



Externalizing Behavior Problems in Offspring of Teen Mothers: A Meta-Analysis

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Abstract

Young maternal age at birth has been consistently recognized as a factor contributing to externalizing behavior. However, estimates of the magnitude of this association across existing studies are inconsistent. Such inconsistencies cloud the interpretation of the literature and highlight the need for a systematic synthesis of existing empirical evidence. Further, the roles of possible moderators in the association remain to be revealed. Moderation analyses will enhance the field's capacity to evaluate needs and locate a subgroup of children born to teen mothers with particularly heightened vulnerabilities. To address these gaps, the present study had two primary aims. First, a meta-analysis was conducted to quantify the magnitude of the association between being born to young mothers and children's externalizing behavior across existing studies. Second, moderation meta-analyses were conducted to evaluate whether the influence of being born to teen mothers on children's externalizing behavior is stronger during specific developmental periods, for a specific gender, for a specific race, or across contexts with varying teen pregnancy rates at a societal level. The current study followed the PRISMA guidelines. The search utilized multiple electronic databases including Web of Science, ProQuest, PubMed, and Ovid MEDLINE through July 2019. Standardized mean difference, Cohen's *d*, was used as a summary estimate of effect size. A random-effects model was conducted. Moderating effects were evaluated. Twenty-one effect sizes from 18 independent samples ($n = 133,585$) were included in the meta-analysis. The main meta-analysis and sensitivity analysis suggested a small yet robust association between teenage motherhood and children's externalizing behavior problems. The relevant moderation analyses detected no statistically significant moderating effect for a specific gender, for racial and ethnic minority groups, during a specific developmental period, or across varying contexts. The current meta-analysis findings suggest that the impact of young maternal age on children's externalizing behavior is small, yet independent. Further, such impacts of young maternal age were similar for girls and boys, in different racial and ethnic groups, across developmental periods, and across different contexts with varying teen pregnancy rates. Prevention efforts seeking to curb the emergence of youth's externalizing behavior should focus on parenting teens, regardless of their child's gender, race, age, or contexts. Further, the current findings suggest that prevention strategies for this specific group may benefit from a hybrid approach that combines universal, selective, and indicated prevention strategies.

Keywords Externalizing behavior problems · Children born to teen mothers · Meta-analysis · Moderation

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Introduction

In 2017, 194,377 babies were born to adolescents aged 15–19 in the United States, accounting for 5% of all births in that year (Martin et al. 2018). Most of these births (89.2%) occurred outside of marriage (Martin et al. 2018) and nearly 8 in 10 (77%) were unwanted and unplanned (Mosher et al. 2012). Being born to young mothers has been consistently noted as a key risk factor for compromised developmental outcomes for children (Coyne and D'Onofrio 2012), including externalizing behaviors among youth (McGrath et al. 2014).

Despite increasing numbers of empirical studies examining the impacts of young maternal age on children's externalizing behavior, estimates of the existence, direction, and magnitude of this association across existing studies have not yet reached a consensus, making it hard to discern where the existing literature stands. Further, possible moderating effects by key social status markers, such as gender and race, or contextual differences, such as teen pregnancy rates at a societal level, have received limited empirical attention. Similarly, the extent to which the influences of young maternal age on children's externalizing behaviors vary across developmental epochs is unknown, despite the inherently developmental nature of externalizing behavior. Revealing where the current literature stands in terms of the impacts of teen pregnancy on externalizing behavior among children is important to consider, including whether a shift in intervention profiles is needed to account for this specific developmental outcome. Locating a possible moderator is also important, because it would help locate a subgroup of children born to teen mothers with particularly heightened vulnerabilities. To address these critical gaps in the existing literature, the current study involved a meta-analysis of existing evidence, including the role of possible moderators.

Young Maternal Age and Offspring Externalizing Behaviors

In contrast to internalizing behavior, which reflects problems within the self taking an inward behavioral form (Achenbach and Rescorla 2001) and often dealing with affect (Mullin and Hinshaw 2007), externalizing behavior problems refer to issues evident in children's outward behavior, representing conflicts with (Achenbach and Rescorla 2001) or negative acting on (Liu 2004) the external environment. Consistent with a dimensional conceptualization of externalizing behavior problems (Coghill and Sonuga-Barke 2012; Wakschlag et al. 2015), externalizing behavior problems have been conceptualized as inclusive of hyperactive, disruptive, and aggressive behaviors (Hinshaw 1987). They include diagnosed disorders such as attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder, and conduct disorder (American Psychiatric Association 2013; Mingeach et al. 2018). Externalizing behaviors are highly prevalent psychiatric diagnoses among youth. ADHD in 2016, for example, affected about 129 million worldwide (Thomas et al. 2015) and 5.7 million American school-aged children and youth (Danielson et al. 2018), representing the most commonly diagnosed childhood mental health problem in the United States (Centers for Disease Control and Prevention 2013). Earlier externalizing behavior has developmental ramifications later in life (Loth et al. 2014), including psychiatric

problems, substance use disorder, and depression in young adulthood (Reef et al. 2011). This reflects the importance of understanding factors shaping externalizing behavior among youth, such as young maternal age at birth.

A sizable literature has probed the impacts of being born to teen mothers on externalizing behavior in children. However, estimates of the magnitude of this association across existing studies are inconsistent. Whereas some work has found no significant associations with maternal age (Moore et al. 1997), other studies have noted either negative (Schneider and Eisenberg 2006) or positive (Chang et al. 2014) impacts. Such inconsistencies in existing studies cloud the interpretation of the literature and highlight the need for a systematic synthesis of existing empirical evidence.

Moderating Effects: Gender, Age, Race, and Teen Pregnancy Rates

Some conceptual discussions and empirical findings suggest that teenage motherhood may affect externalizing behavior differently for girls versus boys. Gender socialization hypotheses (Chodorow 1978) argue that when exposed to a risk factor, girls' maladjustment profile is less likely to result in externalizing behavior because such behavior does not fit gendered behavioral norms (Broidy and Agnew 1997). Consistently, a narrative review concluded that prevalence rates of conduct disorder are elevated among boys (Berkout et al. 2011). Similarly, an early review study suggested that being born to teen mothers might affect boys' externalizing behavior more than girls (Brooksgunn and Furstenberg 1986). Yet gendered behavioral norms have changed, and early onset of externalizing behavior among girls is no longer uncommon (Fontaine et al. 2009)—this notion suggests smaller or possibly no gender differences. Because the relevant empirical evidence is limited regarding for which gender the impact of young maternal age on children's externalizing behavior is worse, these feasible hypotheses remain conceptual.

Further, holding a social status related to less power and fewer resources in a given society may also condition the association between teenage motherhood and children's externalizing behavior. Race, a potent social status marker, fundamentally shapes the probability of risk exposure of any type (Williams et al. 2010), including teen pregnancy (Manlove et al. 2013). Further, once exposed, a given risk will be fully potentiated for those who hold a less privileged racial status, often leading to worse consequences, because access to personal and social resources is often structured unfavorably for those who hold a less privileged position in this potent social status marker (Adler and Rehkopf 2008). Supporting such conceptual speculation, teen pregnancy rates in United States, for example, are

much higher among Black (27.5%) and Hispanic teens (28.9%) than among White teens (13.25%; Romero et al. 2016). The role of race as a potential moderator has not received much empirical attention in relevant studies and thus remains to be clarified.

Children's developmental stage may also moderate the impact of teenage motherhood on children's externalizing behavior. First, externalizing behavior is inherently developmental. On average, a moderate level of externalizing behavior is developmentally appropriate and typically emerges in infancy and toddlerhood (Tremblay et al. 2004), decreases during childhood (Miner and Clarke-Stewart 2008), then increases and peaks during adolescence (Moffitt 1993). The developmental nature of externalizing behavior emphasizes the importance of applying a developmental lens when examining the association between teenage motherhood and children's externalizing behavior. By definition, negative influences of teenage motherhood on children's externalizing behavior imply that children born to teen mothers may deviate from normative trends in an undesirable direction and experience higher levels of externalizing behavior problems. Such deviation among children born to teen mothers may not emerge clearly during developmental periods when externalizing behavior is normatively expected to be high (i.e., infancy, toddlerhood, and adolescence). In contrast, increased externalizing behavior in children born to teen mothers may become more evident during developmental periods when externalizing behavior is normatively expected to be low (i.e., childhood). Although existing studies have examined the possible influences of young maternal age on children's externalizing behaviors during varying developmental periods, these studies typically focused on one developmental period rather than multiple developmental epochs. As such, the extent to which the influences of young maternal age on children's externalizing behaviors vary across developmental epochs is unknown.

Finally, teen pregnancy rates at a societal level may influence the effects of young maternal age at birth on externalizing behavior. Teen pregnancy rates have declined since 1990 in many developed countries (World Health Organization 2015) including the United States (Child Trends Databank 2018). On one hand, when teen pregnancy rates are low at a societal level, allocation of resources and services for a given child born to teen mothers can be more generous. These social resources and services may mitigate the impacts of teenage motherhood on child developmental outcomes. On the other hand, when teen pregnancy rates are low, stigma associated with teen pregnancy at a societal level (SmithBattle 2013) might become intensified. Such stigma associated with teen pregnancy can further exacerbate challenges in the transition to young motherhood for teen mothers (SmithBattle 2013), possibly leading to further

compromised child developmental outcomes. Teen pregnancy rates at a societal level vary across years and locations. As such, exploration of substantial variation based on publication year or location is warranted, yet hard to achieve in an empirical study typically focusing on a data source from a single location in a single year.

Prior Review Studies

Studies examining the impacts of being born to a teenage mother on children's developmental outcomes have increased, and the current study is not the first attempt to generate a systematic synthesis on this topic. Prior review studies (Brooksgunn and Furstenberg 1986; Coley and Chase-Lansdale 1998; Corcoran 1998; Coyne and D'Onofrio 2012; Gibbs et al. 2012; Hofferth 1987; Paranjothy et al. 2009; Ruedinger and Cox 2012) have unearthed common ground in the relevant literature and revealed gaps that future studies should pursue. However, existing reviews tended to broadly assess offspring's developmental outcomes, and no prior known review studies have focused on externalizing behavior problems in children born to teen mothers. In studies with such a broad focus, it is challenging to incorporate the unique characteristics and developmental nature of externalizing behavior. A developmentally informed and targeted synthesis of available literature is essential to revealing a consensus in existing studies and addressing whether, on what, and when to intervene to prevent the emergence of externalizing behavior in children born to teen mothers.

Current Study

Young maternal age at birth has been consistently recognized as a risk factor contributing to child behavioral problems, including externalizing behavior. However, estimates of the magnitude of this association across existing studies are inconsistent. Such inconsistencies make it difficult to interpret the literature in a coherent way. Further, existing studies typically focused on a single developmental period, in a single location, and from a specific year. Thus, the extent to which the influences of young maternal age on children's externalizing behaviors vary across different developmental epochs and across varying contexts is unknown. Similarly, limited empirical attention has been given to possible moderating effects by gender and race, two potent social status markers. Moderation analyses will enhance the field's capacity to evaluate needs and locate a subgroup of children born to teen mothers with particularly heightened vulnerabilities.

To address these research gaps, the current study addressed two central research questions. First, it quantified

the magnitude of the association between being born to young mothers and children's externalizing behavior using a meta-analysis to reveal where the current empirical evidence stands. Second, moderation meta-analysis models were conducted to examine whether the influences of teenage motherhood on children's externalizing behavior are stronger for a specific gender, during specific developmental periods, for people of color, or across varying teen pregnancy rates.

Methods

Literature Search

The current study followed the PRISMA guidelines (Liberati et al. 2009). The search utilized multiple electronic databases including Web of Science, ProQuest, PubMed, and Ovid MEDLINE. It also involved reviews of reference lists of identified studies to ensure a thorough, comprehensive, and systematic search. Search terms with respect to maternal age were “teen childbearing,” “teen parenthood,” “maternal age,” “children of teen mother,” “children of young mothers,” “children born to teen mothers,” “adolescent parents,” “teenage birth,” “teenage mothers,” “adolescent mother,” “early child bearer,” and “age at first birth.” Regarding child behavioral problems, search terms were “externalizing,” “ADHD,” “attention problem,” “hyperactivity,” “conduct problem,” “delinquency,” “aggression,” “offending,” “Child Behavior Check List,” “child behavior,” “behavioral outcome,” “behavioral well-being,” “behavioral problem,” and “behavioral development.” Broader terms were used including “young adult outcome,” “adolescent outcome,” “adult outcome,” and “psychosocial behavior” to ensure a thorough search. Only English language publications were included. Considering that no prior review study focused on young maternal age and children's externalizing behavior problems, no publication date restriction was imposed. The initial search was completed in February 2015 and updated in July 2019 with a targeted search for publications between 2015 and 2019.

Study Selection and Data Extraction

The study selection and screening process was completed via four steps. First, two researchers (JOL and CHJ) reviewed the titles and abstracts of using the pre-established screening criteria: (a) children's externalizing behavior was a main outcome measure and (b) maternal age was the key predictor and was clearly defined or could be derived from available information. When titles and abstracts were insufficient to determine eligibility of a given study, full

articles were reviewed. Second, for studies that met the initial screening criteria, four researchers (JOL, CHJ, CY, and JAC) conducted a full-text review to decide whether a given paper had all needed information and was in line with the focus of the present meta-analysis. Third, two researchers (JOL and JAC) evaluated the quality of studies that qualified for the full-text review using a quality assessment tool for quantitative studies (Effective Public Health Practice Project 1998). Disagreements in ratings between the reviewers were resolved by discussion. Studies that both reviewers rated to have weak quality in study design were excluded ($n = 6$), yielding 35 studies for further screening. Fourth, studies with insufficient available data to calculate effect sizes ($n = 10$), effect sizes incomparable with other studies ($n = 5$; modeling strategies incompatible with the included studies), or operationalization of externalizing behaviors incompatible with other studies ($n = 2$; delinquency, conviction, and involvement in crime) were excluded (Borenstein 2009), resulting in 18 studies being included in the meta-analysis (see Fig. 1).

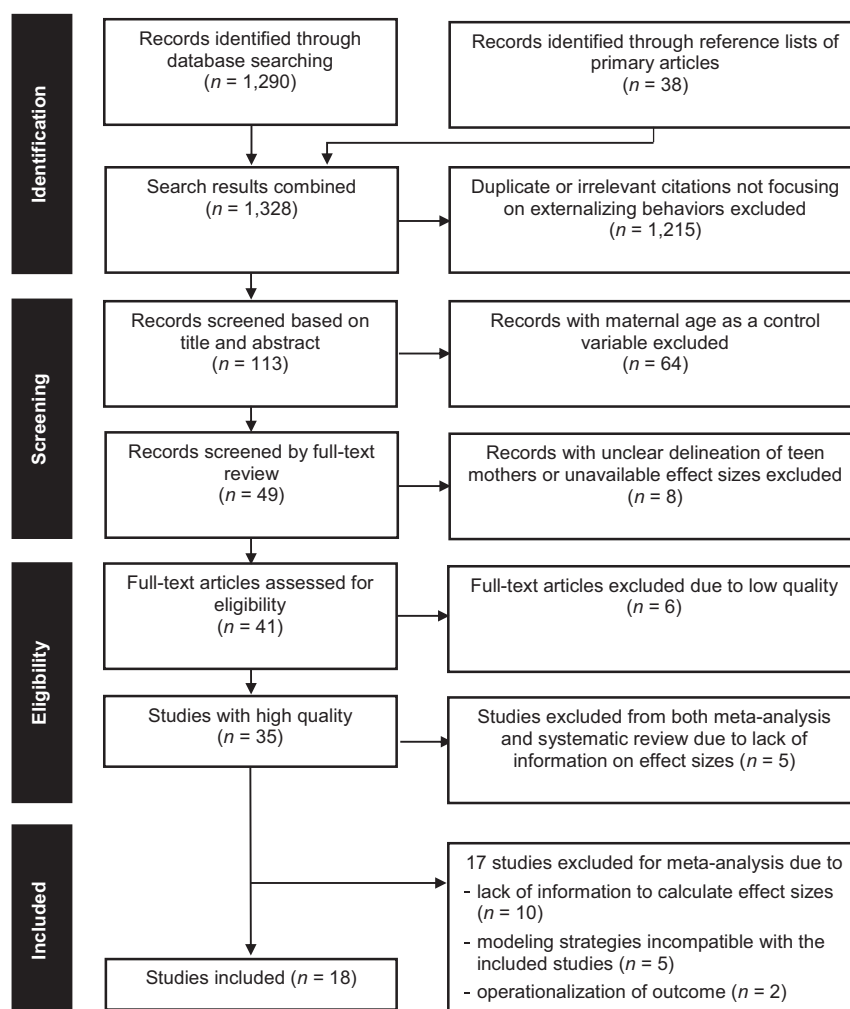
Two standard data extraction forms for the meta-analysis were developed and refined during data extraction. Three researchers (CHJ, CY, and MN) extracted key information, including specific operationalization of maternal age, children's externalizing behavior problems, and effect sizes and variances, from the included studies. Disagreements between reviewers were resolved by discussion and through consultation with the study team, particularly the first author (JOL). Applying these selection and screening criteria resulted in 21 effect sizes from 18 studies ($n = 133,585$) for the meta-analysis. The PRISMA flow diagram illustrates the process of study selection (Fig. 1).

Statistical Strategy for Meta-Analysis

Standardized mean difference, also known as Cohen's d , was used as a summary estimate of effect size. Cohen's d was calculated as $d = (M_1 - M_2) / s_{within}$, wherein M_1 and M_2 are the sample means of teenage mothers and nonteenage mothers and derived from the fully adjusted model in a given study, and s_{within} is the pooled standard deviation across the groups. Transformation formulas for different types of effect sizes were adopted from Borenstein (2009) and Lipsey and Wilson (2001; see online supplementary Appendix A). When a study reported separate effect sizes by subgroups (e.g., effect sizes reported separately for boys and girls), combined effect sizes were calculated using weights by each group size and pooled standard deviation (Headrick 2009). If multiple outcome measures were reported or two independent samples were used, multiple effect sizes were extracted.

A random-effects model was conducted due to expected heterogeneity in samples and methodologies

Fig. 1 PRISMA flow diagram of study selection process



across studies (Borenstein 2009). To minimize possible bias in estimation, the Hartung-Knapp-Sidik-Jonkman adjustment was implemented (IntHout et al. 2014; Knapp and Hartung 2003). Next, to evaluate whether the influence of being born to teen mothers on children's externalizing behavior was stronger for a specific gender, specific race, specific developmental period, or across teen pregnancy rates, moderation analyses were conducted following the guidelines established in the literature on meta-analysis (Borenstein 2009; Schwarzer et al. 2015). Each potential moderator was entered in a separate regression model for the effect sizes of being born to teen mothers on children's externalizing behavior and then evaluated for whether it explained the variance of the observed effect sizes. Regarding possible moderating effects by teen pregnancy rates, publication years were also examined, because teen pregnancy rates have declined in many developed countries (World Health Organization 2015) including the United States (Child Trends Databank 2018) over time.

Sensitivity analyses were conducted to evaluate the model choice (i.e., random-effects model) and probe possible biases and uncertainty in the estimation for the meta-analysis. First, heterogeneity across the included studies was assessed using Higgins' I^2 , which describes the percentage of total variation in estimated effects across studies due to heterogeneity rather than chance (Higgins and Thompson 2002). An I^2 value less than 30% indicates mild heterogeneity; a value higher than 50% suggests notable heterogeneity (Higgins and Thompson 2002). For subgroup analyses, Q-value, the weighted sum of squared deviations of each study's effect size from the combined effect size, was used to test heterogeneity in effect sizes among subgroups. A significant Q-value indicates variance in effect sizes across groups (Borenstein 2009). Second, the influence analysis method (Viechtbauer and Cheung 2010) was used to detect studies with extreme effect sizes that might distort a general trend in results across all studies. To address this concern, sensitivity analyses were conducted only with studies without extreme effect sizes. Third, funnel

plots (Lewis and Clarke 2001) and Egger's test (Egger et al. 1997) were employed to evaluate possible publication bias by testing whether funnel plots were not symmetrical (Sedgwick 2013). Fourth, to address potential bias due to treating multiple effect sizes from a single study as independent, multilevel meta-analysis was conducted. Fifth, the fail-safe N for effect sizes—the number of studies with null results needed to cancel the effect size—was calculated to evaluate the robustness of the effect size in the current study, using the Rosenberg method (Rosenberg 2005).

R statistical software version 3.6.0 with the 'meta' and 'dmetar' packages was used for main meta-analyses. Moderation analyses relied on the 'metareg' function in R package, which was developed specifically for evaluating moderating effects in a meta-analysis framework (Schwarzer et al. 2015).

Results

Meta-Analysis: Effects of Maternal Age at Birth on Externalizing Behaviors

Table 1 summarizes characteristics of the studies included in the meta-analysis, including the percentage of children born to teen mothers (2.06–62.38%). A forest plot (Fig. 2) was used to assess the weighted overall effect size of maternal age of birth on externalizing behavior problems. As shown in the forest plot (Fig. 2), with an exception of one study (Hao and Matsueda 2006), the majority of standardized mean differences—effect sizes from each study—were positive, indicating that teenage motherhood was associated with increases in externalizing problem among youth in each study. The random-effects meta-analysis model produced a combined effect size of $d = 0.21$ (95% CI = 0.14, 0.28; $k = 21$) across studies, suggesting that having a teen mother was associated with increased externalizing behaviors across studies. Tests of heterogeneity revealed significant variability between studies (Higgins' $I^2 = 83.7%$), motivating moderator analyses.

Moderation Meta-Analysis: Gender, Age, Race, and Teen Pregnancy Rates Moderation

To examine whether the influences of being born to teen mothers on children's externalizing behavior are stronger for a specific gender, the influences of percentage of female were evaluated. The effect was not statistically significant ($b = 0.11$, $SE = 0.40$, $p = 0.78$; $k = 11$), suggesting that the effect of being born to teen mothers on children's externalizing behavior is not sensitive to the child's gender.

To examine whether the influence of teenage motherhood on children's externalizing behavior varies across

racial and ethnic groups, a variable representing the proportions of racial and ethnic minorities was created and evaluated using meta-regression with studies that reported these percentages. The effect was not statistically significant ($b = -0.01$, $SE = 0.09$, $p = 0.89$; $k = 9$), suggesting the association of teenage motherhood with children's externalizing behavior is similar across racial and ethnic groups.

For possible moderation by child age, three groups were created: early childhood (age 0–5, $k = 7$), school age (age 6–12, $k = 6$), and adolescence (age 13–18, $k = 3$). When study samples had a wide age range without information about the distribution of each age group and thus could not be assigned to any specific age group, they were excluded ($k = 5$). The relevant moderation analysis detected no statistically significant effect ($b = -0.045$, $SE = 0.050$, $p = 0.39$; $k = 16$), suggesting that the association between young maternal age and children's externalizing behavior does not vary across developmental stages.

To test the potential moderating effects of teen pregnancy rates in a given location, teen pregnancy rates for that location in the publication year for each study were pulled from World Bank's (2017) epidemiology data source for countries. The effect was not statistically significant ($b = -0.003$, $SE = 0.003$, $p = 0.29$, $k = 21$), suggesting that the influences of teenage motherhood on externalizing behaviors among youth do not differ by teen pregnancy rates at a societal level.

Finally, publication years were also examined, because teen pregnancy rates have declined in many developed countries (World Health Organization 2015) including the United States (Child Trends Databank 2018) over time. The relevant moderation analysis detected no statistically significant moderating effects of publication years ($b = -0.001$, $SE = 0.007$, $p = 0.93$; $k = 21$), suggesting no variation in the linkage between young maternal age at birth and children's externalizing behavior across years.

Sensitivity Analyses for Meta-Analysis

To examine possible biases in the current meta-analysis results stemming from heterogeneity (Higgins' $I^2 = 83.7%$, as previously reported), analyses explored whether the association between maternal age and children's externalizing behavior problems was sensitive to five dimensions of study characteristics: (a) having varying operational definitions of children's externalizing behavior; (b) having extreme effect sizes (i.e., outlier); (c) examining mothers' age at first birth (MAFB) vs. mothers' age at the birth of the study child (MASC); (d) having more than one effect size; and (e) having publication bias. First, regarding heterogeneity in operational definitions of externalizing behavior, a Q -value (Borenstein and Higgins 2013) was calculated to test differences in effect sizes across subtypes of

Table 1 Characteristics of studies on externalizing behavior problems in children of teen mothers

Study author (year)	Country	Sample size	Study demographics	Operationalization of externalizing behaviors	Study design
			<ol style="list-style-type: none"> 1. Female % 2. Race 3. Child age (mean) 4. % of children born to teen mothers^a 5. Range of maternal age at birth (mean ± SD)^a 		
Agnafors et al. (2019) ^b	Sweden	1723	<ol style="list-style-type: none"> 1. Female = NR^c 2. Race = NR^c 3. 3 months–3 years old 4. MASC < 21 (vs. ≥ 21) = 3.5% 5. Range = NR^c 	• Broad-span externalizing behavior	Longitudinal
Chudal et al. (2015)	Finland	49,544	<ol style="list-style-type: none"> 1. Female % = NR^c 2. Race = NR^c 3. 4–20 years old 4. MASC < 20 (vs. ≥ 20–33.5) = 3.3% 5. 14 to 47 (27.8 ± 5.7) 	• ADHD	Longitudinal
Galera et al. (2011) ^{b,d}	Canada	1665	<ol style="list-style-type: none"> 1. Female 49.3% 2. Race = NR^c 3. 17 months–8 years old 4. MASC < 21 (vs. ≥ 21) = 11.1% 5. Range = NR^c 	<ul style="list-style-type: none"> • Hyperactivity • Inattention • Impulsivity 	Longitudinal
Guevremont and Kohen (2012) ^{b,e}	Canada	742	<ol style="list-style-type: none"> 1. Female % = NR^c 2. Inuit 100% 3. 2–5 years old 4. MAFB < 20 (vs. ≥ 20) = 41.24% 5. 12 to 25 or older 	<ul style="list-style-type: none"> • Hyperactivity • Inattention • Conduct problems 	Cross-sectional
Guèvremont and Kohen (2013a) ^{b,c}	Canada	1816	<ol style="list-style-type: none"> 1. Female % = NR^c 2. Off-Reserve First Nations 100% 3. 2–5 years old 4. MAFB < 20 (vs. ≥ 20) = 29.92% 5. 12 to 25 or older 	<ul style="list-style-type: none"> • Hyperactivity • Inattention • Conduct problems 	Cross-sectional
Guèvremont and Kohen (2013b) ^{b,c}	Canada	2189	<ol style="list-style-type: none"> 1. Female % = NR^c 2. Off-Reserve First Nations 100% 3. 2–5 years old 4. MAFB < 20 (vs. ≥ 20) = 30.03% 5. 12 to 25 or older 	<ul style="list-style-type: none"> • Hyperactivity • Inattention • Conduct problems 	Cross-sectional
Hao and Matsueda (2006) ^{b,d,e}	United States	4354	<ol style="list-style-type: none"> 1. Female 49% 2. African American 31% 3. MAFB < 20 (vs. ≥ 20) = 3% 4. Range = NR^c 	• Broad-span externalizing behavior	Longitudinal
Harachi et al. (2006) ^{b,d,e}	United States	984	<ol style="list-style-type: none"> 1. Female 35.14% 2. White 81% Asian 7% Hispanic 4% Black 4% Native-American 3% 3. 7–13 years old (7.9) 4. MASC < 20 (vs. ≥ 20) = NR^c 5. Range = NR^c 	• Aggression	Longitudinal

Table 1 (continued)

Harden et al. (2007) ^d	Australia	1368	1. Female 51.5 % 2. Race = NR ^c 3. 14–39 years old (25.1) 4. MASC \leq 20 (vs. $>$ 20) = 6.65% 5. Range = NR ^c	<ul style="list-style-type: none"> • Attention problems • Hyperactivity • Oppositional defiant behaviors • Conduct problems 	Cross-sectional
Hofferth and Reid (2002) ^b	United States	2144	1. Female % = NR ^c 2. Race = NR ^c 3. \leq 13 years old 4. MAFB $<$ 20 (vs. \geq 20) = NR ^c 5. Range = NR ^c	<ul style="list-style-type: none"> • Aggression 	Longitudinal
Moffitt and the E-Risk Study Team (2002) ^{b,d}	United Kingdom	2232	1. Female 51.2% 2. Race = NR ^c 3. 5 years old 4. MAFB $<$ 20 (vs. \geq 20–8.4) = 50.36% 5. Young mother = 15 to 20 (18.5 \pm 1.4) Older mother = NR ^c (28.4 \pm 4.3)	<ul style="list-style-type: none"> • Inattention • Hyperactivity • Broad-span externalizing behavior 	Longitudinal
Nagin and Tremblay (2001) ^{b,d,e}	Canada	1037	1. Female 0% 2. White 100% 3. 6–15 years old 4. MASC = NR ^c 5. (23.8 \pm 4.1)	<ul style="list-style-type: none"> • Aggression 	Longitudinal
Pohlabeln et al. (2017) ^d	Eight European countries	12,964	1. Female 49.4% 2. Race = NR ^c 3. 2–11.9 years (6.2) 4. MASC $<$ 20 (vs. \geq 20) = 2.5 % 5. 19 or younger to 25 or older	<ul style="list-style-type: none"> • ADHD 	Longitudinal
Sagiv et al. (2013) ^{b,d,e}	United States	461	1. Female 49.01% 2. White 69.3% Black 6.2% Hispanic 9.8% Cape Verdean 10.6 % Other 4.1% 3. 8 years old 4. MASC $<$ 20 (vs. \geq 20) = 13.08% 5. 19 or younger to 35 or older	<ul style="list-style-type: none"> • ADHD 	Longitudinal
Shaw et al. (2006) ^b	Australia	4976	1. Female % = NR ^c 2. Race = NR ^c 3. 14 years old 4. MASC $<$ 19 (vs. \geq 19) = 10.59% 5. Range = NR ^c	<ul style="list-style-type: none"> • Attention • Aggression 	Longitudinal
Silva et al. (2014) ^d	Australia	43,062	1. Female 22.85% 2. Race = NR ^c 3. \leq 35 years old 4. MAFB $<$ 20 (vs. \geq 20) = 2.06% 5. 19 or younger to 40 or older	<ul style="list-style-type: none"> • ADHD 	Cross-sectional
Tearne (2015) ^d	Australia	1754	Female 49.1% Race = NR ^c 2–17 years old MASC $<$ 20 (vs. \geq 20) = 7.77% 19 or younger to 40 or older	<ul style="list-style-type: none"> • Aggression 	Longitudinal

Table 1 (continued)

Zimmerman et al. (2001) ^{b,e}	United States	570	1. Female = NR ^c 2. Black 100% 3. 15–19 years old (14.6) 4. MASC < 20 (vs. ≥ 20–7.5) = 25.09% 5. 12 to 44 (21.8 ± 5.7)	• Aggression	Cross-sectional
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^aTypes of maternal age: *MAFB* maternal age of first birth, *MASC* maternal age of study child

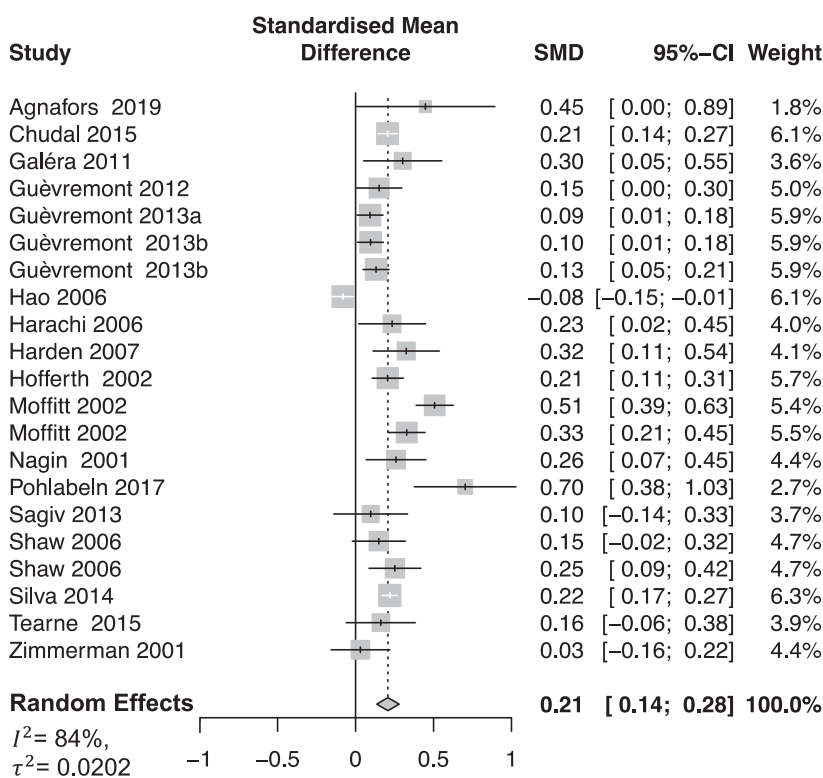
^bIncluded in age moderation meta-analysis model

^cNR: not reported

^dIncluded in gender moderation meta-analysis model

^eIncluded in race moderation meta-analysis model

Fig. 2 Forest plot for effect sizes of maternal age of birth on externalizing behaviors



externalizing behavior. The test yielded a nonsignificant result ($Q = 0.28$, $df = 2$, $p = 0.87$), suggesting no differences in effect sizes across subtypes of externalizing behavior (online supplementary Appendix B). Second, to probe and address possible bias in the current meta-analysis results associated with studies with extreme effect sizes, an influence analysis was conducted (Viechtbauer and Cheung 2010; online supplementary Appendix C) and three outlier studies were detected (Hao and Matsueda 2006; Moffitt and the E-Risk Study Team 2002; Pohlabeln et al. 2017). The 95% confidence intervals of these three studies fall outside the 95% confidence interval of the pooled effect. This observation is consistent with other diagnostic measures.

The absolute value of studentized residuals for these studies (Appendix C, D.1), for example, were greater than 2 and covariance ratios of these three studies (Appendix C, D.4) were particularly low. Taken together, these diagnostic measures suggest that the precision of parameter estimates may improve without these three studies (Shadish et al. 2014). A sensitivity analysis was conducted without these studies, resulting in a slightly decreased overall effect size ($d = 0.19$; 95% CI = 0.15, 0.23; $k = 18$). Third, to evaluate possible influences stemming from investigating MAFB in some studies and MASC in others, two additional meta-analyses were conducted—one with studies focused on MAFB ($k = 9$) and the other with studies focused on MASC

($k = 12$). MAFB ($d = 0.18$) showed a slightly lower effect size than MASC ($d = 0.23$), but the difference was not statistically significant ($Q = 0.51$, $p = 0.48$). Fourth, to address potential bias associated with studies with more than one outcome measure ($k = 3$), a multilevel meta-analysis was conducted. There was no variance between the multiple outcomes within studies ($\sigma^2 = 0$), supporting the single-level model used in the current study. Fifth, to evaluate publication bias, a funnel plot was generated and Egger's test was conducted to evaluate whether it was symmetrical. The result was not significant ($t = 1.21$, $p = 0.24$), suggesting that the funnel plot was symmetrical (online supplementary Appendix D) and thus providing no evidence of publication bias (Sedgwick 2013). Finally, the fail-safe N for young maternal age was robust, indicating 52 studies with null results would be needed to cancel out the effect sizes.

Discussion

Having teen mothers has been associated with increased developmental problems for children, including externalizing behavior. Despite a steady increase in number, existing studies have provided mixed conclusions regarding the existence and extent of this association. Such inconsistencies cloud the interpretation of the literature and highlight the need for a systematic synthesis of existing empirical evidence. Further, whether the association varies across genders, racial and ethnic groups, different developmental epochs, and varying contexts remains unknown. Relatedly, despite many efforts to generate a systematic synthesis, no prior review studies have explicitly focused on externalizing behavior problems in children born to teen mothers. To address these gaps, the present study quantified the magnitude of the association between being born to teen mothers and children's externalizing behavior across existing studies using meta-analysis. Subsequent moderation meta-analyses examined whether the influence of being born to young mothers on children's externalizing behavior differed across genders, racial and ethnic groups, developmental periods, and contexts with varying teen pregnancy rates.

The meta-analysis results suggest a small yet significant association between young maternal age and children's externalizing behavior problems. Having teen mothers is equally associated with an increased risk of externalizing behavior problems for girls and boys with different racial and ethnic backgrounds. The risk does not vary as a function of child developmental period or varying teen pregnancy rates at a societal level.

Using 18 independent samples in the meta-analysis ($n = 133,585$), the current study demonstrated that being born to

teen mothers was associated with increased vulnerability to externalizing behavior problems among children. This finding echoes previous review works (Brooksgunn and Furstenberg 1986; Coley and Chase-Lansdale 1998; Corcoran 1998; Coyne and D'Onofrio 2012; Gibbs et al. 2012; Hofferth 1987; Paranjothy et al. 2009; Ruedinger and Cox 2012) in documenting that being born to teen mothers is associated with compromised child developmental outcomes in a broad sense. The current study findings suggest that such developmental repercussions associated with having a teen mother exist in children's externalizing behavior.

However, the effect size ($d = 0.21$) across studies is small to medium (Cohen 1988). This suggests that the link between being born to teen mothers and externalizing behavior may be less deterministic than previously presumed regarding intergenerational continuity in vulnerability among teen mothers and their children (Rutter 2004). Although being born to a teen mother may exacerbate children's externalizing behavior, children born to teen mothers experience developmental fluidity, often referred to as multifinality (Cicchetti and Rogosch 1996), and thus are more heterogeneous than homogenous (Coyne and D'Onofrio 2012). Such consideration calls for more inquiries into factors contributing to within-group variability in children born to teen mothers along with between-group variability (i.e., comparing children born to teen mothers to those born to older mothers). A balanced investigation of within- and between-group variability will enhance the field's ability to locate specific mechanisms that facilitate healthy development among children born to teen mothers, despite the odds of presumed susceptibility to poorer developmental outcomes.

No evidence was found for possible gender differences in the linkage between young maternal age and children's externalizing behavior. Traditional gender norms for externalizing behavior have changed, as suggested by narrowing gender differences in early onset of externalizing behavior (Fontaine et al. 2009). The current findings support this notion and suggest that challenges of being born to teen mothers can manifest as elevated externalizing behavior problems for girls and boys. This finding echoes prior studies (Habersaat et al. 2018) advocating for the need to more clearly study and create clinical practice strategies to attend to externalizing behavior in girls, who have been overlooked due to relatively lower prevalence rates compared to boys.

No evidence was found that race and ethnicity, particularly belonging to a racial and ethnic minority, shapes the association between teenage motherhood and children's externalizing behavior. This finding suggests that although there is differential exposure in risk by race (i.e., teen pregnancy rates are disproportionately concentrated among

racial and ethnic minority groups; Romero et al. 2016), teenage motherhood doesn't necessarily lead to differential vulnerability across generations. Instead, teenage motherhood exerts similar influences on children's externalizing problems.

Similarly, no evidence was found for a stronger association between maternal age and children's externalizing behaviors by developmental period, refuting the hypothesis of the present study that the negative influence of being born to teen mothers may be more evident during developmental periods when externalizing behavior is expected to be low in general (i.e., childhood). The absence of age moderation in the current study suggests that the developmental repercussions of being born to teen mothers may be independent of a child's developmental stage and instead remain consistent across stages regarding the child's externalizing behavior. In addition to this straightforward interpretation, at least two other possibilities might explain these null findings. First, the operationalization of children's developmental age in the present study might not have been sensitive enough to capture developmental fluctuation in children's externalizing behavior over time. In the current study, developmental periods were trichotomized: early childhood, school age, and adolescence. Although the operational definition of child age in the present study represents distinct developmental epochs, it did not capture possible fluctuations in externalizing behavior in each developmental period. Examining the influence of being born to teen mothers with more fine-grained, age-specific data may further clarify the possibility of age moderation. Similarly, applying special modeling strategies for detecting such a time-dependent influence, such as time-varying effects modeling (Tan et al. 2012), might be a promising analytic approach in future studies. Further, null findings might be a function of not having enough power to detect such moderation in this meta-analysis. There were few effect sizes for each developmental period—early childhood ($k = 7$), school age ($k = 6$), and adolescence ($k = 3$). This possibility once again indicates the need to explicitly consider the developmental nature of externalizing behavior in the association between young maternal age and children's externalizing behavior.

Finally, no evidence was found for the influences of teen pregnancy rates at a societal level on the impacts of teenage motherhood on children's externalizing behavior. As with the other moderation analyses, the practice implications for teen pregnancy rates analysis include locating a subgroup of children born to teen mothers with particularly heightened vulnerabilities. The current findings suggest that no specific gender, race, sensitive period, or pregnancy rates place children born to teen mothers at elevated risk of externalizing behavior problems. This supports implementing a universal prevention strategy. However, considering the

current study findings along with existing studies on the effectiveness of a widely used universal prevention strategy, prevention strategies for externalizing behaviors in this specific group may benefit from a hybrid approach that combines universal, selective, and indicated prevention strategies. The most widely used prevention strategies in the United States for teenage mothers and their children, for example, are universal prevention programs, particularly home visitation and case management (Lachance et al. 2012). These universal prevention strategies have generated positive effects on a wide range of developmental outcomes for young mothers and their children (Duffee et al. 2017). However, a randomized controlled trial reported that the Nurse-Family Partnership program, the most widely known program in the United States that has been replicated in many other countries (Duffee et al. 2017), did not result in positive effects on children's externalizing behaviors (Kitzman et al. 2010). As such, it might be worth integrating effective prevention strategies focused on externalizing behaviors with a universal prevention strategy for youth born to teen mothers, regardless of their gender, race, age, and teen pregnancy rates at a societal level. Further, findings indicate no moderating effects by child's age along with widely documented stability (Pihlakoski et al. 2006) over time and a cascade process (Bornstein et al. 2013) in externalizing behavior starting at the onset of early childhood. Thus, integrating a universal prevention strategy with an indicated prevention strategy during earlier developmental periods, such as the Prevention Programme for Externalizing Problem Behavior (Hanisch et al. 2010), might be a promising way to enhance the field's capacity to curb the emergence of externalizing behavior among youth born to young mothers.

The current study findings should be contextualized in light of a few methodological limitations. First, heterogeneity across studies presented challenges in establishing comparability (Young et al. 2011). However, the sensitivity analyses in the present study did not find empirical evidence suggesting that such heterogeneity might have introduced bias in the current meta-analysis results, rendering confidence in the study findings. Second, the current meta-analysis focused on whether the association between teenage motherhood and children's externalizing behaviors exists. The study did not explicitly examine the question of *why* teenage motherhood is associated with increased risk of externalizing behavior. The nature of the relation between young maternal age and children's externalizing behavior is subject to continued debate (Coyne et al. 2013). The social selection hypothesis suggests that the association between teenage motherhood and children's externalizing behavior is spurious and may be a byproduct of pre-existing differences in teen mothers and older mothers, such as low academic achievement, socioeconomic disadvantage, mothers'

earlier externalizing behavior, or genetically shared vulnerability to externalizing behavior. Consistently, the impacts of maternal age on children's externalizing behavior were substantially attenuated and became statistically nonsignificant with factors reflecting social selection in some studies (Terry-Humen et al. 2005). In contrast, such drastic changes were not observed in other studies (Harden et al. 2007), limiting the field's capacity to reach a more generalizable conclusion about the role of social selection factors in shaping the influences of young maternal age on children's externalizing behavior. A review study with a keen focus on this question of why young motherhood influences children's externalizing behavior will be a fruitful future direction to reveal the current consensus and which possibly critical domains of risk and protective factors have been overlooked. Finally, following a guideline widely used for meta-analysis to ensure a certain degree of quality (Aldao et al. 2010), only studies published in peer-reviewed journals were included. As such, the possibility of omitting important studies can't be completely ruled out, particularly unpublished reports or those with null findings.

Some study limitations are related to critical gaps in the existing literature. First, as shown in Table 1, study participants in prior works were predominately embedded in a Western culture, which reflects a lack of diversity in locations across published studies. As such, the current study could not fully consider policy and cultural contexts with varying behavioral norms, gender expectations, and policy protection that may influence externalizing behavior problems (Lansford et al. 2018) in this population. The current findings regarding gender differences, for example, may be different in regional areas where traditional gender norms about behavior are relatively strong. Similarly, the degree of social protection, such as universal access to different social services, likely affects the impacts of teenage motherhood on child developmental outcomes, because barriers to needed services are relatively lower in countries with universal access to social services compared to countries with means-based eligibility tests. Typologies of welfare states, for example, classify countries based on various elements of social policies, such as universal access to different services (Bergqvist et al. 2013). According to Esping-Anderson's (1990) widely used typology of welfare states, 15 of the 18 studies in the current meta-analysis were published in countries characterized as a liberal welfare state. Studies in regional areas representing different cultural and policy contexts would help advance the field's understanding of the impacts of young maternal age on children's externalizing behavior and potential variability by child gender and other social factors. Second, as shown in Table 1, study participants in the review study represented mostly White and Black racial and ethnic groups. This limitation also highlights a critical gap in the existing literature. Study

findings regarding racial and ethnic differences may be different among Latinx youth born to teen mothers, a subgroup with particularly heightened risk of teen pregnancy (U.S. Department of Health and Human Services 2018) in the United States. Latinx represents the largest (Passel et al. 2011) and youngest (U.S. Census Bureau 2014) racial and ethnic minority group, and Latinx youth and their families experience distinct risk and protective factors, cultural contexts, and social climate (Coleman-Minahan 2017). Thus, it is imperative to advance the current understanding of possible sources of risk and protection for Latinx children born to young mothers.

Despite its limitations, the present study made four important contributions to the relevant literature, which previously had produced mixed results. First, the current meta-analysis results revealed a consensus across existing studies. Second, the current study evaluated possible moderation effects of gender, race, age, and context (specifically, teen pregnancy rates) in a meta-analytic framework. Such moderation analysis determined the need to support subgroups of children born to teen mothers with heightened vulnerability, which did not receive much empirical attention in existing studies. Finally, the current study focused on externalizing behavior rather than a wide range of child developmental outcomes, enabling incorporation of developmental characteristics unique to externalizing behavior problems. By focusing this meta-analysis on externalizing behavior, the present findings generated more direct implications for research and practice.

Conclusion

Coupled with the absence of a targeted systematic synthesis, mixed findings in existing studies on the association between teenage motherhood and children's externalizing behavior have made it challenging to draw a coherent conclusion on the association. To address these gaps, the present study aimed to reveal a common thread across existing studies and roles of moderators using a meta-analysis strategy. The current study findings provide quantified evidence that the impact of young maternal age on children's externalizing behavior is small, yet independent. Further, such impacts of young maternal age were similar for girls and boys and across varying racial and ethnic backgrounds. The impacts of teenage motherhood were not sensitive to developmental periods or different contexts either. Prevention efforts seeking to curb the emergence of youth's externalizing behavior should focus on parenting teens, regardless of their child's gender, race, age, or contexts, and take a hybrid approach that combines universal, selective, and indicated prevention strategies.

Authors' Contributions JOL originated the study and guided data analyses, the evaluation of the quality of studies, and the writing of the article; CHJ extracted key information from each study while updating the literature search and conducted the main and sensitivity analyses; CY conducted the initial literature search and information extraction from each study and conducted the preliminary analyses; JMB contributed to the analysis framework, troubleshooting of analysis, and interpretation of the study findings; AJU contributed to the interpretation of the study findings and contextualized findings in different racial and ethnic groups, particularly young Latina mothers and their children; MN organized the database and ensured the accuracy of information from each study in the database used in the present study; JAC contributed to the conceptualization of the study and the interpretation of findings and evaluated the quality of studies. In addition, all authors have been involved in drafting and critically revising the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Data Sharing Declaration All data generated or analyzed during this study are included in this published article (and its supplementary information files).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval The current manuscript used published studies as the sole data source and did not involve any other data collection or direct interactions with human participants. As such, seeking approval from a human subjects review committee is irrelevant.

Informed Consent As with ethical approval, securing informed consent forms is irrelevant. The study didn't involve any data collection or direct interactions with participants.

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