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A meta-analysis of interventions to reduce repeat pregnancy and birth among teenagers

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Cover Page Footnote

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Abstract

Almost 20% of teen mothers have more than one child before age 20. Researchers have implemented many interventions to prevent subsequent births. The purpose of this study was to examine their effectiveness in preventing repeat pregnancy/birth. We searched nine electronic databases for eligible studies conducted through September, 2014; 47 primary studies met our criteria and provided 52 comparisons. We coded the primary studies for characteristics related to study source, participants, interventions, methods, and outcomes. Using meta-analytic techniques, we calculated intervention effect sizes (ESs) on repeat pregnancy/birth within three time periods: <15 months after the first birth, 15-35 months, and after 36-60 months. Primary studies included 219,086 teen mothers with a mean age of 16.9 years. Interventions had a medium effect in reducing repeat pregnancy/birth for each time period. Teen mothers who received an intervention had 36-60% lower rates of repeat pregnancy/birth than control/comparison mothers. Of the many moderators examined for each time period, only a few explained additional variance. Our results indicate that interventions are moderately effective for as long as 60 months after a prior teen birth. It remains unclear which interventions are most effective, for which teens, and under what circumstances.

Introduction

Early childbearing in the U.S. has declined to its lowest level ever reported (Hamilton & Mathews, 2016). Recent declines are attributed to teenagers' increased use of contraception, and the greater availability and use of long acting reversible contraceptives (LARC) (Ventura, Hamilton, & Matthews, 2014). Repeat births among teen mothers, defined as giving birth at least twice before age 20, has also declined over time, but it remains a stubborn issue. In 2010, 18.3% of births to teens represented repeat births; the vast majority (85.7%) were for a second child, while 14.3% were for a third or higher order child before age 20 (Gavin et al., 2013). The highest rates of repeat teen births occurred among American Indian/Alaska Natives (21.6%), Hispanic (20.9%), and non-Hispanic black teens (20.4%); non-Hispanic whites (14.8%) had the lowest. Rates also varied by state, with Texas having the highest rate of repeat births (22%) and New Hampshire the lowest (10%) (Gavin et al., 2013, p. 249). Having another child has implications for mother and child: subsequent children are more likely to be born premature or low birth weight, and additional parenting responsibilities may deter mothers' further schooling or employment (Gavin et al., 2013; Klerman, 2004; Meade & Ickovics, 2005).

Risk factors for repeat pregnancy/birth include non-use of contraceptive methods or use of less effective methods: the vast majority of sexually active teen mothers (91.2%) reported using a contraceptive method postpartally, but only 29.6% used the most effective methods (Gavin et al., 2013). Other risk factors for repeat births include poor mental health and traumatic experiences (Patchen, Caruso, & Lanzi, 2009). In a primarily Black sample of teen mothers, later age at menarche and expectations of aggression were identified as risk factors (Crittenden, Boris, Rice, Taylor, & Olds, 2009). Surprisingly, other factors, such as substance use or adverse childhood experiences, were not associated with repeat pregnancy, which may reflect the homogeneous nature of the sample. Risk factors for a multiethnic group of Texan teen mothers

included: intention to have another baby, severed relationship with the first child's father, being significantly younger than the child's father, being exposed to intimate partner violence soon after delivery, not attending school, and being friends with other teen mothers (Raneri & Wiemann, 2007).

Qualitative studies shed further light on the issue. Repeat pregnancies were unplanned and considered a "mistake" by the teen mothers interviewed by Herrman (2007). Ambivalence about using contraception combined with misinformation about methods explained teens' limited efforts to prevent pregnancy. Clarke (2010) reported that the experience of loss (due to miscarriage, stillbirth, or abortion) contributed to repeat pregnancies for Caribbean and British teen mothers; teens who felt pressured to have an abortion concealed the next pregnancy to avoid another abortion. Others welcomed a second pregnancy to complete their families at a young age so they could pursue education or work. Dallas (2013) offered a fresh perspective by following 24 unmarried adolescent parenting couples for 2 years. The teen fathers (*n*=9) who had been denied access to the first child had another baby with new partners; four of these men fathered 12 additional pregnancies within 2 years. Almost half of the participating mothers had another pregnancy within 2 years; 6 were fathered by fathers of their first child and 6 were fathered by another partner. A meta-synthesis of qualitative studies (s=10) with teen mothers further suggested that limited aspirations and opportunities contributed to repeat pregnancy (Whitaker et al., 2016).

Programs to improve outcomes for teen mothers and their children (e.g. maternal-child health, maternal education, use of contraception, reduction in repeat pregnancy/birth) began more than five decades ago. An early review of programs to reduce repeat pregnancy/birth by Klerman (2004) summarized the results of 19 studies. Many of these interventions were

designed to increase access to contraceptive methods while promoting life skills and educational and employment opportunities. Interventions occurred in schools, community settings, and homes. Only half of the researchers of these studies reported reductions in repeat pregnancy/birth; only three studies were RCTs, and the size of their effects was small. Programs that were delivered by nurses, began during pregnancy, were longer in duration, and fostered trusting relationships appeared to contribute to positive outcomes.

Other researchers have used meta-analytic methods to examine the effectiveness of programs to reduce repeat pregnancy among teens. Baytop (2004) and Corcoran and Pillai (2007) conducted extensive searches and included published and grey literature; 32 and 16 studies were retrieved respectively. Baytop searched 10 on-line databases from 1970 to 2003, nearly 15 years ago. After excluding international studies, she reported modest intervention effect for 32 programs (OR=0.62; 95% CI: 0.49-0.78; p <.001); RCTs showed no effect while the non-RCTs showed a strong effect. Interventions were found to be more effective for 16- and 17-year-old teens than for 18-year-old teens, and for teen mothers who were enrolled during pregnancy or within 6 months of the birth than for those enrolled after 6 months. Then about ten years ago, Corcoran and Pillai (2007) limited their search to 6 databases from 1980 to 2006 and while they did not report excluding international studies, they reported on US studies only. In their review, they calculated effect sizes based on two follow-up periods. They found programs to be moderately effective in reducing repeat pregnancy compared to control/comparison conditions at about 19 months. Eight of these programs continued to follow mothers for about 31 months and by that time, programs were no longer effective in reducing repeat pregnancy. Programs were more effective in preventing subsequent pregnancies among higher versus lower income teens. Both Baytop (2004) and Corcoran and Pillai (2007) concluded that no one

intervention approach was more effective than others in reducing subsequent pregnancies. The most recent meta-analysis (MA) conducted by Whitaker et al. (2016) found that home-based interventions were not effective in reducing repeat pregnancy, but they excluded non-RCTs and studies published before 1995 and limited the grey literature to the United Kingdom. However, the few studies (*s*=4) reporting on repeat birth were effective.

Given that two MAs (Baytop, 2004; Corcoran & Pillai, 2007) are more than a decade old and the most recent MA (Whitaker et al., 2016) included a very small sample of primary studies (*s*=4), the purpose of this study was to examine the effectiveness of interventions to prevent repeat pregnancy/birth with an updated, thorough search of published and grey literature available through September, 2014. We used the PRISMA-P guidelines (Shamseer et al., 2015) to report this MA including the use of the word meta-analysis in the title, providing the rationale and objectives for the review, specifying the eligibility criteria, and listing the information sources and the search strategy. We described our study selection process and displayed it in a PRISMA flowchart (Figure 1). We provided information about our data collection and data items, summary measures, and the methods for data analyses. We described study characteristics, individual study results, synthesis of the results, and risk of bias. Finally, we discussed the summary of these findings, limitations, and conclusions.

Method

Information sources

Published and unpublished studies were obtained by conducting an electronic search through September, 2014 with the assistance of a medical librarian. Nine data bases (i.e., PsycINFO, Ovid Medline, CINAHL, ERIC, Scopus, Social Work Abstracts, Sociological

Abstracts, ProQuest Dissertation & Theses, and Campbell Collaboration Library) were searched with no date limits.

Search Strategy

Search terms included the following variations: (“adolescen*” OR “teen*”) AND ("repeat childbirth*" OR "secondary childbirth*" OR "subsequent childbirth*" OR "repeat pregnanc*" OR "repeat childbearing" OR "repeat birth*" OR "secondary pregnanc*" OR "secondary childbearing" OR "secondary birth*" OR "subsequent pregnanc*" OR "subsequent childbearing" OR "subsequent birth*") AND (trial*OR program* OR intervention* OR prevention*). The titles and abstracts of 1,035 articles were retrieved; 27 additional articles were identified from reference lists and other searches.

Inclusion/Exclusion Criteria

Studies were included if they were published in English; reported the results of an intervention, program, or trial to prevent repeat pregnancy/birth in adolescents aged 11-20 years of age; and contained a control and/or comparison group. Studies were excluded when teen mothers comprised less than 70% of the study sample, and when the timing of follow-up or the number or proportions of subsequent pregnancy/birth were not reported. We also excluded reports when the outcome (repeat pregnancy/birth) occurred more than five years after the first birth because most mothers would no longer be teens.

Data Management and Selection Process

Eligible articles were placed in a reference manager. After removing duplicates, the first (LS) and second author (CC) screened 472 titles and abstracts (Figure 1); 372 studies were excluded. The full text of the remaining 100 articles were reviewed and 53 articles were excluded. The majority were excluded for two reasons: when more than one study was

published with the same sample at different time points (n=22) or when the proportion of teen mothers in the study was less than 70% (*n*=15). Thus, 47 reports met inclusion criteria; 23 of these reports had not been included in prior MAs.

Data Collection Process

The 47 studies (*s*=47) provided 52 comparisons (*k*=52). Four studies included multiple comparison groups; three studies had two treatment groups and a control or usual care group, and the remaining study compared three treatment groups to one control group. For these studies we followed Borenstein et al.'s (2009) recommendation to divide the control group sample across treatment groups to avoid counting control/comparison participants more than once. Studies were coded individually by two authors (LS and CC); differences were resolved by consulting the third author (JS). We contacted researchers when key information was missing. If we received no response, we coded as missing data.

Data Items

Coding sheets included primary study characteristics related to source, participants, intervention, method, and outcomes. Source data included funding, publication status and year, and country where the study was conducted. Socioeconomic status, ethnicity, age, attrition, and proportion of teen mothers in the studies were coded as participant characteristics. Intervention characteristics included participant status at recruitment (e.g., pregnant, at delivery, within one month of birth), interventionists (e.g., nurses, physicians/ midwife, psychologists/counselors, teachers, social workers), training of interventionists, intervention setting, length, and approach (e.g., job training, case management, parent training, schooling, counseling). Method characteristics included recruitment setting, type of comparison groups (e.g., received no intervention, usual care, or other treatments), sampling strategy (e.g., random, convenience,

cluster random), and indicators of quality (e.g., randomization, blinding, intention-to-treat, fidelity assessment, power estimation). If primary studies reported outcome data on repeat pregnancy and birth, we coded and used pregnancy data for the analyses. When repeat birth was the sole outcome, we coded and used birth data for the outcome. We also coded for the number of months when outcomes were measured in primary studies.

Risk of Bias in Primary Studies

While there are a priori and post hoc approaches to measuring study quality, Valentine (2009) points out that neither work perfectly in every situation and should only be used when there is strong empirical justification to support their use. Instead, he recommends coding study quality dimensions and examining their influence empirically. Thus, we used quality indicators (method characteristics) as moderators to examine the differences between studies with and without these indicators.

Data Analysis

We used descriptive statistics to analyze participant, intervention, and method characteristics of primary studies. The Comprehensive Meta-analysis software (CMA) version 3 was used to calculate effect sizes (ESs) as odds ratios (OR) with 95% confidence intervals (CIs). We used the random-effects model based on the assumption that the true ES varies across studies. Thus, in the random-effects model, each study was weighted by the inverse of both within- and between-studies variance (Borenstein et al., 2009). Heterogeneity across studies was analyzed with Cochran's heterogeneity statistics (*Q*-statistic reflecting total dispersion, weighted sum of squares), the percentage of variation across studies (I^2 statistic, that is, the percentage of variability reflecting real ES difference), and the parameter tau-squared (τ^2 indicating the variance of true ESs) which is the variance of the true ESs.

We conducted separate MAs based on three time-points. With a large pool of studies spanning 6 months to 5 years since first birth, we selected three time points to compare outcomes: <15 months since first birth, between 15 and 35 months, and between 36 and 60 months. We grouped studies based on the follow-up period(s) reported in each primary study. In the first meta-analysis (MA<15), we calculated an ES for repeat pregnancy/birth occurring less than 15 months after the first birth (11.8 mo on average, *k*=18). In the second meta-analysis (MA15-35), ES was calculated for repeat pregnancy/birth occurring between 15 and 35 months (23.1 mo on average, *k*=41). In the third meta-analysis (MA36-60), we analyzed data for 36 to 60 months (40.5 mo on average, *k*=12). We explored moderator effects to identify sources of heterogeneity based on participant, intervention, and method characteristics. Although we coded for intervention approach as an intervention characteristic, we did not examine this moderator because treating each approach as a distinct moderator assumes that approaches operate individually rather than synergistically. For example, providing contraceptive education may be more effective when programs also link teen mothers to family planning clinics, transportation, and/or schooling. While we could not test the synergistic effects of multiple intervention methods employed together, we did examine the effects of combinations of intervention strategies (supporting continued education + access to contraceptives + counseling, case management + counseling, case management + access to contraceptives + counseling, access to contraceptives + counseling + LARC) against studies without those combinations. Finally, we used an analysis of variance analog for categorical moderators and meta-regression, a multiple regression analog, for continuous moderators (Borenstein et al., 2009).

Risk of Publication Bias

We examined publication bias using three techniques: the funnel plot, Begg and Mazumdar rank correlation test, and Egger's test of the intercept. If the funnel plot is asymmetrical, publication bias is suspected. The Begg and Mazumdar test is the rank correlation test reflecting the relationship between the standardized treatment effect and the variances using Kendall's tau (Cooper, Hedges, & Valentine, 2009). Bias is likely if the findings show significant correlation (Borenstein et al., 2009). Egger's test is based on a linear regression of the standardized effect estimate (ES divided by the standard error) against precision (inverse of the standard error) (Borenstein et al., 2009). The slope of the regression line represents the treatment effect, while the intercept reflects bias (Cooper et al., 2009). Therefore, if the *p*-value of the intercept is equal or less than 0.05, publication bias is likely.

Results

Primary Study Characteristics

Descriptive statistics for primary study characteristics are reported in Tables 1 and 2. Of the 47 primary studies, 37 were journal articles, 3 were book chapters, and 5 were unpublished. The majority of studies were funded (*s*=41) and conducted in the US (*s*=43). Although repeat pregnancy was the outcome of interest in most studies (*s*=34, 72%), 21% reported on repeat birth. Researchers targeted additional outcomes such as mother's schooling (*k*=29), contraception/STD prevention (*k*=19), and child outcomes (*k*=16). Among the 52 comparisons provided in the 47 studies, 219,086 teens participated: 17,396 in treatment groups and 201,538 in control/comparison groups. Sample size of the primary studies varied from 24 to 193,552, with a median of 161 teen mothers. The mean participant age was 16.95 years. In the 45 comparisons reporting ethnicity, 40 (89%) included African American teen mothers, followed by Caucasians (*k*=27, 68%) and Hispanics (*k*=23, 58%).

With regard to quality indicators, most researchers recruited convenience samples (*s*=35, 74.5%) from health settings (*s*=23, 48.9%). Fifteen research teams (31.9%) used random assignment to groups. Most researchers did not conceal allocation (*s*=38, 80.9%), blind their data collectors (*s*=37, 78.7%), measure intervention fidelity (*s*=43, 91.5%), or compute a priori power estimation (*s*=40, 85.1%). Nine research teams (19.1%) used intention-to-treat analyses. Attrition was rarely reported for intervention and comparison groups in primary studies so we calculated attrition based on the sample size at recruitment and when the outcome was measured. Of the 39 research teams reporting, attrition ranged between 0 and 87.18% across the intervention groups and from 0 to 75.54% across control/comparison groups.

Intervention characteristics are presented in Table 1. In MA<15 (*k*=18) (B. Barnet, J. Liu, M. DeVoe, K. Alperovitz-Bichell, & A. K. Duggan, 2007; Belzer, Sanchez, Olson, Jacobs, & Tucker, 2005; Cherniss & Herzog, 1996; Elster, Lamb, Tavare, & Ralston, 1987; Field, Widmayer, Greenberg, & Stoller, 1982; F. F. Furstenberg Jr, G. S. Masnick, & S. A. Ricketts, 1972; L. Han, S. B. Teal, J. Sheeder, & K. Tocce, 2014; Hardy & Zabin, 1991; Polit, Kahn, & Stevens, 1985; Roye & Balk, 1996; Schreiber, Ratcliffe, & Barnhart, 2010; Stevens-Simon, Dolgan, Kelly, & Singer, 1997; Stevens-Simon, Kelly, & Singer, 1999; Stevens-Simon, Nelligan, & Kelly, 2001; Templeman, Cook, Goldsmith, Powell, & Hertweck, 2000), most interventionists counseled teen mothers on contraception and STDs to reduce repeat pregnancy/birth (*k*=13, 72%) followed by giving participants access to contraception (*k*=11, 61%). Interventions were delivered to teen mothers once (*k*=4, 22%), in weekly sessions (*k*=4, 22%), or on a varied schedule (*k*=4, 22%). The length of interventions varied from one session (s=6) to 3.5 years (*s*=1). Most interventions were delivered in health care settings (*k*=10).

Physicians/midwives (*k*=3) or graduate students/paraprofessionals/volunteers (*k*=3) were often the interventionists.

The most common intervention approach in MA15-35 (*k*=41) (Akers & Mince, 2008; Beth Barnet, Jiexin Liu, Margo DeVoe, Kari Alperovitz-Bichell, & Anne K. Duggan, 2007; Barnet et al., 2009; Black et al., 2006; Cherniss & Herzog, 1996; Dickens, Mudd, Garcia, Tomar, & Wright, 1973; Elster et al., 1987; Field et al., 1982; Frank F. Furstenberg Jr, G. S. Masnick, & Susan A. Ricketts, 1972; Leo Han, Stephanie B. Teal, Jeanelle Sheeder, & Kristina Tocce, 2014; Hardy & Zabin, 1991; Havens, Wagstaff, Mercer, Longeway, & Gutman, 1997; Jekel, Klerman, & Bancroft, 1973; Katz et al., 2011; Kelsey, 2000; Janice D Key, Gebregziabher, Marsh, & O'Rourke, 2008; Kitzman et al., 1997; Deborah Koniak-Griffin et al., 2002; D. Koniak-Griffin et al., 2003; Lie & Moroney, 1992; Maynard, Nicholson, & Rangarajan, 1993; Nelson, Key, Fletcher, Kirkpatrick, & Feinstein, 1982; O'Dell, Forke, Polaneczky, Sondheimer, & Slap, 1998; O'Sullivan & Jacobsen, 1992; Polit et al., 1985; Quint, Bos, & Polit, 1997; Roy, 2006; Sangalang, Barth, & Painter, 2006; Scott et al., 2004; Setzer & Smith, 1992; Singletary, 2005; Solomon & Liefeld, 1998; Stevens-Simon et al., 1997; Stevens-Simon et al., 1999; Stevens-Simon et al., 2001; Westwood, 2003) was contraceptive/STD counseling (*k*=31, 76%); parent training ranked second in frequency (*k*=30, 73%). Interventions varied tremendously in the number of sessions and intervention length. Interventionists included multidisciplinary teams (*k*=9, 22%) or para-professionals, graduate students, or volunteers (*k*=10, 24%). Thirteen programs (32%) were home-based while 11 (27%) were delivered in health care settings. Many reports lacked information on interventionist training (*k*=24, 59%).

For MA36-60 (*k*=12) (Akers & Mince, 2008; Badger, 1981; Bos & Fellerath, 1997; Britner & Reppucci, 1997; Drayton, Montgomery, Modeste, Frye-Anderson, & McNeil, 2000;

Frank F. Furstenberg Jr et al., 1972; Leo Han et al., 2014; Janice D. Key, Barbosa, & Owens, 2001; Lewis, Faulkner, Scarborough, & Berkeley, 2012; Quint et al., 1997; Salihu et al., 2011; Solomon & Liefeld, 1998), contraceptive/STD counseling (*k*=10, 83%) was the most common approach followed by parental training (*k*=8, 67%). Interventions were mainly delivered in weekly sessions (*k*=4, 44%), in health care settings (*k*=3, 33%), and by social workers (*k*=3, 33%). Information about interventionist training was rarely reported (*k*=3, 25%).

Effect of Interventions on Repeat Pregnancy/Birth less than 15 Months after Birth

The summary ES of MA<15 (*k*=18) was moderate with an OR of 0.44 (95% CI: 0.29, 0.68; *p*=0.00) with significant heterogeneity ($Q_{(18)}$=45.17, *p*=0.00; I^2=62.36) (Figure 2). A 56% reduction in repeat pregnancy/birth was observed for teen mothers in intervention versus control/comparison groups. Although only 6 of 18 comparisons showed a significant ES, the forest plot indicated that the majority of interventions tended to reduce repeat pregnancy/birth relative to control/comparison groups. Significant heterogeneity suggested moderator analyses.

Interventions were significantly more effective when participants were recruited before (ES=0.62) versus after delivery (ES=0.18). Studies reporting higher quality indicators showed greater ESs than studies without these indicators [e.g., random assignment vs non-random (0.77 vs. 0.28), power estimation vs non-estimation (2.14 vs. 0.36), and intention-to-treat vs per-protocol (1.19 vs. 0.34)] (Table 3). Every percentage increase in attrition of the control/comparison group significantly increased ES by 0.04. None of the intervention characteristics (e.g., intervention setting, intervention length, interventionists, and interventionist training) showed significant ESs (Table 4). Only one intervention combination showed significant effects. Groups who had access to contraceptives, counseling, and LARC resulted in an OR of .112 (*k*=3) compared to the OR of .563 (*k*=15) for those who did not get

this combination of interventions (p=.003). This comparison finding should be interpreted conservatively because there were only three studies conducted to test this intervention combination.

Effect of Interventions on Repeat Pregnancy/Birth between 15 and 35 Months

The summary ES for MA15-35 (k=41) showed a medium effect and 36% reduction in repeat pregnancy/birth for those receiving an intervention compared to control/comparison groups (OR=0.64, 95% CI: 0.54, 0.76; p=.00; Figure 3). The heterogeneity test was significant (Q=139.93, p=.00; I^2=71.41). While only 11 comparisons had significant ESs, intervention groups had better outcomes than control/comparison groups overall.

Moderator analyses (Table 3) showed that significantly greater ESs were observed among unpublished (1.07) than published studies (0.58) and among studies with random assignment vs those without (0.82 vs. 0.41) and power estimation vs non-estimation (0.98 vs. 0.59). ESs were higher (0.21) when teen mothers' mean age was higher. Interventions which included graduate students or para-professionals (ES=0.85) demonstrated a higher ES than other interventionists (ES=0.60). There was no moderator effect for attrition (Table 4). Again, one intervention combination showed significant effects. Groups who had access to contraceptives, counseling, and LARC resulted in an OR of .166 (k=2) compared to the OR of .723 (k=39) for those who did not get this combination of interventions (p=.000). As before, this comparison should be interpreted conservatively.

Effect of Interventions on Repeat Pregnancy/Birth between 36 and 60 Months

The studies tracking repeat pregnancy/birth between 36 to 60 months post-interventions (k=12) showed a medium ES with an OR of 0.4 (95% CI: 0.25, 0.65; p=.00; Q=181.76, p=.00; I^2=93.95) showing a 60% reduction (Figure 4). Unpublished studies showed higher ESs (1.1)

than published studies (0.29). Studies with participants recruited from welfare agencies (ES=1.1) showed higher ESs than those recruited from other sites (ES=0.22; Table 3). For every percentage increase in attrition of the control/comparison group ES significantly decreased by 0.02 (Table 4). Once again, one intervention combination showed significant effects. Groups who had access to contraceptives, counseling, and LARC resulted in an OR of .024 (k=1) compared to the OR of .588 (k=11) for those who did not get this combination of interventions (p=.000). As before, this comparison finding should be interpreted cautiously.

Risk of Publication Bias

MA<15 showed no evidence of publication bias. For MA15-35, results suggested minimal publication bias; that is, the funnel plot showed mild asymmetry, reflecting that no small studies with negative findings were included.

The Begg and Mazumdar Rank test showed a Kendall's tau of -0.09 (p=.39, 2-tailed) and Egger's regression intercept suggested mild publication bias with the intercept of -1.61 (95% CI: -2.36, -0.87, $t_{(39)}$=4.39; p=.00, 2-tailed). Publication bias was evident in MA36-60. The funnel plot showed asymmetry, reflecting that small studies of negative results were not included. The Begg and Mazumdar Rank test showed a Kendall's tau of -0.47 (p=.03, 2-tailed), and Egger's regression intercept had an intercept of -14.49 (95% CI: -6.68, -2.3, $t_{(10)}$=4.57; p=.00, 2-tailed). This suggests that findings should be interpreted cautiously.

Discussion

Poor outcomes attributed to early childbearing galvanized interest in programs to improve maternal-child outcomes and prevent subsequent births. We used meta-analytic techniques to examine the effectiveness of programs to reduce repeat pregnancy/birth among teen mothers at different follow-up periods. Based on an exhaustive search, we retrieved 47

studies giving us 52 comparisons; this yield represents a substantial increase in primary studies over previously published MAs (Baytop, 2004; Corcoran & Pillai, 2007; Whitaker et al., 2016). For example, our search includes 47 reports from studies published between 1972-2014; Baytop (2004) included 32; Corcoran and Pillai (2007),16; and Whitaker et al. (2016), 12 primary studies. The relatively small sample in the latter study is likely explained by the exclusion of quasi-experimental studies and studies published before 1995.

Overall, the summary ES for each of the three time periods (<15 months after the first birth, 15-35 months, and 36-60 months) was moderate and ranged between odds ratios of 0.40 and 0.64 (p=0.00) with significant heterogeneity. In general, our findings were consistent with Baytop (2004) and Corcoran and Pillai's (2007) MAs supporting moderate intervention effectiveness.

As might be expected, results varied across follow-up periods. For example, Corcoran and Pillai (2007) found that interventions were moderately effective at 19.13 months but were no longer effective at 31 months, while Baytop (2004) found no effect when length of follow-up was used as a moderator. Whitaker et al. (2016) concluded that home-based interventions were effective in reducing teen birth (but not pregnancy) but the effect disappeared by 24 months. In our study, effectiveness did not decline over time. However, while our findings were consistent with these prior MAs in showing that intervention effects decreased by 35 months, we found contrary results beyond 35 months. That is, we observed a 56% reduction in repeat pregnancy/birth for intervention teen mothers before 15 months, a 36% reduction between 15 and 35 months, and at 36 to 60months the effects bounced up to a 64% reduction in repeat pregnancy/birth. One explanation for our findings across time may be that the teens who were at highest risk conceived in the first 15 months after the prior birth, and were counted as a

pregnancy/birth during that time or in the 15-35 follow-up. Thus, the more highly focused teens would remain in the long-term follow-up samples. At least a portion of the teens who avoided pregnancy following a birth may eventually welcome another child as they age. This may be one explanation for the significant positive findings for age as a moderator; older teens were likely to have a second pregnancy/birth during 15-35 months (see Table 4).This is especially the case for teens who face slim prospects for furthering their education or gaining meaningful work (Whitaker et al., 2016).

Coding decisions also affect results. We followed the example of Baytop (2004) for coding the outcomes of repeat pregnancy and birth. When researchers of primary studies reported both outcomes, we used repeat pregnancy outcome data. If researchers reported repeat birth, we coded that outcome. We could not determine how Corcoran and Pillai (2007) (who focused on repeat pregnancy) coded outcome when repeat birth was the sole outcome in primary studies or when primary studies measured both outcomes. Whitaker et al. (2016) coded for repeat pregnancy and birth separately. Furthermore, we could not determine how Corcoran and Pillai (2007) and Whitaker et al. (2016) dealt with studies that had more than one treatment group and only one control group. For studies with more than one treatment group, Baytop (2004) selected the most effective intervention for analysis. This decision would eliminate studies that met inclusion criteria while biasing results toward higher ESs.

Participant Characteristics

Maternal age was the sole participant characteristic that showed moderator effect, and only in MA15-35, which included considerably more primary studies. We found that older teens were more likely to benefit from the interventions than younger teens. Baytop (2004) reported the converse: interventions were more effective for 16-17 versus 18-year-old teens. It is likely

that these divergent findings reflect the larger sample of comparisons in our study (42 in our study versus 18 RCTs and 14 non-RCTs in the Baytop [2004] study). In addition, the limited age range in the Baytop MA likely dampened statistical findings. We also found that programs were no more effective in preventing repeat pregnancy/birth for teens based on high versus low income, whereas Corcoran and Pillai (2007) reported that higher income teens were more likely to benefit from interventions than lower income teens.

While some researchers reported that attrition varied tremendously (Corcoran & Pillai, 2007) or was high across studies (Baytop, 2004), they did not examine attrition as a moderator. We found that attrition had moderator effects for the control/comparison groups only at MA<15 and MA36-60 (Table 4).

Intervention Characteristics

With one exception, researchers used more than one intervention approach; interventionists counseled, supported, and educated teen mothers on a range of issues including parenting, schooling, and contraception, and linked them to community resources to improve their health and education, and to reduce repeat pregnancy/births. Baytop (2004) and Corcoran and Pillai (2007) concluded that no particular intervention approach was more effective than others. As described earlier, we did not examine intervention approaches as moderators because approaches may operate synergistically. However, we did examine other intervention characteristics as moderators (e.g. recruitment timing, and intervention setting, length, intensity, and interventionist). Interventions were only effective for teen mothers enrolled during pregnancy and only for repeat pregnancies up to 15 months after birth (MA<15). Baytop (2004) found that interventions were more effective for teen mothers who were enrolled during pregnancy or within 6 months of the birth versus those who were enrolled 6 months after birth.

Intervention length and intensity varied tremendously across studies; neither of these characteristics showed an effect in this or prior MAs.

Interventions were delivered at homes, schools, community agencies, health care settings, or at multiple sites. When examined as a moderator, we found intervention setting to have no effect. While other researchers did not examine intervention setting as a moderator, Whitaker et al. (2016) compared home-based (s=4) to community-based interventions (s=2) and telephone interventions (s=1). Only home-based interventions were effective in reducing teen births but this conclusion was based on few primary studies

Method Characteristics

Our results differ from prior MAs when examining quality indicators of the primary studies. We unexpectedly found that studies using randomization and power estimation were more effective than studies not using these techniques in MA<15 and MA15-35, but not MA36-60. We would expect greater ESs in MA<15 and MA15-35 because researchers aimed for the appropriate sample size, but not in MA36-60 because researchers of only two primary studies reported power estimation. Five research teams in MA36-60 randomly assigned participants to groups. Contrary to our findings, Baytop (2004) reported that RCTs showed no effect, while non-RCTs showed a strong effect. Corcoran and Pillai (2007) also suggested that better quality studies had lower overall effect but ESs and quality indicators were not provided. Whitaker et al. (2016) excluded non-RCTs.

Future Research

Our findings have several implications for designing future interventions. Researchers need to carefully describe participant, method, and intervention characteristics of their studies. The lack of detail regarding the background characteristics of participants, intervention intensity, and attrition, to name a few, limited the usefulness of moderator analysis. Retaining

teen mothers in studies is challenging but critical (South-Paul et al., 2014). Reporting outcomes for common follow-up periods (e.g., 1, 2, and 3 years post-birth) would permit researchers to pool studies with greater precision. Addressing these issues would bolster the evidence provided in future meta-analyses.

Only eight (6.5%) of the 52 comparisons in this study included emotional or psychological counseling. The lack of attention to maternal mental health is a significant omission because psychological distress is prevalent among teen mothers (SmithBattle & Freed, 2016) and contributes to repeat pregnancy (Patchen et al., 2009). Even though teen mothers' partners and parents shape fertility decisions and contraceptive use, researchers designed few interventions to address issues with these significant players. This neglect overlooks the role that partners and parents play in repeat childbearing (Crittenden et al., 2009; Raneri & Wiemann, 2007) and teen mothers' mental health (SmithBattle & Freed, 2016). For example, teen mothers whose parents take over the care of the first child sometimes desire another pregnancy to have a child of their own (SmithBattle, 1996). Strained or severed relationships between teen mothers and their children's fathers may factor into the fathers' search for another child and high rates of multi-partner fertility (Dallas, 2013). To date, co-parenting interventions for teens have not addressed repeat childbearing (Florsheim et al., 2012).

We did not examine the effects of individual intervention approaches because we believe approaches operate synergistically. And, in only one of our primary studies did the researchers use a single intervention approach. We addressed synergy as best we could by combining intervention approaches as a moderator; for example, interventions providing access to contraception, counseling, and LARC were more effective at each time period (MA15,

MA15-35, MA36-60) than interventions that did not provide this combination. However, these results should be interpreted with caution due to the small number of studies that tested this combined intervention. Nonetheless, this combined approach may provide a fertile area for future research. In addition to testing combinations, future researchers might conduct comparative effectiveness studies to determine the most effective set of approaches.

A related issue is the lack of fidelity reporting between how interventions were planned and how they were delivered. In addition, few researchers tracked teens' participation in the various intervention approaches. Future researchers might include this level of data collection.

Klerman's (2004) narrative review suggested that more effective interventions strengthened the relationship between the teen mothers and interventionists. No researchers of the primary studies coded teen mother-interventionist relationship as a moderator. We reasoned that stronger relationships may occur when interventionists are trained to tailor programs to individual teen mothers. We therefore coded for tailored interventions when researchers reported that staff were trained to address teen mothers' goals and circumstances; only five primary studies met this criteria. Furthermore, we recommend that future researchers consider designing interventions that are better aligned with teen mothers' perspectives and complex realities in light of some evidence that tailored interventions improve retention and outcomes (O'Brien et al., 2012). Finally, researchers might consider making a concerted effort to follow recruited participants even after dropout since teen dropouts may be at highest risk. Using intention-to-treat analysis would provide a more comprehensive understanding of interventions for these teens (Klerman, 2004).

Strengths and Limitations

Our search was systematic and exhaustive. Nevertheless, we may have missed studies which may introduce bias, typically small studies with non-significant results. We also contacted researchers to obtain missing data and received a few responses.

Heterogeneity is common in this MA given the wide variation in primary studies. Thus, we conducted moderator analyses to examine the effects of participant, intervention, and method characteristics. Heterogeneity is compounded by missing or inadequately described data. Thus, moderator analyses may be of limited value when researchers omit information about the moderators. More than a decade ago, Baytop (2004) and Corcoran and Pillai (2007) noted that missing data was a significant limitation in their studies. This issue has not been rectified; in fact, we excluded four studies because key information was missing. Because teens who drop out of interventions do not receive the interventions' full effects, they are considered to be at high risk for repeat pregnancy/birth (South-Paul et al., 2014). Thus, attrition is a potential source of bias and when it is reported, attrition is often high. To make matters worse, attrition is infrequently reported in primary studies. To remedy this issue, we calculated attrition rates and found that attrition had a small effect in two of the three MAs but only for the control group (see Table 4). Attrition moderator effects should be interpreted with caution because the teens who dropped out, presumably with the highest risk for repeat pregnancy/birth, were likely not considered in study outcomes. Finally, the wide variation in reported follow-up periods across studies limited our ability to pool studies with greater precision.

Conclusion

While the repeat teen birth rate has declined since the 1950s (Ventura et al., 2014), almost 1 in 5 teen mothers have another child before age 20 (Gavin et al., 2013). We analyzed 47 studies with 52 comparisons to show that interventions had moderate effects in reducing

repeat pregnancy/birth for as long as 60 months after a prior pregnancy/birth. Our results are somewhat consistent with two prior MAs. Because moderator analyses were of limited value, it remains unclear which programs, or combination of intervention approaches, had the greatest effect for which teens and under what circumstances. To address these issues, researchers are called to test the effectiveness of future interventions using strong designs and approaches aligned with teen mothers' perspectives and social contexts. We also suggest measuring intervention fidelity, tracking teens lost to attrition, and using intention-to-treat analysis when teens are lost to follow-up. Gaining consensus on measurement issues and common follow-up periods would improve the prospects for pooling studies to address the key question: Which teen mothers, and under what circumstances, postpone having another child?

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Figure 1. Flowchart of the Articles Reviewed

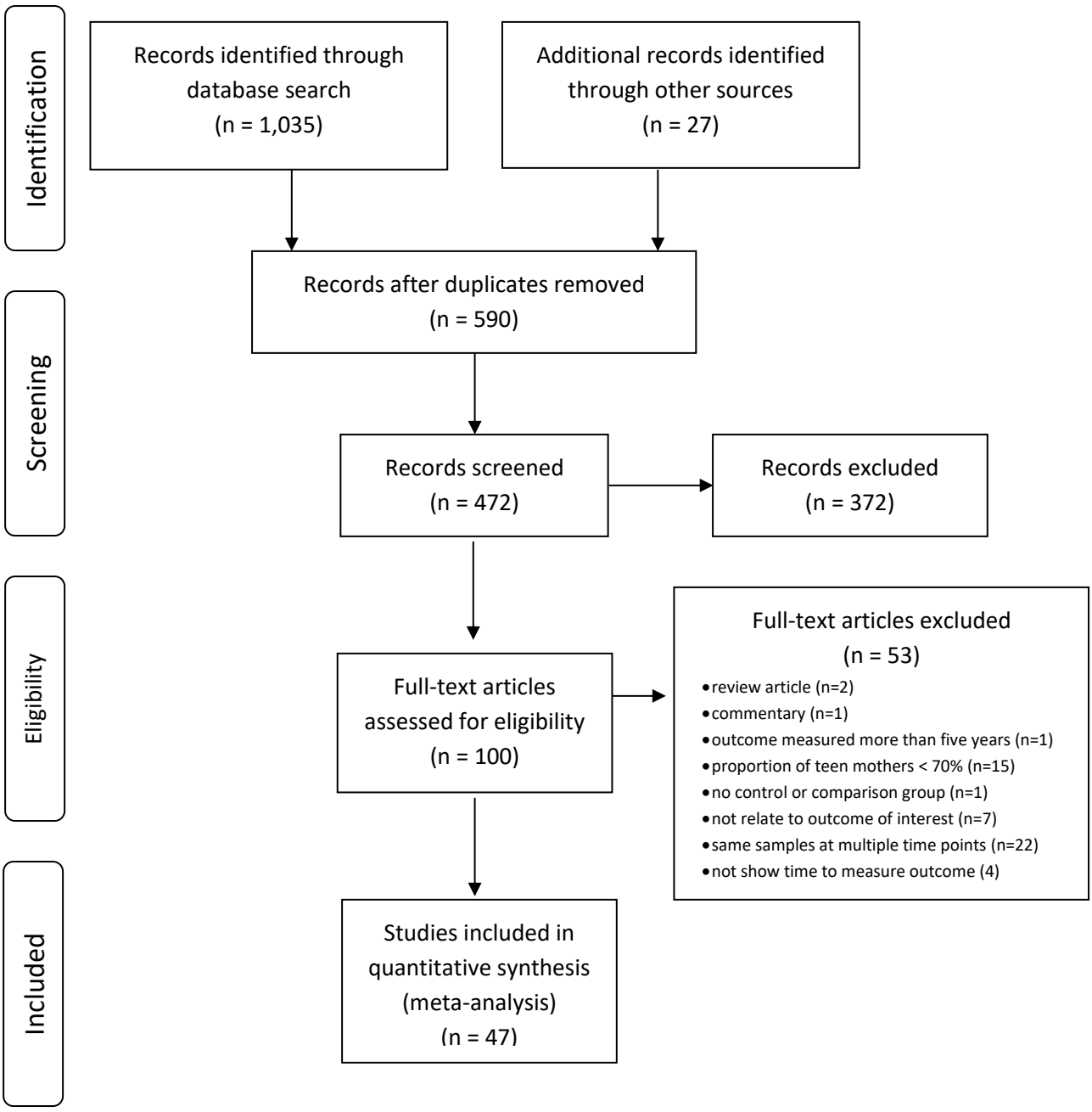


Table 1 Summary of Studies

Study	Year	Treatment (n)	Control (n)	Mean age	Setting for Intervention	Length of Intervention (in months)	Intervention approaches	Outcomes	
								Main	Other
Furstenberg et al.	1972	242	162	NR	Health care setting	3	3 1 13	preg	3
Dickens et al.	1973	50	50	NR	Health care setting	NR	3 4 10 11 12 13	preg	1, 3, 10
Jekel et al.	1973	180	160	NR	various places (no primary site)	NR	4 1 13	preg	1, 5, 10
Badger	1981	24	24	NR	Health care setting	12	3 4 7 12 15	preg, birth	No
Field et al.	1982	40	20	16.3	Nursery or Day care	6	1 3 6	preg	2, 4
Field et al.	1982	40	20	16.3	Home	6	3 7	preg	2, 4
Nelson et al.	1982	35	70	NR	Health care setting	18	3 4 5 9 10 12 13	preg	1, 2, 3
Polit et al.	1985	305	370	16.4	various places (no primary site)	12	3 4 12 15	preg, birth	1, 3, 5
Elster et al.	1987	125	135	16.6	Health care setting	NR	3 10 11 12 13	preg	1, 2, 10
Hardy & Zabin	1991	NR	NR	NR	various places (no primary site)	24	1 2 4 10 12 13 15	preg, birth	1, 2, 3, 5
Lie & Moroney	1992	50	50	17.6	various places (no primary site)	24	1 2 3 4 5 6 12 13 15	birth	1, 2, 3, 4, 5, 8, 10
O'Sullivan & Jacobsen	1992	120	123	NR	Health care setting	18	3 1 13	preg	1, 2
Setzer & Smith	1992	174	165	16	School	NR	3 4 12 13	birth	1, 7
Maynard et al.	1993	2,647	2,650	18.4	Home, Community agency & other	NR	1 2 3 4 5 6 12 15	preg, birth	1, 2, 3, 4, 5
Cherniss & Herzog	1996	58	58	17.1	Home	10.4	2 5 10 11	preg	1, 2, 5, 8
Roye & Balk	1996	NR	NR	15.92	Health care setting	12	11	preg	1, 4
Bos & Fellerath	1997	3,479	672	NR	NR	NR	2 6 15	birth	1, 5, 6
Britner & Reppucci	1997	125	96	NR	NR	12	3 8 12	birth	1, 2
Havens et al.	1997	53	57	16.5	various places (no primary site)	24	3 5 12	preg	1, 4
Kitzman et al.	1997	228	515	NR	Home	24	3 9 12 15	preg, birth	1, 2, 4, 5, 7, 10
Quint et al.	1997	1,401	678	18.8	NR	42	1 2 3 4 12 13 15	preg, birth	1, 2, 3, 4, 5, 6, 10
Steven-Simon et al.	1997	107	18	NR	Health care setting	24	6 1 13 15	preg	No

Study	Year	Treatment (n)	Control (n)	Mean age	Setting for Intervention	Length of Intervention (in months)	Intervention approaches	Outcomes	
								Main	Other
Steven-Simon et al.	1997	101	18	NR	Health care setting	24	6 1	preg	No
Steven-Simon et al.	1997	24	18	NR	Health care setting	0.03	12 1 15	preg	No
O'Dell et al.	1998	111	50	17.8	Health care setting	0.03	12 1	preg	3
Solomon & Liefeld	1998	34	29	NR	various places (no primary site)	NR	2 3 11 15	preg	1
Steven-Simon et al.	1999	171	138	NR	Health care setting	24	12 1 14	preg	No
Drayton et al.	2000	104	178	NR	NR	24	1 1 13	preg	1, 3, 5
Kelsey	2000	1,104	1,292	18.2	Home	NR	1 2 3 5 6 12 15	preg, birth	1, 3, 5, 10
Templeman et al.	2000	76	46	16.19	Health care setting	0.03	12 1	preg	3
Key et al.	2001	50	255	NR	School	24	2 3 4 7	birth	1
Steven-Simon et al.	2001	84	87	17.5	Home	24	2 3 9 12 13	preg	1, 2, 3
Sims & Luster	2002	48	51	16.2	Home	24	2 3 3 12 13 15	preg, birth	No
Koniak-Griffin et al.	2003	55	47	16.78	Home	24	2 3 5 10 11 12	preg, birth	1, 2, 4, 10
Westwood	2003	74	54	NR	School	NR	1 3 4 5 15	birth	1, 5, 8
Scott et al.	2004	102	64	16.95	School, Phone	12	2 3 4 12	preg	1, 4
Scott et al.	2004	72	64	16.95	School, Phone	12	2 3 4	preg	1, 4
Belzer et al.	2005	82	78	17.2	NR	0.03	12 1	preg	3
Singletary	2005	52	258	NR	Home	24	2 3	preg	1, 2
Black et al.	2006	70	79	16.3	Home	12	3 1 12 13	birth	3, 4
Roy	2006	264	94	NR	Home	NR	3 1	birth	1, 2
Sangalang et al.	2006	1,260	1,260	NR	various places (no primary site)	NR	2 10 11 12 13	birth	2, 7, 10
Barnet et al.	2007	44	40	16.9	Home	24	2 3 10 12 13	preg, birth	1, 3, 4
Akers & Mince	2008	49	39	NR	Home & Community agency	24	2 3 11 12 13 15	preg	1
Key et al.	2008	69	252	16	various places (no primary site)	NR	2 3 4 7 9 12 13	birth	6
Barnet et al.	2009	80	34	17	Home	22.5	2 3 10 12	birth	3, 6, 10
Barnet et al.	2009	87	34	17	Home	22.5	10 1	birth	3, 6, 10

Study	Year	Treatment (n)	Control (n)	Mean age	Setting for Intervention	Length of Intervention (in months)	Intervention approaches	Outcomes	
								Main	Other
Schreiber et al.	2010	23	27	17.6	Health care setting	0.03	12 1 14	preg	No
Katz et al.	2011	124	125	17.5	Phone	18	3 4 9 10 11 12	preg	No
Salihu et al.	2011	3,155	190,397	NR	Home	NR	2 3 12	birth	No
Lewis et al.	2012	86	58	NR	NR	36	2 1	birth	3, 8
Han et al.	2014	171	225	NR	Health care setting	0.03	12 1 14	preg	3, 6

Note: *Intervention Approaches:* 1=job training, 2=case management, 3=parent training, 4=schooling, 5=emotional/psych counseling, 6=monetary payment, 7=provide child development materials (toys, books), 8=provide baby materials (i.e., diapers, wipes, layette), 9=promote teen mothers' goal, 10=involve or address issues with partner, 11=involve or address issues with grandparents, 12=contraceptive/ STI counseling, 13=access to contraception, 14=LARC (implant, IUD) or emergency contraception (EC), 15=transportation Other *outcomes:* 1=maternal schooling, 2=child outcome, 3=contraceptive practice/STD prevention, 4=maternal mental health/substance use, 5=maternal employment, 6=cost, 7=prenatal visit, 8=social support, 9=access to primary care, 10=other.

NR = not report

Table 2 Characteristics of Primary Studies Included in Meta-analysis

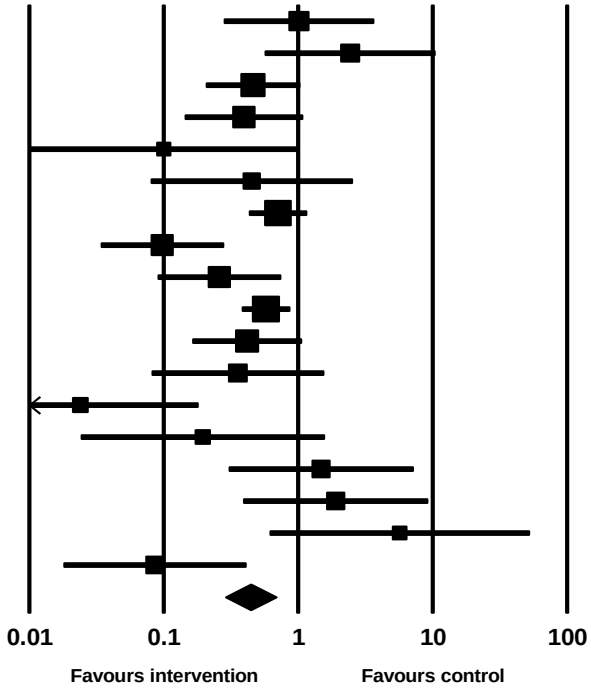
Characteristic	*k*	Minimum	Q_1	Median	Q3	Maximum
Mean age (years)	27	15.92	16.30	16.95	17.5	18.80
Proportion of teen mothers	47	70	100	100	100	100
Meta-analysis <15 months						
Total sample size per study	17	37	62	115	158	675
Number of participants in treatment group	17	18	36	75	97	305
Number of participants in control group	17	14	18	48	87	370
% African-American participants	13	0	28.07	47.54	90.48	100
% White participants	10	0	4.41	17.97	49.66	80
% attrition in treatment groups[a]	16	0	0.43	10.26	17.84	47.56
% attrition in control groups[a]	16	0	0	13.54	20.83	38.52
Meta-analysis 15-35 months						
Total sample size per study	39	37	98	120	310	3844
Number of participants in treatment group	41	23	42	70	135	1928
Number of participants in control group	41	14	34	54	145	1916
% African-American participants	33	0	36.72	64.65	93.11	121.48
% White participants	28	0	4.41	12.65	30.25	80
% attrition in treatment groups[a]	39	0	0	8.57	27.16	64.49
% attrition in control groups[a]	39	0	0	10.49	25.64	75.54
Meta-analysis 36–60 months						
Total sample size per study	12	28	81	247.5	495.25	193552
Number of participants in treatment group	12	15	46	83.5	269.75	3155
Number of participants in control group	12	13	31.25	128	308	190397
% African-American participants	9	35.61	52.28	55.36	95.02	150
% White participants	5	18.18	18.69	22.46	39.22	50
% attrition in treatment groups[a]	11	0	0	16.34	36.05	87.18
% attrition in control groups[a]	11	0	0	10.49	45.83	58.33

Note: *k*=number of studies providing data on characteristics; Q_1 = first quartile; Q_3 = third quartile

[a] = Attrition generally not reported; calculated as ((baseline n - analysis n)/baseline n) x 100.

Figure 2. Forest Plot of Individual and Overall Intervention Effects on Reducing Repeat Pregnancy/Birth, <15 Months

Study name	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value	Events / Total: Treament	Events / Total: Control
Barnet et al. (2007)	1.014	0.283	3.638	0.021	0.983	7 / 36	5 / 26
Belzer et al. (2005)	2.432	0.569	10.396	1.199	0.230	6 / 43	3 / 48
Cherniss & Herzog (1996)	0.461	0.208	1.024	-1.901	0.057	14 / 57	24 / 58
Elster et al. (1987)	0.394	0.144	1.076	-1.817	0.069	6 / 75	15 / 83
Field et al. (1982_1)	0.100	0.010	0.975	-1.982	0.048	1 / 36	4 / 18
Field et al. (1982_2)	0.452	0.081	2.523	-0.906	0.365	3 / 34	3 / 17
Furstenberg et al. (1972)	0.707	0.434	1.151	-1.394	0.163	46 / 211	41 / 145
Han et al. (2014)	0.098	0.034	0.278	-4.353	0.000	4 / 153	44 / 204
Hardy & Zabin (1991)	0.259	0.091	0.740	-2.524	0.012	6 / 87	12 / 54
Polit et al. (1985)	0.576	0.384	0.864	-2.665	0.008	43 / 305	82 / 370
Roye & Balk (1996)	0.417	0.165	1.055	-1.847	0.065	*	*
Schreiber et al. (2010)	0.356	0.082	1.546	-1.378	0.168	3 / 23	8 / 27
Steven-Simon et al. (1999)	0.024	0.003	0.179	-3.634	0.000	1 / 171	26 / 132
Steven-Simon et al. (2001)	0.195	0.024	1.566	-1.538	0.124	1 / 33	12 / 87
Steven-Simon et al. (1997_1)	1.481	0.307	7.149	0.489	0.625	18 / 97	2 / 15
Steven-Simon et al. (1997_2)	1.900	0.394	9.169	0.799	0.424	19 / 84	2 / 15
Steven-Simon et al. (1997_3)	5.688	0.618	52.336	1.535	0.125	7 / 23	1 / 14
Templeman et al. (2000)	0.086	0.018	0.409	-3.084	0.002	2 / 76	11 / 46
Summary random effect	0.444	0.288	0.684	-3.686	0.000		



*Group sample sizes were not reported. (We computed the odds ratio by using p-value, total sample size, effect size, and effect direction.)

Figure 3. Forest Plot of Individual and Overall Intervention Effects on Reducing Repeat Pregnancy/Birth, 16-35 Months

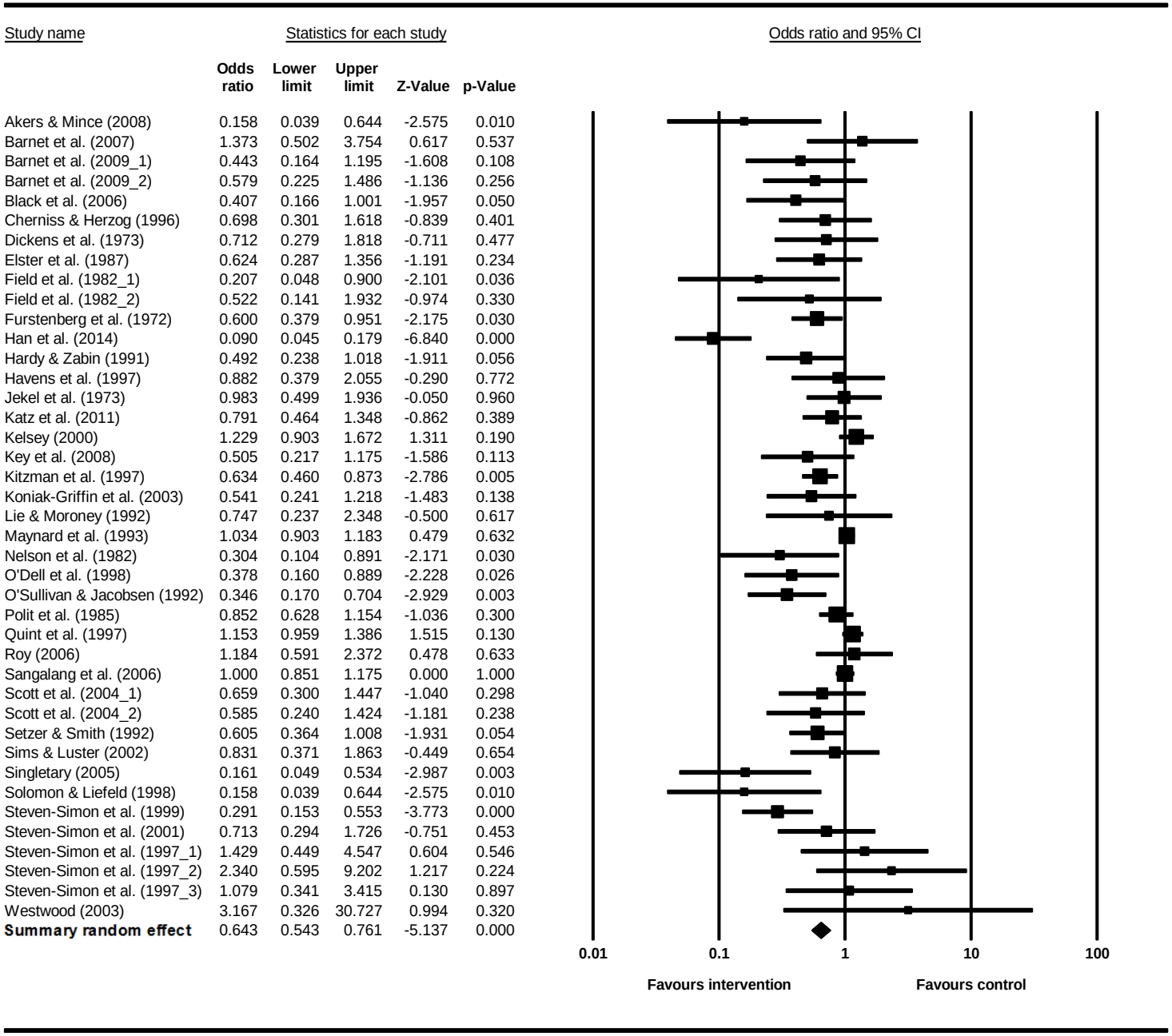


Figure 4. Forest Plot of Individual and Overall Intervention Effects on Reducing Repeat Pregnancy/Birth, 36-60 Months

Study name	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value	Treament	Control
Akers & Mince (2008)	0.099	0.031	0.316	-3.899	0.000	7 / 34	21 / 29
Badger (1981)	0.263	0.051	1.355	-1.597	0.110	7 / 15	10 / 13
Bos & Fellerath (1997)	1.052	0.783	1.414	0.339	0.735	119 / 446	120 / 467
Britner & Reppucci (1997)	0.546	0.247	1.205	-1.498	0.134	23 / 80	17 / 40
Drayton et al. (2000)	0.386	0.227	0.657	-3.510	0.000	32 / 87	104 / 173
Furstenberg et al. (1972)	0.996	0.652	1.520	-0.020	0.984	106 / 211	73 / 145
Han et al. (2014)	0.024	0.011	0.051	-9.467	0.000	22 / 124	100 / 111
Key et al. (2001)	0.108	0.033	0.355	-3.660	0.000	3 / 50	95 / 255
Lewis et al. (2012)	0.430	0.153	1.210	-1.598	0.110	9 / 55	10 / 32
Quint et al. (1997)	1.131	0.919	1.393	1.162	0.245	1054 / 1401	494 / 678
Salihu et al. (2011)	1.466	1.318	1.632	7.007	0.000	391 / 3155	16751 / 190397
Solomon & Liefeld (1998)	0.278	0.092	0.839	-2.272	0.023	7 / 34	14 / 29
Summary random effect	0.401	0.247	0.653	-3.672	0.000		

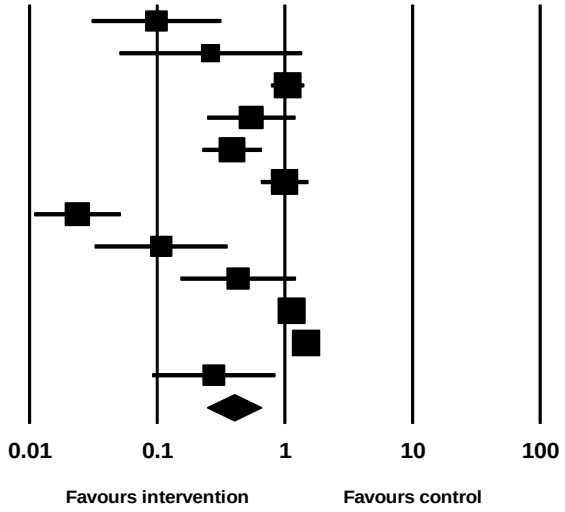


Table 3. Dichotomous Moderator Results for Repeat Pregnancy/Birth: Treatment vs. Control at Outcome for Each Time Period

Moderators	**Coded values**	k_0	k_1	ES_0	ES_1	I^2_0	I^2_1	Q_B	Q_w
Meta-analysis <15 months									
Participant status at recruitment	0 = at pregnancy, 1 = within one month of delivery	4	7	0.62	0.18	0	0	13.39**	7.16
Random assignment	0 = no, 1 = yes	8	10	0.28	0.77	73.64	41.28	5.21*	41.88**
Power estimation	0 = no, 1 = yes	15	3	0.36	2.14	60.68	0	10.27*	36.58*
Intention to treat	0 = no, 1 = yes	13	5	0.34	1.19	64.73	19.49	7.37*	38.99*
Meta-analysis 15-35 months									
Publication status	0= not published, 1= published in journals or books	6	35	1.07	0.58	58.96	64.17	16.6**	107.07**
Random assignment	0 = no, 1 = yes	12	20	0.41	0.82	78.17	54.04	8.53*	91.74**
Power estimation	0 = no, 1 = yes	34	7	0.59	0.98	73.8	56.41	4.68*	139.71**
Recruitment site	0 = not health setting, 1 = Health setting	19	22	0.93	0.47	34.63	60.42	17.98**	806**
Interventionist	0 = not graduate or para-professional 1 = graduate or para-professional	31	10	0.60	0.85	76.61	21.65	4.89*	139.75**
Meta-analysis 36–60 months									
Publication status	0= not published, 1= published in journals or books	2	10	1.1	0.29	0	95.03	9.77*	120.19**
Recruitment site	0 = health setting, 1 = welfare agency	6	2	0.22	1.1	93.39	0	5.23*	74.81**

Note: k_0=number of studies providing data in group coded 0, k_1=number of studies providing data in group coded 1, ES_0=effect size of coding 0, ES_1=effect size of coding 1, I^2_0=quantification of impact of heterogeneity coding 0, I^2_1=quantification of impact of heterogeneity coding 1, Z=Z-test, p(Z) = p-value of Z-test, Q_B=heterogeneity statistics between group, Q_W =heterogeneity statistics combined within groups.

*p < .05, **p < .00

Table 4. Continuous Moderator Analyses: Treatment vs. Control at Outcome for Each Time Period

Moderator	*k*	Slope	*SE*	Tau^2	Q_{model}	*p*(slope)
Meta-analysis <15 months						
Age	8	0.19	0.5	0.12	0.15	0.7
Length of Intervention	18	0.01	0.02	0.5	0.15	0.7
Percent African American	13	0.01	0.007	0.32	1.58	0.21
Percent White	10	-0.01	0.011	0.44	0.75	0.39
Percent Attrition of intervention group[a]	16	0.025	0.018	0.58	1.91	0.17
Percent Attrition of control group[a]	16	0.04	0.02	0.53	4.79	0.03*
Meta-analysis 15-35 months						
Age	22	0.21	0.05	0.00	18.30	0.00*
Length of Intervention	41	0.001	0.008	-0.014	0.01	0.91
Percent African American	33	-0.001	0.003	0.15	0.16	0.67
Percent White	28	-0.003	0.005	0.17	0.00	0.95
Percent Attrition of intervention group[a]	39	0.005	0.005	0.17	1.29	0.26
Percent Attrition of control group[a]	39	0.003	0.005	0.17	0.54	0.46
Meta-analysis 36–60 months						
Length of Intervention	12	0.003	0.021	-0.038	0.02	0.88
Percent African American	9	-0.0002	0.01	0.68	0.00	0.98
Percent White	5	0.053	0.07	3.82	0.53	0.47
Percent Attrition of intervention group[a]	11	0.001	0.01	0.65	0.01	0.92
Percent Attrition of control group[a]	11	-0.021	0.01	20.43	3.97	0.05*

Note: In meta-analysis, only two research teams reported age and meta-regression could not be computed.

[a] = Attrition generally not reported; calculated as ((baseline n - analysis n)/baseline n) x 100.

*$p < .05$