Effectiveness of Secondary Pregnancy Prevention Programs: A Meta-Analysis

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Because subsequent pregnancy in teen parents often worsens the impact of adolescent parenting; therefore, a common goal of teenage parent programs has been to reduce repeat pregnancy. To examine the impact of this goal, a meta-analysis was conducted on 16 control–comparison group studies that evaluated the effect of teenage pregnancy and parenting programs on pregnancy rates. At the first follow-up period at which programs assessed outcome (average 19.13 months), interventions produced a 50% reduction in the odds of pregnancy compared to comparison–control conditions, but by second follow-up (average 31 mos.), the effect had dissipated. Moderator analyses were also performed. Implications are that secondary pregnancy prevention programs are effective in reducing teenage pregnancy—at least at 19 months following the intervention—although there is little to recommend "comprehensive" approaches to programming over others.

Keywords: *adolescent pregnancy; pregnancy prevention; teen parents; secondary prevention; repeat childbearing*

Currently in the United States, the rate of births to teenagers, ages 15 to 19 years, is 43 per 1,000 females (Hamilton, Martin, & Sutton, 2004). This figure represents a 30% decrease since 1991. The rate of births to teens who are already parenting is 8.2 per 1,000 for second births and 1.3 per 1,000 for third births (Martin et al., 2003). Despite the progress that has been made, births to unmarried adolescents still remain higher in the United States than in other developed countries (Henshaw & Feivelson, 2000).

Women who begin childbearing in adolescence face numerous problems during pregnancy and in later life according to reviews of this literature (Corcoran, 1998; Klerman, 2004; Maynard, 1996; Rigsby, Macones, & Driscoll, 1998). Teens who give birth are less likely to complete high school; in turn, educational levels determine the ability and opportunity for higher paying jobs. Higher rates of poverty and welfare dependence for teen parents are the result. Teen parents are also more likely to remain single parents across their adulthood. Single-parent status increases the risk of living in poverty.

Furthermore, there may be health risks to the infant from being born to an adolescent mother. A 20-year study in Utah found that "teenage mothers have a significantly elevated risk of delivering low-birth-weight, premature, and small-for-gestational-age infants . . . even when the analysis is limited to married mothers with age-appropriate educational levels who receive adequate prenatal care" (Fraser, Brockert, & Ward, 1995, p. 1113). Medical services provided to teen parents are more often shouldered by taxpayers in comparison to children born to later childbearers (Maynard, 1996). These higher health care costs contribute to social concerns with adolescent childbearing.

In addition, the parenting behaviors of adolescent mothers may be compromised in terms of less parent-child interaction, especially vocal stimulation, and more punitive attitudes. Indeed, the risk of abuse and neglect is higher among parents who gave birth as teens compared to parents who delayed childbearing even until the age 20 to 21 years. Longitudinal studies indicate that the cognitive

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and behavioral deficits of children of adolescent parents amplify over time in terms of school failure, delinquency and behavior problems, lack of high school completion, early sexual activity, and an increased likelihood of teen parenting (Brooks-Gunn & Furstenberg, 1986; Furstenberg, Brooks-Gunn, & Morgan, 1987; Maynard, 1996).

These economic, psychosocial, medical, and educational outcomes among these women are compounded when young mothers experience repeat pregnancies during their adolescent years (Brown, Saunders, & Dick, 1998; Rigsby et al., 1998).

Researchers, program providers, and policy makers have attempted to interrupt the cycle of early childbearing. Qualitative reviews of programs designed to prevent additional pregnancies and births to teenagers have been reported. Perhaps because of the difficulty of synthesizing this literature, some have not gone beyond descriptions of programs (e.g., Hoyer, 1998) or reporting the results of each study without drawing overall conclusions (Seitz & Apfel, 1999). An exception is Klerman (2004), who conducted a comprehensive review of teenage parent programs that were evaluated using experimental or quasi-experimental designs and were implemented in the year 1980 or later. Different program impacts were examined; however, we only consider the findings for pregnancy/birth rates. Klerman concluded that findings were mixed. Based on statistically significant results, about 50% of the studies were successfully able to affect pregnancy or birth rates for teens and that no one approach or site seemed to outperform another. However, only three of the studies demonstrating statistically significant positive results involved randomized controlled experiments, and rates of subsequent pregnancies and births were still high. Klerman found that in the 2-year follow-up period that was often employed, the methodologically strong research studies failed to reduce the percentage of subsequent births to less than 20% to 25%.

However, a number of limitations are subject when trying to synthesize studies through the use of statistically significant findings alone. Categorizing a study as a success if the experimental group showed positive statistically significant findings and a failure if there were no statistically significant findings does not capture the size of the effect of the difference between the experimental and comparison and/or control group. Sample size of the study is also not taken into account. The current study addresses the gap in the literature by quantitatively examining the impact of teenage parent programs on subsequent pregnancy through the use of meta-analysis.

METHOD

Eligibility Criteria

We included English-speaking published and unpublished, controlled and nonrandomized comparison trials of adolescents that evaluated secondary pregnancy prevention programs. Adolescents were defined as *youth* between ages 11 and 20 years. The young women involved in these studies were pregnant or parenting adolescents. Selection of studies in this meta-analysis was based on four criteria: (a) the study reported on a secondary pregnancy prevention program; (b) the study implemented an intervention; (c) the study included pregnancy as a program outcome; and (d) the study reported sample sizes for the experimental and control and/or comparison group and frequency or percentage data on the rate of pregnancy for each group.

Search for Studies

In reviewing the literature, several electronic databases were systematically searched from 1970 to 2004. The following computerized databases searched included CINAHL, Infotrac, PsychINFO, Medline, and Social Work Abstracts. Search terms included: *repeat childbearing, teenage childbearing, adolescent childbearing,* and/or *teenage pregnancy; adolescent pregnancy, pregnancy prevention; secondary pregnancy; secondary pregnancy prevention; subsequent pregnancy* and/or *childbearing; adolescent pregnancy* and/or *parents; and adolescent* and/or *teen pregnancy prevention*. We also hand searched the contents of *Perspectives on Sexual and Reproductive Health* (formerly *Family Planning Perspectives*) from 1994 to 2004, the *Journal of Adolescent Health* from 1995 to 2004, and the reference lists of all studies and reviews, drawing heavily on Klerman (2004), for relevant citations. Finally, we contacted the National Center for Health Statistics, the Alan Guttmacher Institute, the National Campaign to Prevent Teen Pregnancy, and Child Trends to find out if personnel at these organizations knew of any other studies that examined teen parenting programs. Studies reviewed were those written in the English language.

Abstracts were read to determine their relevance for inclusion in the analysis, and promising studies were reviewed in their entirety. Our search for primary studies yielded 60 studies. However, only 16 of these studies met all four of our eligibility criteria. Common reasons for exclusion included the following: a comparison and/or control group was not used in the study; sample size and pregnancy rate information for the treatment and comparison and/or control group were not presented; and separate sample size information and pregnancy rate data was not provided separately for the teen portion of the sample.

Coding

Studies were coded by the principle investigator and a team of two trained masters in social work students, who were taking an advanced research course. In addition to statistical data necessary to compute an odds ratio (OR), several design-, participant-, and program-related variables were coded. We also developed a study design and information rating for each study that we reviewed. Studies were rated from 1 to 9, with 9 being *high* and 1 a *very low* quality study. Table 1 delineates the criteria for study design and information ratings.

Table 1: ***Study Design and Information Rating Criteria***

Points were assigned as follows:

Research design:
- 6 – Randomization to treatment conditions and a control group
- 5 – Randomization to a treatment and control group
- 4 – Randomization to a treatment and comparison group
- 3 – Nonrandomized treatment and control group
- 2 – Nonrandom treatment and comparison group

Sample size:
- A point is assigned if the sample size was at least 30 participants per group.

Demographic information:
- A point is assigned if the study gave all the necessary participant-related information (race, gender, socioeconomic status, mean age of sample)

Program information:
- A point is assigned if the study gave all the necessary program information (the locus of the intervention, the type of program, the length of the intervention, and the number of contacts/sessions)

Data Analysis

The effect size provided a standardized measure that makes possible comparison of the magnitude of pregnancy risk reduction across studies. Although there are several effect-size measures, the OR was used because it measures the odds of an intended outcome in a treatment group (pregnancy in the current study) relative to the odds of the same outcome in the control and/or comparison groups. The formula for OR is as follows:

$$\frac{(c_1 + c_2)/(a_1 + a_2)}{(d_1 + d_2)/(b_1 + b_2)} = Odds - Ratio$$

where a_1 and a_2 are the number of nonpregnancies in the treatment groups, and b_1 and b_2 are the number of nonpregnancies in the control groups at Follow-up periods 1 and 2. The number of pregnancies in the two treatment groups are c_1 and c_2, and the number of pregnancies in the control groups at the two follow-up periods are d_1 and d_2.

When pregnancy was tracked over multiple follow-up periods, an OR was generated for each follow-up period. Furthermore, a number of the studies involved a treatment condition and a variety of comparison and/or control groups. When effect sizes from multiple comparison groups are included in meta-analysis, estimates of mean effect size tend to be biased. In particular, the comparisons from any single study are unlikely to be independent. When each comparison group is treated as if it is from an independent study, the standard error for the overall effect is likely to be small and the Confidence Interval (CI) too narrow. These results then lead to the wrong conclusions from testing of statistical significance (Biostat, 2004). When multiple comparison groups or multiple time points are to be used, it is therefore appropriate to use the mean of the selected comparisons or selected time points (Biostat, 2004).

In the current study, various strategies were used to avoid the problem of nonindependence of effects for the same study. The first strategy was to obtain an effect size using the treatment group condition with one of the comparison conditions selected at random based on the first time period that studies reported outcomes. The second strategy was to average the effect sizes created by the various comparison conditions against the treatment condition. This strategy is similar to the use of Mantel–Haenszel ORs, which are generally robust (Robins, Breslow, & Greenland, 1986). These strategies were again repeated for the second time period at which studies reported outcomes.

The estimation of the mean effect size requires making a choice between two types of assumptions with respect to the error structure. The first type of estimation approach, fixed-effect modeling approach, is based on the assumption that there is one true effect size for each group of studies. This assumes that the only variation in effect sizes is due to sampling error. The second type of estimation, random-effect modeling approach, assumes that in addition to sampling error, there is a true random component of variation in effect sizes between studies (Gurevitch & Hedges, 2001; Raudenbush, 1994). In the current study, the mean effect sizes were calculated under each assumption separately. The extent of homogeneity among the effect sizes is often measured using the Q statistic. The measure of heterogeneity, Q, is based on the notion that the expected squared deviation of an effect size estimate from its true value is equal to the square of its standard error (Hedges & Olkin, 1985). The Q statistic is useful in identifying effect sizes that deviate significantly from the weighted average of the effect sizes. The total heterogeneity, *QT*, is tested against a chi-squared distribution with $n - 1$ degrees of freedom (Gurevitch & Hedges, 1993).

To explore the variation in effect sizes at each stage of follow up, a number of participant (race and socioeconomic status), design (whether randomization to treatment conditions and a control group was present, and overall quality), and program characteristics (whether the program was comprehensive or not) were used as factors in a regression analysis.

RESULTS

This meta-analysis involved a total of 16 studies; 13 studies were published, and 3 were unpublished. All studies included in the current meta-analysis took place in the United States. Tables 2 and 3 provide program and research design information, respectively, on the 16 studies. Of the 15 studies that reported race, 60% involved African Americans. Most studies, 74%, targeted low-income groups. The majority of programs were hospital based. A high proportion (38%) of programs were identified as comprehensive. “Comprehensive” programs are described as such in studies and are ones in which teens were offered an array of services, such as case management and referral; education about pregnancy, labor, and delivery, contraception, and infant health; and individual counseling. One-fourth of the program involved home visiting. The average age of participants across the 11 studies that reported mean age was 16.75 years.

Recall that the first meta-analysis performed used the treatment condition, and when multiple comparison groups were present, one group was selected at random, ignoring the rest. Separate analysis using each of the comparison groups is feasible. However, this would have resulted in conducting multiple comparison tests, which would have increased the likelihood of Type I error.

The first follow-up period for which pregnancy was tracked occurred at an average of 19.13 months. Table 4 displays the effect sizes, CIs, z values, and *p* values for the studies included in the current meta-analysis. Of the 16 ORs, only 3 have values above 1. ORs above 1 indicate that the odds of pregnancy in the treatment group is larger than the odds of pregnancy in the control group. The rest have values less than 1, indicating that the interventions tend to reduce the occurrence of unwanted pregnancy among teenagers.

However, a number of these reductions could have occurred due to sampling error alone. The magnitude of this error can be assessed by examining the 95% CIs with their commensurate effect sizes (see Figure 1). A large proportion of the CIs, 10 of 16, contained the null value of 1. In all these cases, the reduction in unwanted teenage pregnancy occurrence is not statistically significant at the .05 level.

Table 5 presents the mean effect sizes computed using the fixed-effect approach, and the random-effect approach. The second column in the table provides information on the number of comparison groups included in the computation of the ORs. The entry *1 & 2* indicates that when any of the 16 studies provided data on multiple comparison groups, an average OR for only two of the multiple comparison groups was computed at Time Point 1. If the study had a third comparison group, it was ignored.

The mean fixed-effect size of all the ORs computed at Time Point 1 and containing either one or two comparison groups is .792. The value of Q obtained from this meta-analysis is 57.04 with 15 degrees of freedom. It is significant at the .05 level, which is indicative of considerable heterogeneity in the OR values. The mean effect size (OR) is .792 under the fixed-effect modeling approach, and .474 under the random-effect approach. Both are significant at the less than .05 level. The 95% CIs of these mean estimates do not include the null value. These results suggest that pregnancy intervention programs are effective in reducing unwanted pregnancies among teenagers.

Referring once again to Table 5, the entry *1, 2, & 3* indicates that when any of the 16 studies provided data on three comparison groups, an average OR for three of the multiple comparison groups was computed at Time Point 1. The mean fixed-effect size of all the ORs computed at Time Point 1, containing either one, two, or three comparison groups is .803. The mean effect size under the random-effect approach is .491. Both are significant at the less than .05 level. The 95% CIs of these mean estimates do not include the null value. The value of Q obtained from this meta-analysis is 55.28 with 15 degrees of freedom. It is significant at the .05 level indicating the presence of heterogeneity among ORs.

In sum, the mean of all ORs, computed using the random-effect approach, from studies using only one comparison group, is .474 with a CI of .322 to .695. When information from a second comparison group is utilized in the computation of the mean OR using the random-effect approach, the mean effect size is .491 with a CI ranging from .335 to .719. When information from a third

Table 2: ***Program Information***

Study	*Name of Program and Setting*	*Type of Program and Length of Intervention*	*Program Description*
Badger (1981)	Infant Stimulation/Mother Training, Cincinnati, OH	Education: unknown	Weekly postnatal mother-infant classes on child development and appropriate parent-child interaction
Belzer, Yoshida, Tejirian, Tucker, Chung, & Sanchez (2003)	Advanced supply of emergency contraception, Los Angeles, CA	Contraceptive; 10-15 mins of education about emergency contraception + unspecified amount of family planning services	Provision of emergency contraception
Elster, Lamb, Tavaré, & Ralston (1987)	Teen Mother and Child Program at the University of Utah School of Medicine, Salt Lake City	Comprehensive: Average of 10.9 months	Comprehensive services include: psychosocial and nutritional assessment; education about pregnancy, labor, delivery, contraception, and infant health; individual counseling about relationships; financial management; school; work; parenting; and stress and coping; family and relationship counseling; Women, Infants, Children (WIC) services; and efforts to involve families and fathers of the child
Field, Widmayer, Greenberg, & Stoller (1982)	Home visit parent training compared with nursery parent training	Home visit parent training and the nursery parent training were educational in nature : 6 months	Home visits focused on training mothers in infant stimulation; the nursery parent training combined education, job training, and paid work in which the mothers were trained as teacher's aide trainees in a day care for the infants of faculty and staff.
Kelsey, Johnson, & Maynard (2001)	Teenage Parent Home Visitor Services Demonstration, Chicago, Dayton, OH, & Portland, OR	Home visiting: Average number of visits were 28	Weekly home visits lasting for 45 minutes to an hour
Key, Barbosa, & Owens (2001)	Second Chance Club, South Carolina	Comprehensive: Unknown-average length of follow-up 21 months	A high school–based intervention for pregnant and parenting adolescents that focused on school involvement, medical care and community outreach. Individuals received individual case management and participated in weekly groups.
Koniak-Griffin et al. (2002); Koniak-Griffin, Anderson, Verzemnieks, & Brecht (2000); Koniak-Griffin et al. (2003)	Public Health Nursing Early Intervention Program, Southern California	Home visiting: Unknown but was designed for 17 home visits during a 2-year period	Comprehensive interventions were provided through home visiting in five major areas: health, sexuality and family planning, maternal role, life skills, and social support. Prenatal visits focused on health care during pregnancy and preparation for childbirth, and maternal role and mental health issues. Postpartum visits focused on family planning, infant care, and well-baby health care, demonstration of the Neonatal Behavior Assessment Scale, educational and vocational goals, and video instruction for promoting appropriate maternal behaviors.
Nelson, Key, Fletcher, Kirkpatrick, & Feinstein (1982)	Teen-Tot Clinic, University of Alabama in Birmingham Medical Center	Comprehensive: 18-mo. period but no average length of intervention	Intervention is delivered at infant health visits at 2, 6, 12, and 18 weeks, 6, 9, 12, 15, and 18 months Young mothers receive support for parenting, family planning, and completion of education. Group sessions cover a comprehensive range of issues.

(continued)

Table 2: (continued)

Study	*Name of Program and Setting*	*Type of Program and Length of Intervention*	*Program Description*
O'Sullivan & Jacobsen (1992)	"a large urban teaching hospital located in the eastern US" (p. 211)	Education: seven education sessions held during well-baby visits during 18 months, but no known average intervention	Intervention comprised seven education sessions held during well-baby visits during 18 months delivered by nurse practitioner and volunteers. Counseling was also provided by social worker, pediatrician, and nurse practitioner.
Polit & Kahn (1985)	Project Redirection was implemented by community-based organizations in Boston; Harlem, NY; Phoenix, AZ; and Riverside, CA.	Comprehensive: Intervention was designed for 18 months, but average amount received was 11.6 months	Intervention coordinated a wide array of services through the use of community volunteers and peer-group sessions.
Quint, Bos, & Polit (1997)	New Chance Demonstration, operated in 16 communities in 10 states	Comprehensive: Average activity = 6.4 months; average hours of participation in all counted activities= 296.3 hrs	Purpose was to increase academic and vocational skills, to delay further childbearing, and to improve parenting skills and communication skills.
Sims & Luster (2002)	Family Ties, Mott Children's Health Center in Flint, MI	Home visiting: Designed for a 2-year period but unknown average amount of intervention received	Weekly home visits provided by a paraprofessional who let teens know about services in the community, provided emotional and instrumental support, and encouraged the teens to complete high school and limit further childbearing.
Solomon & Liefeld (1998)	Family Growth Center in Pittsburgh, PA	Comprehensive: 2 year intervention period possible but unknown average amount of intervention received	Family Growth Center is centrally located within high-risk neighborhood and linked with a university hospital to provide comprehensive medical care. Services also include short-term day care; recreational activities, transportation, home visiting with counseling provided; parenting support; and advocacy and referral to services for education, daycare, healthcare, and so on.
Stevens-Simon, Kelly, & Singer (1999)	Colorado Adolescent Maternity Program in Denver, CO	Contraceptive: Unknown	Girls who chose the implant as their contraceptive method.
Stevens-Simon, Dolgan, Kelly, & Singer (1997)	Dollar-a-Day Program, Denver, CO	Incentive: Data collection proceeded for 2 years but unknown interventions length	A peer-based incentive program designed to prevent adolescent pregnancies promoting the consistent use of reliable contraceptive methods and future-oriented family and career planning.
Wagner, Cameto, & Gerlach-Downie (1996)	Teen Parents as Teachers Demonstration, four sites in California	Education: Average length for active participants was 2 years; for dropouts, 1 year	Parenting and/or child development education was provided through home visits, parent support groups, and child screenings and/or assessments.

comparison group is included, the random mean effect size is .442 with a CI of .293 to .666. The random mean effect sizes from the meta-analysis of ORs are consistently less than .5, and the CIs around the mean effect sizes do not include the null effect. Overall, these results indicate that pregnancy intervention programs are effective in reducing unwanted pregnancies among teenagers.

In the presence of significant statistical heterogeneity among the ORs, the mean effect size obtained under the random-effect modeling is preferred over the mean effect size from the fixed-effect model. Yet another method that complements the statistical evaluation of heterogeneity when the number of studies is few, is the Galbriath Plot (Galbraith, 1988). Figure 2 presents the Galbraith plot of the effect sizes reported in Table 4.

The weight associated with each of the effect sizes is indicated by its location along the two axes of the plot. The estimate of the standardized OR logarithm is represented

Table 3: ***Research Design Information***

Study	*Sample*	*Design and Follow-Up Periods with Retention Percentages*[a]	*Study Design and Information Rating*
Badger (1981)	N = 48 females who were age 19 years and younger (no average age specified). Although 75% of the treatment and comparison groups were African American at entry, due to attrition of the White participants, results were only reported at follow-up for the African American participants	Randomization to treatment (weekly postnatal mother-infant classes) and comparison (monthly supportive home visits were provided by nurse or social worker in which infant sensorimotor development was assessed and health and nutrition issues were addressed). Follow-up: 36 & 60 months	5
Belzer, Yoshida, Tejirian, Tucker, Chung, & Sanchez (2003)	N = 160 females, ages 14 to 20 years, 80% Latina	Randomization to treatment (provision of emergency contraception) and comparison (education about emergency contraception). Both groups also received an unspecified amount of family planning services, although these services were applied equally to both groups. Follow-up: 6 months (70% experimental group, 69% for comparison group)	5
Elster, Lamb, Tavaré, & Ralston (1987)	N = 260 females who were younger than age 18 years (no average age specified). Treatment group had higher socioeconomic status than comparison group. Treatment group 85% White, 14% Hispanic, 1% Other. Comparison group 76% White, 22% Hispanic, 2% Other.	Nonrandomization: Comprehensive intervention and comparison group (teens who came to the city-county health department for Women, Infants, Children (WIC) services during study period) Follow-up: 12 months (60%) and 26 months (42% for experimental group, 48% for comparison group)	3
Field, Widmayer, Greenberg, & Stoller (1982)	N = 120 African-American, low income females with a mean age of 16.3 years	Randomization: Home visit parent training, nursery parent training, and control group. Follow-up: 12 and 24 months	9
Kelsey, Johnson, & Maynard (2001)	N = 2,396, mean age 18.25 years, 60% and 56% African American in intervention and comparison group, respectively	Randomization: Intervention (paraprofessional home visiting + Job Opportunities and Basic Skills Training Program services - welfare-to-work office-based case management focusing on education, job training, and work experience) and Comparison (JOBS services) Average length of follow-up: 21 months (36% for intervention, 24% for comparison group)	7
Key, Barbosa, & Owens (2001)	N = 305 adolescent females; mean age 15.8 years; 98% African American, 2% White	Nonrandomization: School-based clinic intervention and control group (participants were selected from the South Carolina Birth Certificate Registry and matched for all variables) Follow-up: 36 months (100%)	4
Koniak-Griffin et al. (2002); Koniak-Griffin, Anderson, Verzemnieks, & Brecht (2000); Koniak-Griffin et al. (2003)	N = 121 low-income females; average age 16.74 years; 67% Hispanic for intervention group, 62% for comparison group, 19% White for intervention group, 12% for comparison group	Randomization: Intervention and comparison group (a couple of prenatal home visits focusing on health care, self-care, preparation for childbirth, educational plans, and well-baby care) Follow-up: 24 months (90% for intervention group, 76% for comparison group)	7
Nelson, Key, Fletcher, Kirkpatrick, & Feinstein (1982)	N = 105 females; average age 15.75 years; Treatment group 32% African American, 3% White; Comparison group 64%, 6% White[b]	Nonrandomization: Intervention and comparison group (public health department services)Follow-up: 18-24 months (91% for intervention group, 94% for comparison group)	4

(continued)

Table 3: (continued)

Study	*Sample*	*Design and Follow-Up Periods with Retention Percentagesa*	*Study Design and Information Rating*
O'Sullivan & Jacobsen (1992)	N = 243 low income, African American females; average age 16.4 years	Randomization: Experimental group (routine care and special care) and comparison group (routine care-well-baby visits at 2 weeks, 2 months, 4 months, 6 months, 9 months, 12 months, 15 months, and 18 months) Follow-up: 18 months (91%)	7
Polit & Kahn (1985)	N = 789 low-income females; average age 16.4 years; 47.6% African American, 23.2% Mexican American, 16.2% Puerto Rican, 9.2% White	Nonrandomization: Experimental group and comparison group (four comparison sites were matched with experimental sites in terms of location, social and economic characteristics of the area, and service delivery characteristics) Follow-up: 12 months and 24 months (78% for intervention group, 93% for comparison group)	4
Quint, Bos, & Polit (1997)	N = 2,079 females; average age 18.8 years; 52.4% African-American, 22.8% Hispanic, 22.5% White	Randomization: Intervention and comparison group (were free to attend other programs and services available in the community) Follow-up: 18 and 42 months 90.2% for intervention group, 88.2% for comparison group)	6
Sims & Luster (2002)	N = 142 low-income females, mean age 16.2 years; 64% African American, 29% White, 3% Hispanic, 4% Biracial	Randomization: two treatment groups: intensive treatment (home visits) and standard program (phone and mail contact) Follow-up: 24 months (67% for intervention group, 73% for comparison group)	6
Solomon & Liefeld (1998)	N = 88 low income adolescent females; mean age of intervention group 16.62 years; mean age of comparison group 17.38 years; significantly more White mothers in comparison group than in the intervention group	Randomization: First-time adolescent mothers residing in high-risk neighborhoods serviced by the Family Growth Center composed the intervention group. First-time adolescent mothers residing outside zip codes serviced by the Family Growth Center comprised the comparison group. Follow-up: 24 months and 36 months (69% for intervention group, 74% for comparison group)	4
Stevens-Simon, Kelly, & Singer (1999)	N = 354 females between ages 13 and 18 years; White 50%, African American 27%, Hispanic 22%, Other 1%	Nonrandomization: Intervention (55% chose the contraceptive implant) and comparison group (45% chose an alternate form of contraception) Follow-up: 12 months and 24 months (94% for intervention group, 71% for comparison group)	3
Stevens-Simon, Dolgan, Kelly, & Singer (1997)	N = 286 low-income females; ages 18 years or younger, 44% White, 25% African American, 29% Hispanic and 2% Other	Randomization to four interventions: monetary incentive and peer support group; peer support group; monetary incentive only; and no intervention. Follow-up: 6 months, (91% for intervention #1, 100% for intervention #2, 83% for intervention #3, 81% for control group), 12 months, 18 months, 24 months (for latter 3 follow-up periods, similar patterns: 91% for intervention #1, 100% for intervention #2, 100% for intervention #3, 100% for control group)	6

(continued)

Table 3: (continued)

Study	*Sample*	*Design and Follow-Up Periods with Retention Percentagesa*	*Study Design and Information Rating*
Wagner, Cameto, & Gerlach-Downie (1996)	N = 704 pregnant and parenting teens; average age = 16.7 years; combined intervention 59.4% Hispanic, 21.1% African American, 18.3% White; Parenting and/or child development education 57.1% Hispanic, 18.1% African American, 20.3% White; case management 52.6% Hispanic, 17.9% African American, 25.4% White; Control 55.1% Hispanic, 24.2% African American, 19.1% White	Randomization to four conditions: Combined intervention (parenting and/or child development education + case management); parenting and/or child development education; case management; and control (could have received services from other sources) Follow-up: 2 years (39% combined intervention, 44% parent and/or child education, 40% case management, 48% control)	8

a. Numbers in parentheses after follow-up periods are the retention rates at those follow-up periods.
b. Numbers supplied by the study do not add up to 100%.

Table 4: ***Statistics for Each Study***[a]

Study	*Odds Ratio*	*Limit Upper*	*Limit Lower*	z *Value*	p *Value*
Stevens-Simon, Dolgan, Kelly, & Singer (1997)	1.533	.325	8.201	.596	.551
Sims & Luster (2002)	.831	.371	1.863	–.449	.654
Stevens-Simon, Kelly, & Singer (1999)	.024	.003	.179	–3.634	.000
Key, Barbosa, & Owens (2001)	.108	.033	.355	–.3660	.000
Solomon & Liefeld (1998)	.158	.039	.644	–2.575	.010
Polit & Kahn (1985)	.761	.382	1.514	–.778	.437
O'Sullivan & Jacobsen (1992)	.346	.170	.704	–2.929	.003
Nelson, Key, Fletcher, Kirkpatrick, & Feinstein (1982)	.304	.104	.891	–2.171	.030
Koniak-Griffin et al. (2002); Koniak-Griffin et al. (2003)	.541	.241	1.218	–1.483	.138
Elster, Lamb, Tavaré, & Ralston (1987)	.394	.144	1.076	–1.817	.069
Quint, Bos, & Polit (1997)	1.044	.805	1.353	.322	.748
Field, Widmayer, Greenberg, & Stoller (1982)	.387	.091	1.643	–1.287	.198
Badger (1981)	.161	.027	.944	–2.023	.043
Kelsey, Johnson, & Maynard (2001)	1.203	.884	1.637	1.173	.241
Belzer et al. (2003)	.332	.097	1.132	–1.762	.078
Wagner, Cameto, Gerlach-Downie (1996)	.622	.317	1.222	–1.379	.168

a. Multiple comparison groups and multiple time points not included.

by the vertical axis, and the horizontal axis represents the precision, the inverse of the standard error. A regression line that goes through the origin is drawn along with the 95% CIs on the Y axis. In the presence of homogeneity, all the effect sizes will be distributed within the upper and lower bounds of the CI. The effect sizes outside the confidence bounds contribute in a large measure disproportionately to the statistical heterogeneity. In the current study, there are five effect sizes originating from the following studies: Belzer et al. (2003); Field, Widmayer, Greenberg,

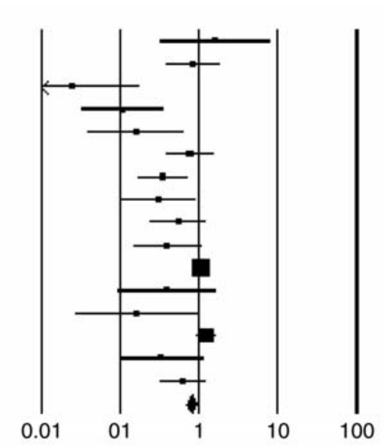

Figure 1: Odds Ratios with 95% Confidence Intervals

and Stoller (1982); Key, Barbosa, and Owens (2001); O'Sullivan and Jacobsen (1992); and Stevens-Simon, Kelly, and Singer (1999).

Because the presence of heterogeneity was confirmed by the two approaches toward detecting statistical heterogeneity in the effect sizes, the mean effect size estimate obtained from the random approach modeling is preferred. This mean effect size estimate of .474, statistically significant at the .05 level, suggests that interventions programs for preventing unwanted teenage pregnancies have been successful. There is at least a 50% reduction in the odds of pregnancy brought about by the intervention programs in general with the level of success of intervention program indicated in the moderate range.

Of the 16 selected studies, 8 provided data on control and treatment group characteristics at yet another time point after the first. This occurred at an average of 31 months A meta-analysis of this data indicated a mean fixed-effect size of .744 with a CI between .605 and .915. The Q statistic, 18.2 with 6 degrees of freedom, is significant. Given the presence of heterogeneity, the estimate of the mean effect size under the random-effect assumption is more realistic. The mean random-effect size is .661 with a CI between .430 and 1.017. Thus, the 95% CI of the mean estimate includes the null OR value of 1. The intervention effect at Time Point 2 is therefore not significant.

In addition, two of the seven studies with data on control and comparison group characteristics at Time Point 2 include multiple comparison groups. These two studies, Stevens-Simon, Dolgan, Kelly, and Singer (1997) and Field et al. (1982), have three comparison groups. Because the finding of "no intervention effect at Time 2" might be altered if data from other available comparison groups are utilized, this possibility is explored in two steps. In the first step, referring once again to Table 5, the entry *1 & 2* against "second" under the column Number of Time Points indicates that when any of the seven studies provided data on multiple comparison groups, an average OR for two of the multiple comparison groups was computed at Time Point 2. If the study had a third comparison group at Time Point 2, it was ignored at this point.

The resultant mean fixed-effect size of all the ORs computed at Time Point 2 and containing either one or two comparison groups is .750. The value of Q obtained from this meta-analysis is 17.28 with 6 degrees of freedom. It is significant at the .05 level, which is indicative of considerable heterogeneity in the OR values. Given the presence of heterogeneity, the mean random-effect size at Time Point 2 was generated. The mean random-effect size is .682 with CIs between .441 and 1.053. The 95% CI of the mean random-effect size estimate includes the null value. Therefore, including the available information on the second comparison group has not altered the finding of "no intervention effect" at Time Point 2.

In the second step, data available on a control group and a third comparison group, in addition to the first and the second comparison groups, was utilized. The mean fixed-effect size of all the ORs computed at Time Point 2 and containing either one, two, or three comparison groups is .749. The value of Q obtained from this meta-analysis is 17.20 with 6 degrees of freedom. The Q statistic is significant at the .05 level. Because there is significant heterogeneity present in the ORs, the mean random-effect size at Time Point 2 is considered. The mean random-effect size is .679 with CIs between .442 and 1.043. The intervention effect at Time Point 2 in this analysis is not significant. Thus, including the available information on the third comparison group has not changed the finding of "no intervention effect" at Time Point 2.

A number of demographic and research design characteristics may bring about statistical heterogeneity in the effect sizes. Among research design characteristics, whether participants were randomly assigned to intervention or not, tend to influence effect size values. Three additional nominal characteristics, whether the study group is composed of African American teenagers or not, whether the group is low socioeconomic status (SES) or not, and finally whether the treatment is characterized as "comprehensive" or not, were used to examine the source of statistical heterogeneity in the effect sizes. Finally, study quality scores were used to explain heterogeneity.

Single-factor ANOVAs were conducted for each of the three selected nominal characteristics. The results are presented in Table 6. Only one variable, *SES*, is significant. The estimates of the mean random-effect sizes are .678 for lower SES samples, and .255 for the higher SES samples.

Table 5: ***Meta Analysis of Odds Ratios*** [a]

Type	*No. Comparison Groups*	*No. Time Points*	*Odds Ratio*	*Lower*	*Upper*	p *Value*	*Q Statistic* (df)
Fixed	1	1	.792	.676	.927	.004	57.04 (15)*
Random	1	1	.474	.322	.695	.000	
Fixed	1 or 2	1	.803	.685	.941	.007	55.28 (15)*
Random	1 or 2	1	.491	.335	.719	.000	
Fixed	1, 2, or 3	1	.794	.675	.935	.005	59.16 (15)*
Random	1, 2, or 3	1	.442	.293	.666	.000	
Fixed	1	Second	.744	.605	.915	.005	18.21 (6)*
Random	1	Second	.661	.430	1.017	.060	
Fixed	2	Second	.750	.609	.922	.007	17.28 (6)*
Random	2	Second	.682	.441	1.053	.084	
Fixed	3	Second	.749	.608	.921	.006	17.20 (6)*
Random	3	Second	.679	.442	1.043	.077	

a. Multiple comparisons and multiple time points included.
*$p < .05$ level.

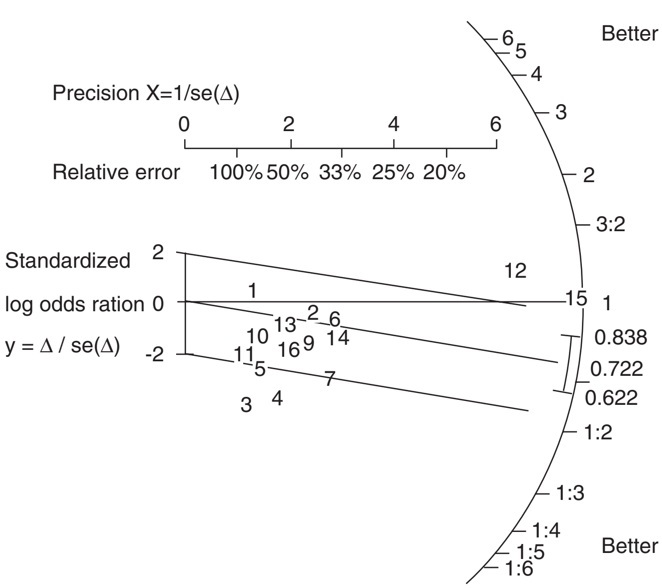

Figure 2: Galbraith Plot of Meta-Analysis of Odds Ratios

The Q value is high and statistically significant. Thus, intervention programs appear to be more effective in preventing unwanted teenage pregnancies among high SES teens than among low SES teens. Because only one variable is significant at the gross level (single-factor ANOVA), examination of the net effects of these variables using multiple regression methods was not pursued.

Because quality scores are continuous, it is possible to regress effect sizes on quality scores using simple linear metaregression methods. Table 7 presents the results of the regression of effect sizes on quality scores. In the current study, an increase in the OR indicated a decrease in the intervention effect. However, on log transformation of the OR, an increase in the log of the OR would suggest an increase in the intervention effect. The dependent variable in the metaregression is the log of the OR. The results indicate that as quality scores increase, there is a significant increase in the log of the OR. Thus, better designed studies, with high-quality scores, tend to be significantly associated with high log of ORs. This result is only suggestive as the number of studies in the regression is small. Furthermore, there are no controls in the regression. Therefore, inadequate controls for internal validity threats in the design of the program evaluation may bias the results of our program evaluation.

The studies included in this meta-analysis are vulnerable to a number of sources of selection biases, the most well-known of which is publication bias. This occurs because scientific journals in general tend to accept studies with significant findings. One method of detecting publication bias provides a measure of the magnitude of the bias. An empirical measure of the extent of publication bias is Rosenthal's "fail-safe N" (Rosenthal, 1979). It is the number of unpublished studies that are to be added to the meta-analysis to move the results of the meta-analysis from significance to nonsignificance. A large fail-safe *N* resulting from Rosenthal's method indicates low levels of publication bias. Results of the fail-safe *N* test are presented in Table 8. This test indicates that at least 136 new studies are needed to render the estimate of the mean effect size insignificant. Thus, the role of publication bias as a threat to the validity of our findings from meta-analysis of the 16 studies is not serious.

Discussion and Application to Social Work

The goals of teen parenting programs are many and include child health, parenting, and welfare dependency,

Table 6: ***One-Way ANOVA Table: Selected Intervention Characteristics Versus Effect Size Mixed-Effect Analysis***

		Limit			
Variable	*Point Estimate*	*Lower*	*Upper*	*Q Value*	p *Value*
Race					
1: African American	.557	.356	.872	.933	.334
0: Rest	.377	.196	.724		
Socioeconomic status					
1 = Lower	.678	.469	.981	5.379	.020
0 = Rest	.255	.122	.534		
Type					
1 = Comprehensive	.396	.191	.823	.248	.618
0 = Rest	.499	.293	.850		

Table 7: ***Meta Regression of Effect Size on Quality Scores (Unrestricted Maximum Likelihood Estimates)***

		Limit			
	Point Estimate	*Lower*	*Upper*	z *Value*	p *Value*
Slope	.251	.051	.451	2.469	.01
Intercept	–2.172	–3.396	–.948	–3.477	.00

Table 8: ***Assessing the Extent of Publication Bias Using the Fail-Safe N Method***

Classic Fail-Safe N	
z value for observed studies	–6.031
p value for observed studies	.000
Alpha	.050
Tails	2.000
z for alpha	1.960
Number of observed studies	16.000
Number missing studies that would bring *p* value > alpha	136.000

among other outcomes. This meta-analysis focuses on the prevention of subsequent pregnancies given the possible deleterious effects of rapid repeat childbearing among adolescent mothers. Furthermore, this outcome is critical for the teen parent's economic viability, her parenting resources, and her child's development and functioning.

The results of this meta-analysis of 16 studies indicated that teen parenting programs do affect this outcome in a moderate way at the average first follow-up period reported in studies, which occurred, on average at 19.13 months. There was at least a 50% reduction in the odds of pregnancy brought about by the intervention programs compared to their respective comparison and control conditions. By the second follow-up period, however, occurring at an average of 31 months, the impact of programs had waned considerably, although pregnancy was only tracked to second follow-up in 8 of the 16 studies. To inform social work delivery of services, therefore, the available programs seem effective in reducing subsequent childbearing, at least for more than 1½ years after intervention begins. This delay of subsequent childbirth seems important because the spacing of births is a salient factor; rapid childbearing is most detrimental because of the way it affects time devoted to the first child (Klerman, 2004). In addition, most of the studies involved comparison conditions in which teens received some type of other service. Therefore, the experimental conditions showed effects above and beyond participants receiving another type of services (either treatment as usual or at least a different intervention than the experimental group).

Only one participant-related characteristic was influential, SES; the programs that worked with higher SES teens had lower rates of pregnancy overall than the programs with participants of lower SES. Reviews of the literature have indicated that teens living in poverty are more prone to early pregnancy, presumably because they lack other options for identity and fulfillment (Luker, 1996).

In examining design-related characteristics, consistent with other meta-analyses, the higher the quality of the study, the lower the overall effect. Future research in this area should strive for high methodological rigor, so a clear picture of intervention effects can be found.

When looking at program factors that may moderate the results, it might be expected that a comprehensive array of services would act to prevent repeat pregnancy. However, this was not found to be the case. Our finding was consistent with Klerman's (2004) narrative review in that no one approach seemed to emerge as most effective. Therefore, in guiding social work interventions, the type of pregnancy prevention programs—whether they were comprehensive and offered a range of services or not—does not seem to matter.

Some of the limitations of the current study include those associated with meta-analysis. Although every effort was made to create a comprehensive review, some publications may have been overlooked in the data collection process. Another problem was a lack of comparison and/or control group studies to include in the meta-analysis. Future research in this area should strive to involve experimental and quasi-experimental designs with randomization to conditions. Another limitation of the available literature is that several studies were excluded because of missing information on sample sizes of the treatment and comparison and/or control groups and their corresponding pregnancy rates. Researchers should consistently and clearly provide this type of basic information in their reports. In the same vein, some of the studies excluded participant-related variables, such as mean age, SES, or race. These should also be routinely reported in studies.

Some of the studies included in this meta-analysis reported high attrition rates. The lack of available follow-up data contributed to higher effect sizes because people who dropped out from programs and/or who were lost to follow-up may be more vulnerable to repeat pregnancy. It is recommended, therefore, that future studies analyze their results in terms of an intent-to-treat model (Klerman, 2004). In such a model, all those who were originally recruited for participation in the program should be included in the analysis of outcomes. Those who drop out or who cannot be located at follow-up should be treated as "failures" in terms of the outcome in question.

Another limitation of the literature as noted by Klerman (2004) is that many of the studies reported only on the length of the particular program as ideally implemented. However, rates of actual implementation were often not provided. Finally, follow-up periods varied considerably in studies, and this variation precluded effect-size analysis across common periods (such as all those studies that examined pregnancy rates at 6 months, 1 year, 2 years, etc.).

CONCLUSION

Programming for prevention of subsequent pregnancies in teen mothers has been in existence for the last three decades or so. This meta-analysis indicates that these programs are having a moderate effect on pregnancy prevention outcomes at, on average, a 19-mo. follow-up, although by 31 months, the impact seems to dissipate. The results of this meta-analysis indicate that other goals of teen parenting programs, beyond pregnancy prevention, should be subject to the same quantitative scrutiny, to determine if programs are meeting their stated and expected outcomes.

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