Executive Function and Mothering: Challenges Faced by Teenage Mothers

ABSTRACT: Previous research has established that in comparison to adult mothers teen mothers respond less sensitively to their infants. In adults, components of executive functions relate directly to maternal sensitivity. Since teenagers are known to have a less developed prefrontal cortex and greater difficulties in parenting, this study sought to determine whether the association between executive processes and mothering exists among teenagers. Two groups of mothers, teens (n = 30) and adults (n = 27), who were approximately 4–6 months postpartum, completed tasks assessing spatial working memory and attentional set shifting (cognitive flexibility) using the Cambridge Neuropsychological Test Automated Battery. Mothers were videotaped interacting with their infants and were later coded for various maternal behaviors. As predicted, teenagers performed more poorly than adults on tasks of cognitive flexibility and were less sensitive in their infant interactions. Among both groups there was a negative association between executive function and mothering; however, depending on the age of the mother different executive function tasks were relevant. © 2014 Wiley Periodicals, Inc. Dev Psychobiol 56: 1027–1035, 2014.

Keywords: teen motherhood; executive function; parenting

INTRODUCTION

Teenage pregnancy is a significant problem in North America. Notably, in 2003, the pregnancy rate for Canadian teenagers 15–19 years old was 32.1 per 1,000 (McKay, 2006). Teen mothers tend to interact with their infants differently than adult mothers; they exhibit less affectionate contact, fewer positive facial expressions and reduced verbal and emotional responsiveness (Flanagan Coppa, Riggs, & Alario, 1994; Garcia Coll, Hoffman, Van Houten, & Oh, 1987; Krpan, Coombs, Zinga, Steiner, & Fleming, 2005; Levine, Garcia, Coll, & Oh, 1985; Lyons-Ruth & Block, 1996; McAnarney, Lawrence, Riciuti, Polley, & Szilagyl, 1986; Williams, Mathews, & MacLeod, 1996). Often, teen mothers have unrealistic expectations of their infant and are less sensitive to their needs (Garcia Coll et al., 1987). Teenage mothers engage in more “physical” interactions with their infants (i.e., prodding, pinching, and poking) and are less physiologically responsive to audiotapes of infant cries (Giardino, Gonzalez, Steiner, & Fleming, 2008). Although teen and adult mothers do not differ in their self-reports of attachment to their infants, or in their subjective reports about motherhood (Giardino et al., 2008; Krpan et al., 2005), their endocrine and autonomic patterns in response to infant cries are markedly different, with teen mothers showing minimal change from baseline in both cortisol and heart-rate (Giardino et al., 2008).

We believe that maternal responsiveness is related to other behavioral systems such as, how focused the mother is on the infant, how impulsive the mother is and how contingently she responds to the infant. This association has been well-established in the animal...
literature. Rat mothers who displayed greater impulsivity and made more errors in an attention set-shifting task were more easily distracted in the maternal context, spending less time in contact with and actively licking their pups (Lovic & Fleming, 2004; Lovic, Palombo, & Fleming, 2011). Consistent with this animal work, Gonzalez, Jenkins, Steiner, and Fleming (2012) also found associations between executive processes and maternal sensitivity during the early postpartum period in adult human mothers. In particular, less sensitive parenting was associated with poorer strategy and performance on a spatial working memory task and less cognitive flexibility. While motivated to care for their infants, these mothers tend to respond less contingently to their baby’s behaviors and show deficits in tasks that require shifting attention to relevant cues and inhibiting responses to irrelevant ones (Atkinson et al., 2009; Gonzalez, Atkinson, & Fleming, 2009; Gonzalez et al., 2012). These findings have important implications since a key component of maternal sensitivity is a mother’s ability to recognize and attend to infant cues and integrate environmental demands with infant needs. This requires a capacity to hold information on-line (working memory) and use flexible strategizing (cognitive flexibility).

The question arises: Does immature executive function, that is part of normative adolescent development, contribute to deficits in maternal sensitivity found in teenage mothers?

Adolescence is marked by a period of multiple “desynchronizations” in physical growth, endocrinology, and changes in cognitive and emotional skills (Padmanabhan, Geier, Ordaz, Teslovich, & Luna, 2011). The interface between affect, decision making, and action is one of the critical elements in adolescent development. There is considerable evidence in the literature to suggest that a number of changes in executive function occur between childhood and early adulthood. These include gains in attentional control (e.g., task-shifting), working memory capacity, response inhibition, and a gradual shift from relatively concrete to increasingly abstract thinking (Anderson, Anderson, & Garth, 2001; Conklin, Luciana, Hooper, & Yager, 2007; Huizinga, Dolan, & Van der Molen, 2006; Klenberg, Korkman, & Lahti-Nuttila, 2001; Luciana & Nelson, 1998; Spear, 2000). These studies show that compared to adults, teenagers tend to perform more poorly on tests of impulsivity and executive function; an outcome that has been attributed to an immature prefrontal cortex (Albert & Steinberg, 2011; Best & Miller, 2010; Geier, Terwelliger, Teslovich, Velanova, & Luna, 2010; Huizinga et al., 2006; McAnarney, 2008; Newman & McGaughy, 2011; Rubia, Hyde, Halari, Giampietro, & Smith, 2010; Sturman & Moghaddam, 2011). These results lead to the prediction that problems in teenage mothering may relate to their immature executive functioning.

In the present study, the link between executive functions and maternal responsiveness in adolescence will be examined. Based on previous research, we expect teenage mothers will perform poorly on executive function tasks and these deficits will be related to the quality of their parenting. Based on the animal and human literature we predicted that teen and adult mothers would show: (1) differences in performance on executive function tasks; (2) qualitatively different mothering behaviors; and (3) these differences in executive function would be related to mothering behavior.

METHODS

Participants

A total of 57 women participated in the study. Adult mothers, \((n = 27; M_{age} = 30.5, SD = 4.9)\) were recruited through two primary sources: (1) Ontario Early Years Centres (OEYC) in Halton, Mississauga, Cambridge, Kitchener and Hamilton regions and (2) the maternity ward at St. Joseph’s Healthcare, Hamilton, Ontario. Teen mothers \((n = 30; M_{age} = 17.6, SD = 1.47)\) were recruited from various community social programs within Hamilton, Mississauga, and Brampton, Ontario. These include facilities such as OEYCs, Teen Supper Clubs, and the YMCA. Generally, these are government sponsored community programs for teenage mothers where they obtain information on early childhood development, social assistance, personal care and health care resources. In many cases, teen mothers are referred to these centers by caregivers and/or healthcare providers. Mothers in our sample ranged from 2 to 6 months postpartum at the time of testing \((M = 5.54, SD = 2.57)\). Missing data were not imputed and hence different analyses were used with the total sample size varying between 52 and 57. With regards to maternal experience, 73.1% of the adults were first-time mothers and 83.3% of the teens were first-time mothers. Generally, subjects spoke English as a first language and were primarily of Caucasian descent. The study was approved by the Research Ethics Boards of St. Joseph’s Healthcare and the University of Toronto and written informed consent was obtained from each participant.

Procedure

Mothers were assessed during two home visits spaced approximately 2 weeks apart. During the first assessment, women reviewed provided informed consent. Then, mothers completed an automated neuropsychological assessment battery including the National Adult Reading Test (NART; Nelson & Willison, 1991), as a measure of premorbid intelligence and the CANTAB® battery (Robbins et al., 1994). To control for any potential confounding effects of
depression on executive function or maternal behaviors, we assessed maternal mood using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987). Participants also completed demographic questionnaires assessing factors such as education, income, partner or paternal occupation. Due to natural constraints imposed by the teen versus adult status (e.g., education and employment), it was difficult to equate the two populations on demographics. Therefore, we included a measure of SES—paternal occupation (for teens) and partner occupation (for adults) as a covariate in all subsequent analyses. Our measure of occupation was based on the Hollingshead scale which ranged from 1 to 6, where 1 = menial service workers, students or unemployed (dependent on welfare, no regular occupation) to 6 = professional (executive, business owner, major professional) with manual labor, retail and office work ranging in between. Occupation was chosen because it is one SES measure with the highest concordance between teen and parental reports (Pu, Huang, & Chou, 2012). Household income was unattainable with the adolescent mothers as they could not accurately report on parental income. However, all teen mothers could report on paternal occupation. For both groups, the majority of the testing occurred between 12:00 and 18:00h. During the second assessment, mothers were videotaped with their infants during a 20-min free play interaction followed by a 10-min divided attention task.

Measures of Maternal Sensitivity From Behavioral Interactions

Mothers were asked to interact with their infant as they would if alone but to remain within the camera’s view. After 20-min of free play interaction, mothers were presented with a short questionnaire while the infant was still in their presence. This produced an ecologically valid divided attention task for the mothers, such that each mother would have to allocate her attentional capacity between completing the questionnaire and responding to infant cues during the remaining 10-min of video. Maternal sensitivity-responsiveness was later coded using the Ainsworth Maternal Sensitivity Scales (AMSS; see Ainsworth, 1979 for greater description of individual scales). The AMSS consists of four global rating scales: (i) acceptance versus rejection; (ii) accessibility versus ignoring and neglecting; (iii) cooperation versus interference; and (iv) sensitivity vs. insensitivity. These scales were developed in the context of attachment theory and extensive home observations of mothers and infants during the first year of life. The sensitivity scale assesses the mother’s ability to perceive and accurately interpret the signals of her infant and to respond to these signals promptly and appropriately—therefore, sensitivity has four essential components: (1) awareness of signals; (2) accurate interpretation of signals; (3) prompt response to the signals; and (4) appropriate response. The cooperation/interference scale taps into whether the mother’s initiations for interactions disrupt or interrupt the baby’s ongoing activity rather than being in tune with the infant’s current level of interest and mood in an ongoing activity. The accessibility scale emphasizes the mother’s awareness and responsiveness to the infant. Finally, the acceptance/rejection scale, deals with the balance of positive and negative feeling towards the infant. For example, on the positive end, a mother is able to over-ride frustrations, limitations and irritations with feelings of love and acceptance. On the negative end of the spectrum, irritation, resentment or hurt are evident during the interaction. Ratings are assigned along a nine-point Likert scale for all four rating scales, ranging from 1 to 9, with higher scores indicating higher quality of interactions. A primary coder (EC) classified all cases and a second coder independently coded 20 cases. Agreement across the four scales was $r = .80$. Both coders were trained by a doctoral level clinician. Initially, the training consisted of watching a series of sample videos ($n = 10$) and coding them together; followed by independently coding a second series of videos until reliability was achieved. The four maternal care scales, acceptance, accessibility, cooperation, and sensitivity, were significantly correlated with Pearson correlation coefficients ranging from $r = .45$ to $.75$. The four scales were combined and averaged to create a single score of maternal sensitivity which reflected maternal warmth, and responsiveness towards her infant, Cronbach’s $\alpha = .83$.

Behavioral Observations. Behaviors were coded from the first 20 min of the video-taped interaction using the BEST system (S & K and NorPark Computer Design, Toronto, Canada). Coded behaviors include duration of looking away from the infant, vocalizing to the infant (all instances of quiet talk, motherese, singing, adult talk), and instrumental caregiving (all instances of burping, wiping face, adjusting blanket, grooming, or rocking the infant). Infant behaviors included all instances of crying or fussing, infant gurgling (positive vocalizations), and infant smiles. These behaviors and coding scheme have been used in our past research (Giardino et al., 2008; Krpan et al., 2005). Inter-rater reliability was obtained by having two observers code the same 10 videos of mother-infant interactions. Inter-rater reliability on the analyzed maternal and infant behaviors were correlated with $r$ values ranging from .75 to .98.

Neuropsychological Tests of Executive Function (CANTAB™)

Testing occurred over a 2-hr period, during which time the National Adult Reading Test (NART; Nelson & Willison, 1991) and CANTAB™ battery were administered. All CANTAB™ (Robbins et al., 1994) tasks were run on a DELL Latitude 810 laptop computer with a Microvitec 501 touch sensitive screen. Participants were introduced to the apparatus by way of a motor screening task. All participants completed a series of tests from the CANTAB™, including the attentional set-shifting and spatial working memory tests. In most cases, tests were administered in the afternoon before 17:00h (see Maheu, Collicutt, Kornik, Moszkowski, & Lupien, 2005).

Attention/Cognitive Flexibility (Attentional Set-Shifting; ID/ED). The ID/ED task includes a series of visual discrimination tasks and is derived from the Wisconsin Card
Sorting Test. The participant is presented with two dimensions, shapes and lines. Participants were trained to discriminate the dimensions on the basis of trial and error feedback. The test consists of nine stages, progressing in complexity from simple discrimination (i.e., two purple shapes) and compound discrimination (i.e., two pink shapes and two white lines) through to extra-dimensional shifts (ED; shifting attention from purple shapes to white lines). For each stage, subjects progressed through the test by satisfying a set criterion (six consecutive correct responses) of learning at each stage. If at any stage a participant failed to reach this criterion after fifty trials, the test was discontinued. Throughout stages 1–7, reinforcement depended on one dimension, for example, purple shapes are relevant and the white lines are irrelevant. At stage 8, the compound stimuli were changed and participants were required to shift attention to the previously irrelevant dimension (white lines); this is the ED shift task. In the final stage the contingencies are reversed; this is extra-dimensional reversal (EDR). Dependent variables for this task included the number of ED shift errors (measure of cognitive flexibility).

**Working Memory (Spatial Working Memory; SWM).**

The SWM is a self-ordered search task measuring a subject’s ability to retain spatial information and manipulate remembered items in working memory and assesses heuristic strategy (see Owen, Downes, Sahakian, Polkey, & Robbins, 1990). The goal of this task was to collect blue tokens hidden inside a series of boxes. Since every box was used only once, the total number of blue tokens to be found on each trial corresponded to the number of boxes on the screen. The number of boxes gradually increased in difficulty from 4 to 8 boxes. Subjects were instructed to search through boxes for the hidden tokens without returning to a box which had already contained a token. Between-search errors were defined as the number of times the subject revisited a box in which a token has previously been found. Performance indices included were the number of between errors.

**Statistical Analyses**

Data were checked for normality prior to analyses. Performance on the executive function tasks were analyzed in a series of one-way (teen vs. adult) MANCOVAs. For measures of attention (ID/ED test), total errors on the extra-dimensional (ED) shift stage were analyzed. For measures of working memory (SWM) number of between were analyzed. In all analyses, a proxy measure of socioeconomic status (SES), represented as partner/paternal occupation, was included as a covariate. We also included NART score converted to full scale IQ score as a covariate to control for intelligence. For measures of maternal sensitivity and BEST behaviors two-group MANCOVAs were used. This was followed by ANCOVAs, to covary contribution of the infants’ behavior to the analysis of maternal behaviors. We used Chi-square analyses comparing the two groups on the ordinal demographic measures. For correlational analyses, we used Pearson tests. To test for moderation, we conducted a series of hierarchical multiple regressions comprised of three steps. In the first step, SES (paternal or partner occupation) was entered as a covariate with the predictor age category (teen vs. adult). In the second step, executive function: either cognitive flexibility (number of ED errors) or spatial working memory (SWM between errors) were added. In the last step the interaction between age and each of the proposed executive function moderators was added. Following recommendations by Aiken and West (1991), moderator variables were grand-mean centered prior to the analyses.

**RESULTS**

**Demographic Characteristics**

**Preliminary and Descriptive Analyses.** Demographic data were compared between teen and adult mothers using multivariate analyses of variance (MANOVA; infant age) and Chi-square tests (education, employment, marital status, and partner/paternal income). As shown in Table 1, the majority of teen mothers were

<table>
<thead>
<tr>
<th>Table 1. Description of Demographic Characteristics of Population</th>
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<tbody>
<tr>
<td>Demographic</td>
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<tr>
<td>Sample size (N)</td>
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<tr>
<td>Mother [years, M (SD)]</td>
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<tr>
<td>Infant [months, M (SD)]</td>
</tr>
<tr>
<td>Highest education (%)**</td>
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<tr>
<td>Some high school</td>
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<tr>
<td>High school graduate</td>
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<tr>
<td>Some college/university</td>
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<tr>
<td>College/university grad</td>
</tr>
<tr>
<td>Some grad school</td>
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<tr>
<td>Employment status (%)**</td>
</tr>
<tr>
<td>Full time</td>
</tr>
<tr>
<td>Part time</td>
</tr>
<tr>
<td>Full time parent</td>
</tr>
<tr>
<td>Student</td>
</tr>
<tr>
<td>No occupation</td>
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<tr>
<td>Self employed</td>
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<tr>
<td>Marital status (%)**</td>
</tr>
<tr>
<td>Single</td>
</tr>
<tr>
<td>Married</td>
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<tr>
<td>Separated</td>
</tr>
<tr>
<td>Divorced</td>
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<tr>
<td>Cohabitate</td>
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<tr>
<td>Occupation type (%) father (teen/partner)</td>
</tr>
<tr>
<td>Manual</td>
</tr>
<tr>
<td>Retail/service</td>
</tr>
<tr>
<td>Office/clerk/own business</td>
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<tr>
<td>Professional</td>
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**Chi square, p < .001.**
single (76%) whereas adult mothers were married (65.4%) or cohabiting with a partner (23.1%). We found significant differences between groups for education ($\chi^2(4, N = 55) = 49.46, p < .001$), paternal/partner occupation ($\chi^2(3, N = 55) = 29.24, p < .001$), and employment status ($\chi^2(5, N = 55) = 25.31, p < .001$). Overall, most adult mothers had a minimum level of education consisting of an undergraduate degree (69%). In contrast, teenage mothers often had not yet completed high school, but were currently enrolled in high school or had plans of returning to school (93.5%). There were no group differences in gender of offspring, duration of pregnancy, birth related events, or depression scores on the EPDS. There were no difference between groups on parity status, 83% of the teen mothers were primiparous and 72% of adults were first time mothers. When in an initial set of analyses parity and paternal/partner were entered as covariates into the analyses comparing teen and adult mothers on the outcomes, there were no main effects of either covariate and no differences in the significant pattern of age difference effects reported below.

The raw means and standard deviations among the ID-ED, SWM, and maternal sensitivity measures are presented in Table 2. For statistical analyses, log transformations of ED shifting errors, individual maternal behaviors (look away, vocalizations, and instrumental behaviors) were applied to normalize the distribution.

### Executive Functioning Between Age Groups

In terms of performance on the ID/ED task, teen mothers made significantly more errors than adult mothers ($F_{1, 56} = 15.12, p < .001$, see Fig. 1). When the two groups were compared on spatial working memory, teens made more between errors in comparison to adults ($F_{1, 56} = 9.27, p < .002$, see Fig. 2). However, when we controlled for IQ (NART IQ), only the difference between performance on cognitive flexibility (number of ED errors) remained significant ($F_{1, 56} = 5.85, p < .05$).

### Maternal Behavior

As shown in Figure 3A,B, teen mothers were rated as less sensitive than adult mothers ($F_{1, 52} = 5.579, p < .02$) during interactions with their infants. Teen mothers also spent less time vocalizing to their infant ($F_{1, 53} = 4.34, p < .04$) and more time orienting away from their infant ($F_{1, 53} = 7.00, p < .012$). No age differences were found in the amount of time mothers engaged in caregiving instrumental behaviors. In order to determine whether the differences in maternal behavior relate also to differences in infant behavior,

Table 2. Means and Standard Deviations of the Main Variables by age [M (SD)]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mother</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Teen</td>
<td>Adult</td>
</tr>
<tr>
<td>ID-ED set shifting task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Errors, ED shift**</td>
<td>18.03</td>
<td>6.93</td>
</tr>
<tr>
<td>Spatial working memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between, errors*</td>
<td>30.39</td>
<td>18.85</td>
</tr>
<tr>
<td>Maternal sensitivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ainsworth rating$^5$</td>
<td>5.39</td>
<td>5.99</td>
</tr>
</tbody>
</table>

**$p < .001$.  
$p < .005$.  
$p < .05$.
we recomputed the above age analysis on mothers’ behaviors, but included infant behaviors “cry fuss,” “positive vocalization,” and “infant smile” duration as covariates. Results showed that significant age differences in maternal behaviors persisted ($p < .049$; look away, $p < .013$). Moreover, the two maternal groups did not differ in these infant behaviors.

Associations Between Executive Functioning and Maternal Behavior. In this next set of analyses, associations between mothering behaviors and executive function performance were examined using Pearson correlations. Among teen mothers, maternal behaviors were related primarily to attention measures. Poorer performance on the attention task (ED errors) was correlated with less maternal sensitivity ($r = -.50$, $p < .01$) and fewer vocalizations to their infant ($r = -.35$, $p < .07$). Spatial working memory errors were not significantly related to any maternal behaviors or maternal sensitivity in teen mothers. Among adult mothers, more between errors on the SWM task was related to less time looking at and attending to their infants ($r = -.67$, $p < .01$) and more time engaging in instrumental behaviors ($r = .47$, $p < .02$).

**Does Mothers’ Age Moderate the Association Between Executive Function and Mothering?**

In the next set of analyses, we explored the hypothesis that age moderates the association between executive function (cognitive flexibility) and current parenting (maternal sensitivity and maternal vocalizations, which are the maternal behaviors showing the most robust associations) in a series of hierarchical multiple regression analyses. For all models, paternal/partner occupation and IQ, as covariates, and maternal age category (teen vs. adult) were entered in the first step, followed by ED errors in the second step. Finally, in the third step, the interaction between maternal age category and ED errors was added. For all models, multicollinearity diagnostics were assessed and were within an acceptable range.

Results from the third step of the model predicting maternal sensitivity with age as a moderator of cognitive flexibility effects, showed that the overall model was significant ($R^2 = .24$, $F_{4, 54} = 3.95$, $p < .01$). In predicting maternal sensitivity, there was a significant main effect for ED errors ($\beta = -1.08$, $p < .02$), while the interaction of maternal age category by ED errors approached significance ($\beta = .81$, $p = .07$). When maternal vocalizations were analyzed as the dependent measure of parenting, the final three-step model was also significant ($R^2 = .20$, $F_{4, 54} = 3.16$, $p < .05$), as were variances in maternal vocalizations explained by age category ($\beta = .36$, $p < .05$), ED errors ($\beta = -1.19$, $p < .01$), and the interaction between age and ED errors ($\beta = 1.24$, $p < .01$). Hence, mothers’ cognitive flexibility (reflected in ED errors) predicts mothering behavior, but the extent of the effect depends on whether mothers are adults or teenagers.

To illustrate the interactive effect of maternal age category by cognitive flexibility on parenting, we graphed ED errors as 1 standard deviation above and below the mean and at the mean. As shown in Figure 4A,B, in adult mothers, cognitive flexibility performance did not affect parenting; however, in teen mothers, poorer cognitive flexibility was related to decreased maternal sensitivity and less vocalizations to the infants.

**DISCUSSION**

Our results show that in comparison to adult mothers, teen mothers show reduced maternal sensitivity and
infant-directed attention. They also show reduced performance on both tasks that reflect mothers’ spatial working memory and cognitive flexibility. However, the group differences for spatial working memory were reduced when IQ was controlled for in the analyses. This is not surprising given that working memory is closely linked with intelligence (Van Rooy, Stough, Pipingas, Hocking, & Silberstein, 2001; Kinsley, 2008; Kinsley et al., 1999; Leuner & Gould, 2011; Macbeth & Luine, 2010; Parsons et al., 2004; Pawluski, Vanderbyl, Ragan, & Galea, 2006).

In the cognitive domain, our findings of poorer performance on cognitive flexibility and working memory tasks are consistent with the extant literature showing that even outside of the postpartum period, teenagers demonstrate poorer executive function compared to adults (Geier et al., 2010; McAnarney, 2008; Rubia et al., 2010; Sturman & Moghaddam, 2011; Van Leijenhorst et al., 2010). In a separate set of analyses (data not shown), comparing mothers and nonmothers (teenagers and adults) on executive function tasks, we found that for many of the tasks, teen mothers performed the most poorly. This indicates that teen mothers are particularly challenged in their executive functioning and that motherhood (postpartum state) does not enhance performance in these domains, consistent with some of the animal and human research (Buckwalter, Buckwalter, Bluestein, & Stanczyk, 2001; Kinsley, 2008; Kinsley et al., 1999; Leuner & Gould, 2011; Macbeth & Luine, 2010; Parsons et al., 2004; Pawluski, Vanderbyl, Ragan, & Galea, 2006).

Our hypothesis that parenting in teen mothers would be associated with deficits in executive function was also supported. Interestingly, we found that the association between executive function and mothering occurred in both teen and adult mothers; however, the pattern of associations was different between the two age groups. In teen, but not adult mothers, poorer performance in cognitive flexibility was related to lower maternal sensitivity. In adult, but not teen mothers, poorer spatial working memory was associated with reduced attention to the infant and more time engaged in instrumental caregiving. For both teen and adult mothers poorer cognitive flexibility was associated with decreased infant-directed vocalizations. The importance of age as a moderator between executive function and mothering was also supported by the interaction between maternal age and cognitive flexibility on maternal vocalizations; where age moderates the extent and direction of the relation.

There are a few limitations that may constrain the interpretation of the data. First, our sample size was relatively small, thereby limiting the statistical procedures we could use and the generalizability of these findings to the wider population of adolescent mothers. Secondly, given the nature of the sample, it was very difficult to equate teenagers and adults on many of the demographic characteristics. We attempted to control for some of these differences by obtaining information on paternal occupation, however we acknowledge this is not an optimal proxy measure for socio-economic status and it may limit the interpretation of the data. Finally, our observation of maternal behaviors was limited to a single session relatively early in the postpartum period. Presumably as the infant gets older and more challenging, there would be greater observable differences between the two age groups. Although we were able to establish that the differences between teenage and adult mothers in maternal vocalization and looking away were not due to differences between the two groups in the behavior of their offspring during the interactions, it is possible that a more enduring measure of infant temperament would be associated with differences in parenting behaviors, especially as the children grow older (Kiff, Lengua, & Zalewski, 2011). Evaluating...
tion of mother-infant interactions at differing child ages and across varied contexts, which include measures of child effects is warranted and necessary for future studies.

The current study represents a preliminary investigation examining differences between adolescent and adult mothers in executive functioning and exploring whether these differences may be related to variations in parenting. Findings from this study suggest that poorer executive function is evident in teen mothers and these deficits, especially in cognitive flexibility performance, is associated with parenting difficulties. Understanding these cognitive processing difficulties in relation to parenting and screening for problematic executive function performance may serve as avenues of providing more personalized intervention programming for young mothers. For example, outside the parenting context, mindfulness training is associated with improved cognitive flexibility (Moore & Malinowski, 2009). Assessing a mother’s executive functioning prior to implementing an intervention may help improve the success of promising interventions with mothers.

NOTES

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REFERENCES


