19	.06 (.07)	.00-.20
<u>30 Months</u>									
Overall Compliance	39	.59 (.27)	.00-1.00	43	.56 (.26)	.00-.78	17	.54 (.38)	.00-1.00
Passive Noncompliance	39	.26 (.21)	.00-.75	43	.27 (.20)	.00-.79	17	.34 (.37)	.00-1.00
Active Noncompliance	39	.13 (.22)	.00-.92	43	.12 (.21)	.00-.77	17	.06 (.09)	.00-.25
<u>36 Months</u>									
Overall Compliance	34	.60 (.27)	.00-1.00	44	.64 (.28)	.00-1.00	15	.32 (.32)	.00-.91
Passive Noncompliance	34	.25 (.19)	.00-.67	44	.23 (.20)	.00-.75	15	.47 (.32)	.00-1.00
Active Noncompliance	34	.10 (.21)	.00-.85	44	.09 (.14)	.00-.44	15	.11 (.16)	.00-.50

Note. Values are the proportion of time spent engaging in each category of behavior (number of episodes observed/total number of episodes).

Table 3

Results of separate HLM models for compliance

	Without MSEL Receptive Language				With MSEL Receptive Language			
	High-Risk/ ASD b (SE)	High-Risk/ No ASD b (SE)	Low-Risk b (SE)	High-Risk/ ASD b (SE)	High-Risk/ No ASD b (SE)	Low-Risk b (SE)	Receptive Language b (SE)	
Intercept– 24 Months	.46 (.06) ***	-.03 (.08)	.04 (.08)	.50 (.08) ***	-.07 (.09)	-.01 (.10)	.00 (.00)	
Slope	-.03 (.05)	.14 (.05) *	.09 (.06)	-.01 (.05)	.12 (.06) *	.06 (.07)	.00 (.00)	

Note.

 $p < .001$;
**
 $p < .01$;
*
 $p < .05$;
†
 $p < .10$.

Two dummy codes were created to test whether High-Risk/No ASD and Low-Risk (each coded 1) differed from the High-Risk/ASD group (coded 0). Significance tests for the High-Risk/ASD group represent a difference from zero and significance tests for the High-Risk/No ASD and Low-Risk groups represent differences from the High-Risk/ASD group.

Table 4

Results of separate HLM models for passive noncompliance

	Without MSEL Receptive Language			With MSEL Receptive Language		
	High-Risk/ ASD b (SE)	High-Risk/ No ASD b (SE)	Low-Risk b (SE)	High-Risk/ ASD b (SE)	High-Risk/ No ASD b (SE)	Low-Risk b (SE)
Intercept-24 Months	.50 (.06)***	-.20 (.07)**	-.29 (.07)***	.45 (.07)***	-.14 (.08) [†]	-.21 (.09)*
Slope	-.28 (.13)*	.26 (.16)	.35 (.16)*	-.30 (.16) [†]	.28 (.18)	.36 (.20) [†]
Quadratic	.13 (.06)*	-.14 (.08)	-.15 (.08)*	.13 (.07) [†]	-.14 (.08) [†]	-.15 (.09)

Note.
*** $p < .001$;
** $p < .01$;
* $p < .05$;
[†] $p < .10$.

Two dummy codes were created to test whether High-Risk/No ASD and Low-Risk (each coded 1) differed from the High-Risk/ASD group (coded 0). Significance tests for the High-Risk/ASD group represent a difference from zero and significance tests for the High-Risk/No ASD and Low-Risk groups represent differences from the High-Risk/ASD group.

Table 5

Results of separate HLM models for active noncompliance

	Without MSEL			With MSEL		
	High-Risk/ ASD	High-Risk/ No ASD	Low-Risk	High-Risk/ No ASD	Low-Risk	Receptive Language
	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)
Intercept-24 Months	.05 (.05)	.14 (.06) [*]	.21 (.07) ^{**}	.15 (.07) [*]	.22 (.08) ^{**}	.00 (.00)
Slope	.02 (.04)	-.07 (.04) [†]	-.11 (.05) [*]	-.08 (.05) [†]	-.12 (.06) [*]	.00 (.00)

Note:

 $p < .001$;

**
 $p < .01$;

*
 $p < .05$;

[†] $p < .10$

Note: Two dummy codes were created to test whether High-Risk/No ASD and Low-Risk (each coded 1) differed from the High-Risk/ASD group (coded 0). Significance tests for the High-Risk/ASD group represent a difference from zero and significance tests for the High-Risk/No ASD and Low-Risk groups represent differences from the High-Risk/ASD group.