Published in final edited form as:

Arch Womens Ment Health. 2016 October ; 19(5): 871–882. doi:10.1007/s00737-016-0627-3.

Predicting adolescent postpartum caregiving from trajectories of depression and anxiety prior to childbirth: A five year prospective study

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Abstract

Purpose—Symptoms of depression and anxiety in pregnancy have been linked to later impaired caregiving. However, mood symptoms are often elevated in pregnancy and may reflect motherhood-specific concerns. In contrast, little is known about the effects of pre-pregnancy depression and anxiety on postpartum caregiving. Understanding these developmental risk factors is especially important when childbearing also occurs during adolescence.

Methods—The sample comprised 188 adolescent mothers (ages 12–19 years) who had participated in a longitudinal study since childhood. Mothers were observed in face-to-face interaction with the infant at 4 months postpartum, and caregiving behaviors (sensitivity, hostile-intrusive behavior and mental state talk) were coded independently. Data on self-reported depression and anxiety gathered in the five years prior to childbirth were drawn from the large-scale longitudinal study.

Results—Parallel process latent growth curve models revealed unique effects of distal anxiety and slow decline in anxiety over time on lower levels of maternal mental state talk after accounting for the overlap with depression symptom development. Depressive symptoms showed significant stability from distal measurement to the postpartum period, but only concurrent postpartum mood was associated with poorer quality of maternal speech.

Conclusions—The results highlight specific targets for well-timed preventive interventions with vulnerable dyads.

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Conflict of interest: Alison Hipwell, Stephanie Stepp, Eydie Moses-Kolko, Shuangyan Xiong, Elena Paul, Natalie Merrick, Samantha McClelland, Danielle Verble, and Kate Keenan declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Keywords

Prospective; Depression; Anxiety; Risk factors; Maternal caregiving; Adolescent mothers

Theoretical models of compromised caregiving and adverse child outcomes highlight the role of maternal mental health problems, such as depression and anxiety (Goodman & Gotlib, 1999). In the postpartum period, maternal depression is often associated with lower levels of warmth, responsiveness, and engagement during mother-infant interactions (e.g. Field, 2010; Murray, Halligan, & Cooper, 2010), as well as alterations in the form and function of infant-directed speech (Herrera, Reissland, & Shepherd, 2004; Murray, Kempton, Woolgar, & Hooper, 1993; Zlochower & Cohn, 1996). In particular, the speech of depressed, compared to non-depressed, mothers during interaction with their infant tends to be more focused on their own experience, and contains fewer acknowledgements of infant agency (Cox, Puckering, Pound, & Mills, 1987; Murray et al., 1993). While these effects appear to be greatest among low SES mothers (Lovejoy, Graczyk, O'Hare, & Neuman, 2000), there remains substantial variability in the relationship between concurrent depression and caregiving quality (Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007; Field, Diego, Hernandez-Reif, Schanberg, & Kuhn, 2003) in ways that are not well understood.

Maternal anxiety frequently co-occurs with depression (Coelho, Murray, Royal-Lawson, & Cooper, 2011; Marrs, Durette, Ferraro, & Cross, 2009; Reck et al., 2008) and may be more prevalent than depression across the peripartum period (Matthey, Barnett, Howie, & Kavanagh, 2003). As with depression, observational studies have demonstrated adverse effects of anxiety on maternal behaviors during interactions with the infant, including insensitive or intrusive behaviors and confusing, non-contingent forms of communication (Beebe et al., 2011; Feldman et al., 2009; Nicol-Harper, Harvey, & Stein, 2007; Warren et al., 2003). Some investigators have suggested that anxiety partially accounts for the impairments that have been reported among postpartum depressed mothers (O'Connor, Heron, & Glover, 2002), while others contend that 'maternal anxiety and depression are expressed in two polarized styles' (Feldman et al., 2009, p.920) such that anxiety tends to be manifested in intrusive parenting behavior, whereas depression is more often related to low levels of involvement in interaction with the infant. Other research has shown no distinct adverse effects of anxiety on concurrent caregiving behaviors compared with healthy controls (Kaitz, Maytal, Devor, Bergman, & Mankuta, 2010; Murray, Cooper, Creswell, Schofield, & Sack, 2007) or mothers with depression (Weinberg, Beeghly, Olson, & Tronick, 2008). These equivocal findings highlight the need for further research to examine the unique effects of depression and anxiety on maternal behaviors in the postpartum period.

Prospective studies that begin in pregnancy have shown that for many women, postpartum depression and anxiety are indicators of pre-existing illness (Marcus, Flynn, Blow, & Barry, 2003; Stowe, Hostetter, & Newport, 2005). In fact, mood symptoms are typically higher in pregnancy but decline in the period following delivery (Heron, O'Connor, Evans, Golding, & Glover, 2004; Milan et al., 2004). Specifying the timing and developmental patterns of these symptoms is important given that prenatal anxiety often predicts postpartum depression

(Matthey et al, 2003), and that depression and anxiety assessed in pregnancy are more closely related to deficits in the quality of mother-infant interaction than are symptoms assessed in the postpartum period (Flykt, Kanninen, Sinkkonen, & Punamaki, 2010; Parfitt, Pike, & Ayers, 2013; Pearson, Cooper, Penton-Voak, Lightman, & Evans, 2010; Pearson et al., 2012). Although prenatal mood symptoms often reflect specific concerns related to the transition to motherhood (Marrs et al, 2009) and thus there may be little continuity from the pre-pregnancy state, these findings raise the intriguing possibility that the origins of maternal impairment could be detected earlier in development. However, prospective studies of maternal postpartum function that begin prior to pregnancy are lacking. The current study aims to fill this gap by examining links between depression and anxiety assessed during a five-year, pre-pregnancy developmental window and caregiving in the early months following delivery.

Adolescent mothers tend to be a group at high risk for difficulties in caregiving. Although considerable between-person variability exists, adolescent compared with adult mothers tend to show lower levels of sensitivity (Spieker, Larson, Lewis, Keller, & Gilchrist, 1999) and infant-focused speech (Borkowski, Whitman, & Farris, 2007; Demers, Bernier, Tarabulsky, & Provost, 2010), and higher levels of restrictive, punitive and impatient behavior towards their infant (Barratt & Roach, 1995). These parenting behaviors may partly reflect the social disadvantage and lack of support of many adolescent mothers (Letourneau, Stewart, & Barnfather, 2004) and a lack of preparedness for the maternal role (Leadbeater, 2014). Far less is known about factors that explain variability in caregiving behaviors *within* adolescent samples, although poverty, age, partner support and perceived norms and expectancies about teenage motherhood (that may reflect a desire for young motherhood) are likely to be important contextual factors.

Compounding these challenges, adolescent motherhood also intersects with a high risk developmental period for emerging depressive and anxiety disorders in females (Costello, Copeland, & Angold, 2011; Essau, Lewinsohn, Seeley, & Sasagawa, 2010). Thus, community-based studies have shown that by late adolescence, between 16%–35% females have experienced an episode of major depressive disorder (Lewinsohn, Rohde, & Seely, 1998; Merikangas et al., 2010) and 38% have experienced an anxiety disorder (Merikangas et al., 2010). In addition, increases in adolescent symptoms of depression and anxiety tend to co-occur (Leadbeater, Thompson, & Gruppuso, 2012) and cross-predict each other (Hale, Raaijmakers, Muris, van Hoof, & Meeus, 2009). These data highlight a particular need to examine predictors of postpartum adolescent caregiving in a developmentally informed manner.

The current prospective study examines the impact of pre-childbirth developmental trajectories of depression and anxiety on the quality of observed postpartum caregiving in a sample of adolescent mothers. Specifically, we examined whether changes in symptoms of depression and anxiety symptoms across 5 years prior to childbirth were uniquely related to impairments in adolescent mothers caregiving. Extending prior research that has been limited the peripartum period, we hypothesized that after accounting for overlap in the symptom trajectories of depression and anxiety, the course of anxiety would predict impairments in postpartum caregiving behaviors. Furthermore, based on the notion that

postpartum mood is probably a product of pre-existing disorder, we expected this relationship to hold after controlling for postpartum mood in addition to sociodemographic variables (i.e. age, poverty), expectancies of becoming a young mother and partner support.

Method

Sample

The sample consisted of adolescent participants in the Pittsburgh Girls Study (PGS); a longitudinal community-based study of girls recruited in 2000/2001 following enumeration of 103,238 households in the City of Pittsburgh (see details in Hipwell et al., 2002; Keenan et al., 2010). In this process, every household in low-income city neighborhoods (using 1990 census data on poverty), and 50% of households in all other neighborhoods were enumerated. Of 2,875 girls who were age-eligible at the start of the study, 2,450 (85.2%) 5–8 year-old girls and their caregivers agreed to participate. Approximately half of the PGS sample was African American (52%), 41% was European American, and the remaining girls were described as multiracial or representing another race.

A substantial minority (39%) of households received public assistance (e.g., food stamps, Medicaid) and 17% of caregivers had completed fewer than 12 years of education. At the end of annual assessment wave 13 (2013–2014, participant ages 18–21 years), 85.6% of the original sample had been retained (mean retention across waves was 91.3%). A subsample of adolescent mothers was identified in the course of annual PGS interviews. From age 11 onwards, all participants were asked whether they were currently pregnant and planning to carry the baby to term, and whether they had recently delivered a baby. Adolescents endorsing either of these items and providing at least two hours of care daily for their infant, were considered eligible. By wave 13, 262 first-time mothers under age 20 years had been identified. Eight mothers were excluded because the infant was adopted and/or the mother was living in a residential facility without her infant. Of 254 eligible mothers, 210 (82.7%) were successfully recruited and completed a research visit in the year following delivery. To reduce heterogeneity due to infant developmental factors and changes in maternal speech with infant age (Stern, Spieker, Barnett, & MacKain, 1983), mothers with infants older than 10 months ($n=22$) were excluded from the current analyses. The final sample therefore included 188 childbearing adolescents and their infants (48% female). The adolescent mothers were predominantly African American ($n=158$, 84%); 24 (13%) were European American and 6 (3%) were more than one race, and most of the young mothers (83%) lived with their primary caregiver after the infant was born. Participating mothers did not differ from those who refused participation or could not be scheduled ($n=34$) on the basis of maternal age, race, rates of household poverty or living with a single parent, or pre-pregnancy severity of anxiety or depression. The attrition group were, however, more likely to have a parent with a low level of education ($\chi^2[1]=13.50$, $p<.001$).

Procedure

Approval for all study procedures was obtained from the University of Pittsburgh Human Research Protection Office. For adolescent mothers younger than 18 years, written informed consent from the caregiver and verbal assent from the adolescent were obtained. The

adolescent mothers also provided written consent for their infants participation. Adolescent mothers aged 18 and older provided written informed consent for both themselves and their infant.

In-home interviews had been conducted with all PGS participants ($n=2450$) and their primary caregiver every year since the girls were ages 5–8 years. In addition to these annual interviews, the 188 adolescent mothers were contacted at around 4 months postpartum ($M=4.7$, $SD=1.8$, range=2–10 months) and invited to come with their infant to the research laboratory. As part of this lab assessment, the mother and infant were filmed in face-to-face interaction for 5 minutes: 2 minutes when the mother was asked to talk to her infant “in any way she wanted to” without the use of toys, and 3 minutes when the mother was asked to “help your child to get interested” in a specific toy. The sessions were filmed using two wall-mounted cameras, which focused on either the mother’s or the infant’s face. Digital video output was then mixed to produce a split-screen image for observational coding. Families were compensated for their participation.

Measures

Depression and anxiety symptom trajectories—At the time of the study, symptoms of depression and anxiety had been assessed annually in the PGS for 13 years (from ages 5–8 through 18–21 years). In the current sample of adolescent mothers, data from the PGS that spanned the five assessment waves prior to first delivery were used. Thus, the PGS study year in which the birth occurred was labeled ‘T’ and served as the reference point to determine 1 year prior to childbirth (T-1), 2 years prior to childbirth (T-2) etc. for each adolescent mother. Therefore data most proximal to the delivery were denoted by T-1, and data most distal were denoted by T-5.

Depression severity across childhood and adolescence was assessed using self-reports on the Child Symptom Inventory-4th edition (CSI-4; Gadow & Sprafkin, 1994) transitioning to the Adolescent Symptom Inventory (ASI-4; Gadow & Sprafkin, 1998) at age 12. Eleven depression items were administered: nine DSM-IV symptoms of major depressive disorder in addition to two items that assessed symptoms of reduced self-esteem and hopelessness. On the CSI/ASI, seven symptoms are scored on 4-point scales (0 = never to 3 = very often), and four (significant change in weight or appetite, sleep, activity and concentration) are scored as absent (0.5) or present (2.5), and then summed to produce a depression severity score. Adequate concurrent validity, sensitivity and specificity of depression symptom scores to clinicians diagnoses have been reported for this measures (Gadow & Sprafkin, 1994, 1998). In the PGS sample, the internal consistency of depressive symptoms from childhood through age 19 ranged from $\alpha=.72$ (at age 10) to $\alpha=0.84$ (at age 18).

Symptoms of generalized anxiety were assessed annually using self-reports on the Screen for Child Anxiety Related Emotional Disorders (SCARED; Birmaher et al., 1999; Birmaher et al., 1997). Nine items (e.g. “I worry about what is going to happen in the future”) were scored on 3-point scales (0=not true/hardly ever true to 2=very true). The SCARED has good psychometric properties (Birmaher et al., 1999) and a score of 9 or higher is used to indicate clinically significant symptoms of generalized anxiety disorder (Birmaher, Khetarpal, Cully, Brent, & McKenzie, 1995). The internal consistency of these items in the

PGS sample across adolescence was good, with values ranging from $\alpha = 0.80$ (at age 10) to $\alpha = 0.88$ (at age 17).

Observed maternal caregiving—Caregiving behaviors during the warm-up and toy-play lab sessions were coded by two independent observers using time-sampled global ratings. These trained coders (researchers who were graduate and doctoral level) were unaware of all other information about the mother-infant dyads, and observations in the warm-up session were coded independently from those during toy-play. Maternal behaviors were coded on five dimensions (hostility, intrusiveness, warmth, involvement and responsiveness) using rating scales adapted from the Early Parenting Coding System (Shaw et al., 1998). Ratings of hostility reflected maternal negative expressions such as impatience, annoyance, critical comments, angry teasing and sharp tone of voice. Intrusive behaviors included rough pulling and poking at the infant, lunging face or hands close to the baby's face, loud or high-pitched vocalizing. The maternal warmth dimension evaluated the amount of positive affect (e.g. smiling, laughter) expressed towards the child. Maternal involvement assessed the extent to which the mother attended to and attempted to communicate with the baby, and responsiveness measured the extent to which the mother responded promptly and appropriately to the infant's bids and appeared attuned to the infant's emotional state. The dimensions were rated on 4-point likert scales which were behaviorally anchored for each scale and ranged from 1 (none/low/minimal) to 4 (a lot/highly).

One aspect of verbal communication, maternal mental state talk was coded from verbatim transcriptions of maternal speech during the filmed sessions (Hipwell, Guo, Phillips, Swain, & Moses-Kolko, 2015). Maternal comments that attributed intentionality to the preverbal infant, and indicated a belief that the infant could play an active role in, or have an impact on, the environment (e.g. "Do you think that's funny?", "Are you saying you want to go home?") were coded. The frequency of mental state talk was rated on 4-point scales (1=none to 4=five or more comments). Because this variable showed moderate stability across the warm-up and toy-play sessions ($r=.48$, $p<.001$) and a mean score was calculated.

Inter-rater reliability on all the global ratings was conducted on a random selection of 55 (29%) mother-infant pairs and intraclass correlation coefficients (ICCs) were computed. Inter-rater reliability was high as indicated by average measures ICC for absolute agreement: 0.93 hostility; 0.72 intrusiveness; 0.89 warmth; 0.82 involvement; 0.79 responsiveness; and 0.82 for maternal mental state talk.

To reduce the number of outcome variables, global ratings on the five dimensions of observed behaviors in the warm-up and toy-play were entered into a Principal Components Analysis with varimax rotation. Two components explained 70.7% of the variance. The first component labeled 'Sensitivity' comprised warmth, involvement and responsiveness (factor scores ranged from 0.78 to 0.88). The second component comprised hostility and intrusiveness (factor scores=.71 and .84 respectively).

Covariates—Household poverty (0=none, 1=household receipt of public assistance such as food stamps, Medicaid, monies from public aid) reported by the adolescent mother's primary caregiver 5 years prior to childbirth (T-5) was included as a covariate. In order to account for

perceived norms/expectancies about teenage motherhood, the adolescent's response at time T-5 to the item, "How likely is it that you will have a baby before you are 18?" was also covaried. This item was scored on a 4-point scale (1=definitely won't, 4=definitely will). Maternal and infant ages at the postpartum assessment were included as covariates to account for any differences in maternal caregiving as a function of development. In addition, scores on the widely used Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) were used to covary postpartum depressed mood and anxiety (Rowe, Fisher, & Loh, 2008). The EPDS has good psychometric properties (Cox et al., 1987; Murray & Carothers, 1990) and a score higher than 12.5 indicates 'probable' clinical impairment (Cox et al., 1987). In the current sample, the mean EPDS score was 5.20 ($SD=4.75$) and 7.4% of the sample scored above the clinical threshold. Finally, presence of a current romantic partner (0=none, 1=romantic partner) was included as a proxy for postpartum support.

Data Analysis Plan—A series of latent growth curve models (LGCs) was estimated to investigate the relationship between the course of depression and anxiety symptoms assessed across 5 years prior to childbirth (T-5 through T-1) and observed maternal caregiving in the postpartum period. First, two separate unconditional LGCs were run to model change in depression and anxiety symptoms. Second, the trajectories of symptoms of depression and anxiety were modeled simultaneously to examine the association between the respective growth processes after accounting for overlap in the trajectories.

We then tested our substantive questions of interest using the conditioned dual-model of depression and anxiety symptoms to predict each of the maternal caregiving variables. Thus, in this model we examined the relationships between the intercepts (initial values at the most distal point from childbirth, T-5) and slopes of depression and anxiety symptoms on maternal sensitivity, hostile-intrusive behaviors and mental state talk. We included T-5 covariates (poverty and teen motherhood expectancies) and maternal and infant age, severity of postpartum mood and presence of a romantic partner at time T to provide a stringent and conservative test of the hypotheses.

A robust maximum likelihood indicator was used to handle non-normal distributions of study variables, and missing data were handled with the expectation maximization (EM) algorithm. The effect of missing data however was minimal with sample sizes varying between $n=181$ and 188 . All models were estimated with Mplus 7.1 (Muthén & Muthén, 2013). Model fit was evaluated using the χ^2 goodness of fit test, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean-square error of approximation (RMSEA). For CFI and TLI, we used the conventional cutoff .90 for acceptable fit, and .95 for good fit. RMSEA values between .05 – .08 represented acceptable fit, while values $<.05$ indicated good fit (McDonald & Ho, 2002).

Results

Descriptive statistics

Table 1 presents descriptive statistics for all the variables used in the analyses. The mean depression symptom score ranged from 8.60 ($SD=4.79$, at T-5) to 7.46 ($SD=5.06$, at T-1).

Rates of estimated major or minor depressive disorder ranged from 14% (at T-2) to 18% (at T-4), with 48% ($n=91$) meeting criteria for depressive disorder at any time during the five pre-childbirth assessment waves. The mean generalized anxiety severity scores ranged from 4.83 ($SD=3.70$, at T-2) to 5.30 ($SD=4.05$, at T-5). The proportion of the sample scoring above the clinical threshold ranged from 15% (at T-2 and T-3) to 19% (at T-5), and 70 adolescents (37%) reported clinically significant generalized anxiety disorder at any time across the five pre-delivery waves.

Moderate zero-order correlations were revealed between depression and anxiety symptom scores across time (see Table 2). Postpartum depressed mood was also positively correlated with severity of both depression and anxiety in the period prior to childbirth, especially in the waves that were more proximal to delivery (T-3 through T-1) providing support for continuity in mood and anxiety symptoms across the transition to adolescent motherhood. Higher maternal sensitivity was associated with greater distal expectancies about becoming a teenage mother, higher depression severity scores at T-5, lower depression severity scores at T-1, older adolescent age, and younger infant age. Maternal sensitivity was also positively correlated with frequency of mental state talk ($r=.44$, $p<.01$). Maternal hostile-intrusive behaviors were largely unrelated to the variables included in the current study except for an association with older infant age. Finally, higher levels of mental state talk were correlated significantly with lower proximal (T-1) anxiety symptoms, older maternal age and younger infant age.

Unconditional Latent Growth Curve Models (LGCMS)

The unconditional linear LGCM for depressive symptoms across the 5 years prior to childbirth showed good model fit: $\chi^2[10]=11.17$, $p=.35$; CFI=.99; TLI=.99; RMSEA=.02. The LGCM had a significant negative mean slope, $M_s=-.28$, $z=-2.61$, $p<.01$, indicating that, at the group level, depressive symptoms decreased with age across the 5 years approaching childbirth. The variances for the intercept and slope were $D_i=13.78$, $z=6.33$, $p<.001$ and $D_s=.70$, $z=2.37$, $p<.05$ respectively, indicating substantial variation between adolescent mothers in both initial level (at T-5) and rate of change in depression symptoms. Initial levels of depressive symptoms at T-5 were negatively associated with rate of change over time ($b=-.55$, $z=-5.06$, $p<.001$) reflecting a slower reduction in depressive symptoms for individuals with higher initial scores.

The unconditional linear LGCM for anxiety severity across T-5 to T-1 also demonstrated a good fit: $\chi^2[10]=5.11$, $p=.88$; CFI=1.00; TLI=1.00; RMSEA=0. There was no significant mean change in anxiety across time $M_s=-.09$, $z=-1.18$, $p=ns$. Nevertheless, there was significant variance in both the intercept ($D_i=9.34$, $z=5.73$, $p<.001$) and slope ($D_s=.49$, $z=3.72$, $p<.001$) factors, which again indicates variability between adolescent mothers in terms of the severity and course of their anxiety symptoms. As with depression, the initial level of anxiety symptoms at T-5 was negatively associated with rate of change over time ($b=-.40$, $z=-3.19$, $p<.01$).

Dual depression and anxiety model

The depression and anxiety symptom trajectories were then modeled simultaneously to estimate the association between the respective growth processes after accounting for overlap in the trajectories. Fitting dual process linear LGCMs to model depression and anxiety symptoms in parallel produced a non-significant Chi-square test statistic χ^2 [36]=42.70, $p = .21$, and fit indices representing good model fit, CFI=.99, TLI=.99, and RMSEA=.03. In this parallel process model, the initial level of depressive symptoms at T-5 was significantly and positively correlated with initial severity of anxiety ($\beta = .62$, $p < .001$). The slopes depicting change in depression and anxiety symptom severity in the five assessment waves prior to delivery (T-5 through T-1) were also closely related ($\beta = .50$, $p < .01$), indicating that increases in depressive symptoms were positively related to increases in anxiety across time.

Effect of the conditioned dual model on observed caregiving adjusting for T-5 and postpartum covariates

To examine the unique effects of the dual model on observed caregiving, maternal sensitivity, hostility-intrusive behavior and mental state talk were simultaneously regressed on the latent variable growth factors and all the covariates including poverty and expectancies at T-5 as well as maternal age, infant age, postpartum mood and presence of a romantic partner. This model demonstrated acceptable model fit: χ^2 [111]=143.74, $p = .02$; CFI=.96; TLI=.94; RMSEA=.04.

The results showed that maternal sensitivity was unrelated to the intercept and slope factors of depressive symptoms after accounting for growth in anxiety symptoms, and was also unrelated to anxiety symptom severity after accounting for growth in depressive symptoms (see Table 3 and Figure 1). Although older adolescent mothers showed higher levels of observed maternal sensitivity ($\beta = .17$, $p < .05$), and sensitivity remained positively associated with mental state talk ($\beta = .42$, $p < .001$), none of the other covariates were related to sensitive caregiving in the postpartum period. Observed hostile-intrusive caregiving behaviors were unrelated to all other variables in the model including initial levels and growth in the severity of depression and anxiety symptoms.

A different pattern of results was revealed for maternal mental state talk. As shown in Table 3, the T-5 intercept factors of depression and anxiety symptoms were each uniquely associated with mental state talk but in opposite directions. Thus, higher levels of infant-focused speech were predicted by lower levels of initial (T-5) anxiety symptoms ($\beta = -.39$, $p < .01$) but higher levels of depression at T-5 ($\beta = .48$, $p < .01$). In addition, the slope of anxiety was significantly associated with observed mental state talk ($\beta = -.41$, $p < .05$), indicating that a faster reduction in anxiety severity between T-5 to T-1 predicted higher levels of mental state talk in face-to-face interaction in the postpartum period. In contrast, the results showed that the latent slope of depression in the 5 years prior to childbirth was unrelated to maternal mental state talk ($\beta = .36$, ns). In terms of covariates, maternal age was significantly associated with mental state talk ($\beta = .25$, $p < .001$) indicating that older adolescent mothers were more likely to engage in mental state talk compared with younger mothers. In addition, more severe postpartum depressed mood was associated with reduced

levels of mental state talk ($\beta = -.17, p < .05$). Postpartum mood was also associated with depression severity prior to childbirth in expected directions (see Figure 1). Thus, higher initial depression severity scores at T-5 ($\beta = .43, p < .001$) and a more rapid increase in depression severity in the 5 years prior to childbirth ($\beta = .42, p < .01$) both predicted more severe postpartum depressed mood. In the final model, there was also a significant association between the distal assessment of expectancy of becoming an adolescent mother at T-5 and the depression severity slope such that higher expectancies of teenage motherhood were related to decreasing severity of depression symptoms in the five years prior to childbirth ($\beta = -.28, p < .05$).

Discussion

The current study used a multi-method, multi-wave approach to examine symptom trajectories of depression and anxiety symptoms prior to childbirth as unique risk factors for observed postpartum caregiving among adolescent mothers. We extended prior research in two important ways: we utilized prospective assessments of psychopathology across a five year period preceding childbirth; and we examined the distinct developmental effects of depression and anxiety symptomatology on caregiving quality. In particular, we hypothesized that the severity and trajectory of pre-childbirth anxiety symptoms would predict impairments in postpartum caregiving after the developmental overlap with depression symptoms was accounted for. We also expected that the influence of this pre-childbirth trajectory would be evident over and above the effects of postpartum mood. In large part, the results lent support to our hypotheses.

The findings showed that higher levels of distally measured anxiety, and a slower decline in anxiety across the period before childbirth, predicted lower levels of maternal mental state talk in the postpartum period. These effects were independent of the simultaneous developmental effects of depressive symptoms, and also held after accounting for the significant associations between this aspect of caregiving and severity of postpartum mood and maternal age. These results are also consistent with prior short-term prospective studies showing that prenatal anxiety is an important factor in understanding early caregiving behavior (e.g. Parfitt et al., 2013), as well as cross-sectional research that has shown links between postpartum symptoms of anxiety and a reduced tendency of the mother to comment on her infant's mental state. Nicol-Harper and colleagues (2007) for example, reported an association between high trait anxiety and maternal utterances that were incongruous or non-contingent with the interaction or the infant's behavior. In another study, mothers who made fewer mind-related comments with their infant displayed more anxious behavior during mother-infant interactive tasks (Rosenblum, McDonough, Sameroff, & Muzik, 2008). Evidence from non-childbearing samples suggests that anxiety interferes with the ability to take the perspective of others or accurately interpret others' mental states (Hezel & McNally, 2014; Onur, Alkin, Sheridan, & Wise, 2013). Although our data indicate, more specifically, that symptoms of generalized anxiety (e.g. persistent worrying, tension, difficulty concentrating) impact the mother's proclivity to comment on her infant's mental state, this behavioral manifestation could reflect an underlying impairment in the ability to understand other minds. Thus it is possible that severe and persistent generalized anxiety symptoms in late childhood/early adolescence has an adverse impact on typically developing social

cognitive capacities (Rudolph, 2002) that are critical for infant-focused caregiving. Gaining a better understanding of these underlying developmental processes will be an important avenue for future research.

Our expectation that pre-childbirth depression would play a lesser role than anxiety in predicting adolescent caregiving was borne out in the lack of a unique effect of 5-year depression trajectory on mental state talk in the postpartum period. Nonetheless, the results did show associations between this aspect of caregiving and severity of depressed mood assessed both distally (at T-5) and concurrently in the postpartum period. Consistent with prior research (Herrera et al., 2004), our results showed that the extent of mental state talk was reduced when postpartum depression was high. However, this aspect of maternal speech was also found to be higher among young mothers with more severe distal depression. These opposing effects did not appear to be a function of the change in measurement given that distal depression (assessed on the CSI/ASI) was a significant positive predictor of postpartum depression (assessed on the EPDS) assessed 5 years later. Furthermore, a faster rate of growth in depression severity across this 5-year interval also predicted postpartum mood. Instead, it is possible that some component of depression (*e.g.* high empathic responding, Keenan & Hipwell, 2005) that was less related to clinical impairment and did not share variance with anxiety, explains the link between high distal depression and mental state talk in the postpartum period. Alternatively, despite significant within-person continuity in depression across this extended period, the relationship between symptoms and mental state talk may have been altered by the considerable changes in roles and responsibilities that occur with the transition to young motherhood (Leadbeater, 2014).

The current study showed no developmental relationships between anxiety or depression symptoms and observations of sensitive or hostile-intrusive behaviors in the postpartum period. These findings add to a number of community-based studies that report no adverse effects of depression and/or anxiety on caregiving sensitivity, even among women at high social risk (*e.g.* (Campbell et al., 2007; Field et al., 2003; Kaitz et al., 2010; Murray et al., 2007; Parfitt et al., 2013). In the current study however, the absence of any unique associations with maternal sensitivity may have been due to the shared variance with mental state talk; a relationship that has also been shown in prior work (Laranjo, Bernier, & Meins, 2008; Meins, Fernyhough, Fradley, & Tuckey, 2001). It is also possible that the constraints of the relatively brief laboratory assessments limited opportunities for observing certain caregiving behaviors. For example, most mothers (regardless of their history of depression or anxiety) may have been able to inhibit any impatient, hostile or critical feelings or intrusive behaviors for the duration of the filmed interaction. Although different tasks or settings (*e.g.* diaper change, free play in the home) may have elicited different behaviors, prior research does support the validity of brief structured laboratory observations coded with similar global rating scales (Leventhal, Jacobsen, Miller, & Quintana, 2004; Shaw et al., 1998).

Some methodological limitations need to be taken into account in the interpretation and generalization of the results reported here. In order to examine the impact of developmental change in symptoms of anxiety and depression on caregiving, individual trajectories were anchored by their timing relative to childbirth. This meant that in the current sample of

adolescent mothers aged between 12 and 19 years at delivery, the pre-childbirth years spanned developmental periods that ranged from 7–11 years to 14–18 years. Given age-specific changes in affective symptoms across childhood and adolescence, aligning the trajectories by timing relative to each individual's delivery may have introduced new sources of developmental heterogeneity. For example, studies have shown that symptoms of generalized anxiety tend to increase until mid-adolescence and then level off or decrease (Costello et al., 2011; Hale, Raaijmakers, Muris, van Hoof, & Meeus, 2008). In addition, the prevalence of depressive symptoms in girls tends to be low in preadolescence, with rates increasing rapidly thereafter (Nolen-Hoeksema & Girgus, 1994). Thus the transition to adolescent motherhood intersects the developmental course of psychopathology at different points for different individuals. Although maternal age at delivery was covaried in the LGCMs in the current study, substantive age-linked group differences may have remained. Future research will be needed to examine putative moderators of the relationships reported here.

For a small number of mothers ($n=16$), the assessment of anxiety and depression symptoms at T-1 occurred during their pregnancy and therefore reports may have been elevated by pregnancy-specific worries such as concerns about the health and well-being of the baby, health-care experiences, impending childbirth, or coping in the maternal role (Schetter & Tanner, 2012). In addition, normal sequelae of pregnancy (e.g. fatigue, sleep difficulties, change in appetite and weight) may have been captured in the T-1 measures of depression and anxiety and could have artificially elevated both types of affective symptoms for certain individuals (Matthey & Ross-Hamid, 2011). However, *post hoc* analyses revealed no group differences by T-1 pregnancy status on severity of either depression or anxiety symptoms. Furthermore, recent evidence indicates that somatic symptoms are valid indicators of mood disorder during pregnancy (Nylen, Williamson, O'Hara, Watson, & Engeldinger, 2013), so it is unlikely that confounding effects of pregnancy symptoms had a major impact on the results reported here.

Finally, with the exception of age, infant characteristics were not considered in the current analyses. It is possible that mothers with lower initial anxiety and/or with more rapidly decreasing levels of anxiety over time had infants with high prosociality and low levels of negative emotionality who were responsive and engaging interactive partners. Conversely, infants of mothers reporting high and persistent symptoms of worry and anxiety may have been exposed to elevated stress hormones *in utero*, which are associated with heightened infant fussiness, reactivity and stress dysregulation (Grant et al., 2009; Werner et al., 2013) contributing to more discordant mother-infant interactions. Infant temperament may thus have modified the associations between maternal symptomatology and caregiving in important ways that were not detected here.

Gaining a better understanding of the developmental relationships between depression and anxiety and caregiving quality is critical for tailoring effective and timely interventions for mothers and infants. The current study findings underscore the importance of past experience of anxiety in combination with postpartum depressed mood as sources of compromised caregiving, specifically deficits in mental state talk, among adolescent mothers. Furthermore, the results reported here suggest a clear opportunity for primary

prevention by addressing symptoms of anxiety, not only prior to the transition to motherhood, but considerably earlier in development.

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Figure 1.

Parallel process growth model of depression and anxiety severity scores across 5 years prior to childbirth on caregiving behaviors in the postpartum period.

Note: * $p < .05$; ** $p < .01$. Dep = depression severity; Anx = anxiety severity. Standardized beta weights are shown. Only significant paths are depicted (N=188). T-5 through T-1 refers to data gathered 5 years prior to delivery through one year prior to delivery respectively.

Descriptive statistics for depressive and anxiety severity scores at five annual assessment waves prior to childbirth (time T).

Table 1

	n (%)	Mean (SD)	range	T-5 Mean (SD)	T-4 Mean (SD)	T-3 Mean (SD)	T-2 Mean (SD)	T-1 Mean (SD)
<i>T-5 covariates</i>								
Household poverty	98 (54)							
Teen mother expectancy								
Definitely won t	32 (17)							
Probably won t	84 (45)							
Probably will	38 (20)							
Definitely will	34 (18)							
<i>T-5 through T-1 predictors</i>								
Depression severity				8.60 (4.79)	8.44 (4.86)	8.29 (4.72)	7.84 (4.99)	7.46 (5.06)
Anxiety severity				5.30 (4.05)	4.93 (3.83)	5.03 (3.50)	4.83 (3.70)	4.84 (3.79)
<i>Postpartum covariates</i>								
Maternal age (years)		17.61 (1.55)	12–19					
Infant age (months)		4.72 (1.80)	2–10					
Postpartum mood		5.05 (4.71)	0–19					
Romantic partner	129 (71)							
<i>Observed caregiving</i>								
Sensitivity		0 (1) <i>I</i>	–2.95–1.40					
Hostile-intrusive		0 (1) <i>I</i>	–1.39–3.81					
Mental state talk		2.46 (.89)	1–4					

Note: T-5 through T-1 refers to data gathered 5 years prior to delivery through one year prior to delivery respectively.

I Sensitivity and Hostile-Intrusive variables were derived from Principal Components Analysis.

Table 2

Zero-order correlations among the study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. T-5 Poverty	1																	
2. T-5 TM Expectancy	.14																	
3. T-5 Depression	-.14	-.20**																
4. T-4 Depression	-.15*	-.09	.53**															
5. T-3 Depression	-.01	.10	.40**	.52**														
6. T-2 Depression	-.14	-.01	.25**	.41**	.40**													
7. T-1 Depression	.01	-.01	.29**	.25**	.38**	.40**												
8. T-5 Anxiety	-.08	-.08	.53**	.26**	.23**	.21**	.21**											
9. T-4 Anxiety	-.05	.01	.40**	.61**	.40**	.48**	.24**	.54**										
10. T-3 Anxiety	.01	-.06	.34**	.29**	.41**	.38**	.26**	.51**	.62**									
11. T-2 Anxiety	-.03	-.11	.36**	.28**	.28**	.48**	.32**	.43**	.59**	.66**								
12. T-1 Anxiety	.01	-.05	.23**	.22**	.35**	.43**	.41**	.33**	.49**	.55**	.68**							
13. Maternal age	-.13	-.17*	.07	.09	.08	-.01	-.13	0	.05	.03	.03	-.04						
14. Infant age	-.08	.05	-.09	-.02	-.01	0	-.05	-.10	-.06	-.04	.05	.17*	.01					
15. Postpartum mood	-.09	-.05	.14	.18*	.25**	.32**	.24**	.11	.10	.16*	.27**	.37**	-.07	.08				
16. Romantic partner	-.06	-.14	.10	-.01	.13	-.08	-.02	.1	-.11	-.02	-.06	-.10	.07	.02	-.01			
17. Sensitivity	-.07	.15*	.15*	-.03	-.03	-.01	-.16*	.09	-.02	.03	.12	.02	.16*	-.15*	.06	.05		
18. Hostile-intrusive	.06	.11	.03	.03	.08	.06	.04	.01	-.04	-.06	-.01	.01	-.09	.14*	-.04	.10	0	
19. Mental state talk	.01	-.14	.11	.06	.04	.03	.05	-.04	-.05	-.11	-.06	-.23**	.27**	-.33**	-.03	-.12	.44**	0

Note:

* $p < .05$;** $p < .01$ (two-tailed).

TM Expectancy = future expectancy of becoming a teenage mother. Depression = depression symptom severity, Anxiety = generalized anxiety symptom severity. Underlined zero reflects the Principal Components Analysis strategy.

Latent growth curve model results for the trajectories of depression severity and generalized anxiety severity and covariates in predicting postpartum mental state talk.

Table 3

	Sensitivity		Hostile-intrusive		Mental state talk	
	β	95% CI	β	95% CI	β	95% CI
<i>Covariates</i>						
T-5 household poverty	-.01	[-.17, .14]	.04	[-.12, .20]	.11	[-.05, .27]
T-5 teen motherhood expectancy	-.12	[-.35, .11]	.11	[-.09, .31]	-.17	[-.36, .02]
Maternal age	.17*	[.03, .32]	-.09	[-.25, .08]	.25***	[.10, .39]
Infant age	-.06 [†]	[-.12, .01]	.04	[-.01, .09]	-.07 [†]	[-.14, .01]
Postpartum mood	-.02	[-.23, .20]	.08	[-.10, .26]	-.17*	[-.33, -.01]
Romantic Partner	.05	[-.11, .20]	-.02	[-.19, .14]	-.02	[-.16, .12]
<i>Depression severity trajectory</i>						
T-5 Intercept	.10	[-.27, .45]	.17	[-.12, .46]	.48**	[.16, .79]
T-5 through T-1 Slope	.18	[-.33, .68]	.02	[-.41, .45]	.36	[-.12, .85]
<i>Anxiety severity trajectory</i>						
T-5 Intercept	-.02	[-.29, .26]	-.13	[-.35, .09]	-.39**	[-.66, -.12]
T-5 through T-1 Slope	-.06	[-.42, .32]	-.05	[-.34, .24]	-.41*	[-.78, -.03]

Note:

[†] $p < .10$;

* $p < .05$;

** $p < .01$.