

Research Papers

A Meta-Analysis Examining Effects of School Sexuality Education Programs on Adolescents' Sexual Knowledge, 1960-1997

Eun Young Song, B.E. Pruitt, James McNamara, Brian Colwell

ABSTRACT: *This study analyzed and synthesized findings from selected studies conducted from 1960 through 1997 regarding effects of school sexuality education on adolescents' sexual knowledge. This purpose was achieved using meta-analysis. Sixty-seven studies that met the selection criteria were included in the meta-analysis. The 67 studies reported 72 outcomes regarding sexual knowledge, which were grouped into six independent variables related to knowledge about sexuality. A weighted effect size method developed by Hedges and Olkin was calculated using all studies. For all studies, 97% of weighted effect sizes were positive. The weighted average effect size on sexual knowledge across all studies of 0.41 was statistically significant, indicating a significant difference occurred between control and experimental groups' mastery of objectives related to sexual knowledge. It was concluded that sexuality education programs positively affect overall sexual knowledge. (J Sch Health. 2000;70(10):413-416)*

Numerous studies the past 25 years were conducted to examine effects of sexuality education programs. Results from these studies have been inconsistent. Many studies indicated sexuality education programs were not effective,¹⁻⁶ while others provided evidence of valuable and effective results.⁷⁻⁹

Several recent studies sought to integrate results from evaluation studies on effects of sexuality education and to specify characteristics of effective sexuality education programs.^{8,10-12} These reviews of literature often used a narrative approach to integrate existing research without concern for limitations of such an approach. Hyde and Linn¹³ argued that narrative reviews, such as those recently published, present three major problems. First, by attaching more importance to some studies (personal biases), two different researchers may reach substantially different conclusions. Second, when the number of studies reviewed is large (more than 100), information in the studies exceeds the human capacity to process it. Third, conclusions reached in narrative reviews are not quantitative.

To overcome these limitations, Glass¹⁵ introduced meta-analysis as a method of research integration. Meta-analysis describes a statistical procedure used to search for trends in the magnitude of effects observed in a group of quantitative research studies all involving the same research problems. Meta-analysis uses sampling errors and point estimates reported from individual hypothesis testing studies to

generate a combined estimate and a corresponding confidence interval that accurately represent the common population parameter for the complete group of studies in the review.

The disciplined nature of meta-analysis research designs offers an opportunity for researchers to examine effectiveness studies of sexuality education with new rigor. Meta-analysis results can provide accurate information regarding development, implementation, and evaluation of effective sexuality education in schools. This study sought to analyze and synthesize findings from selected studies about effects of school-based sexuality education on adolescents' sexual knowledge from 1960 through 1997 using appropriate meta-analytic techniques.

METHOD

Meta-Analysis Population

To locate published or unpublished studies on the effectiveness of sexuality education programs, six computerized indices were searched. Five indices addressed published studies: Cumulative Index to Allied Health Literature (CINAHL); Educational Resources Information Center (ERIC); Health Star; Medical Literature (MEDLINE); and Psychological Abstracts (PSYCHINFO). One index, Dissertation Abstracts International (DAI), was used to search for unpublished studies. The following search terms were used: adolescents, AIDS education, contraception education, curriculum, effectiveness, evaluation, family life education, health education, pregnancy, school, sex education, sexuality, sexuality education, sexually transmitted diseases, and venereal disease. Combinations of search terms also were used.

In addition to computer searches, manual searches were conducted using information retrieved from computer searches, recent journals, bibliographies, references of selected studies, and individual reference files. To find unpublished studies, letters requesting unpublished reports

Eun Young Song, PhD, CHES, Post-Doctoral Research Fellow, School of Medicine, Wayne State University, 4100 John R. Road, Hudson-Webber Cancer Research Center, Fourth Floor, Detroit, MI 48201; or (songe@karmanos.org); B.E. Pruitt, EdD, Professor, Division of Health and Safety, Dept. of Health and Kinesiology; James McNamara, PhD, Professor, Dept. of Education Psychology; and Brian Colwell, PhD, CHES, Associate Professor, Dept. of Social and Behavioral Health, School of Rural and Public Health, Texas A&M University, College Station, TX 77843. This article was submitted January 21, 2000, and revised and accepted for publication July 24, 2000.

and identification of other persons to contact about research studies were sent to 60 institutions and organizations.

Selecting Studies

The extensive literature search procedures located 345 abstracts and lists addressing sexuality or sexuality education. From these abstracts and lists, 211 articles, reports, and dissertations focused on effectiveness of sexuality education. All were obtained and examined. The remaining abstracts were excluded based on content contained in the abstract. After examining all 211 studies, 137 published or unpublished studies reporting the effectiveness of sexuality education for adolescents were selected to determine if the studies met selection criteria for meta-analysis. One hundred published or unpublished studies (29% of the original pool) reported empirical findings on the effectiveness of school-based sexuality education programs. Among the 100 studies, 67 reported findings regarding sexual knowledge. Studies that met the selection criteria were included in the meta-analysis. Studies that did not meet the selection criteria were integrated into the review of literature.

Selection of studies in this meta-analysis was based on six criteria: 1) The study must have been a quantitative analysis of empirical data; 2) The study must have been conducted in a school setting; 3) The study must have been conducted in the United States; 4) The study must have been conducted during the years 1900-1997; 5) The sample must have included normal adolescents between grades five and 12; and 6) Statistical data such as correlations, t values, F values, chi-square values, percentages, means and standard deviations, and other independently measured variables required to estimate weighted effect sizes must have been reported or available.

Estimation of Weighted Effect Size

A weighted effect size developed by Hedges and Olkin¹⁵ was used for the study. The unbiased estimator weighted effect size, d , is obtained by multiplying effect size, g , by a constant that depends on the sample size in the studies. That is,

$$d = Cn * g = Cn * \frac{Y^e - Y^c}{S}$$

where the values of Cn are given to a very good approximation by

$$Cn = 1 - \frac{3}{4n^e + 4n^c - 9}$$

$$S^2 = \frac{(n^e - 1)S^2e + (n^c - 1)S^2c}{n^e + n^c - 2}$$

Y^e and Y^c represent the experimental and control group sample means, and n^e and n^c represent the experimental and control group sample sizes. S is the standard deviation estimated by pooling the within-group variances S^2e for experimental group and S^2c for control groups.

One weighted effect size and a corresponding 95% confidence interval were calculated per outcome per sample. Next, the weighted average effect size and 95% confidence interval were calculated per dependent variable for all samples. If mean and standard deviation were not

available, appropriate conversion formulas developed by Ray and Shadish¹⁶ were applied to statistical information to determine a standardized score.

RESULTS

Weighted Effect Size

The 67 studies reported 72 outcomes regarding knowledge about sexuality. Most studies (69%) did not report means and standard deviations. Only 22 (31%) reported basic information to estimate effect sizes. All other individual effect sizes were estimated using the methods reported in Table 1.

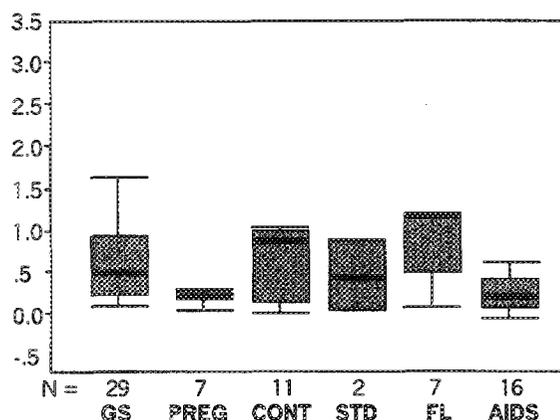
The 72 outcomes were grouped into six dependent variables on knowledge about sexuality: 1) general sexuality, 2) pregnancy, 3) family life, 4) HIV/AIDS, 5) contraception, and 6) sexually transmitted diseases.

Figure 1 presents a box plot of weighted effect sizes for the six dependent variables about sexual knowledge. Taken collectively, 97% of weighted effect sizes were positive. Frequency counts and ranges for the six distributions repre-

Table 1
Calculation Method of Weighted
Effect Size for Sexual Knowledge (N = 72)

Reported Statistics	N	%
Mean / pooled standard deviation	22	30.5
Percentage	17	23.6
Significance level	13	18.0
F value	11	15.2
T value	7	9.7
Other	2	2.7

Figure 1
Box Plot of Weighted Effect Sizes
for Knowledge About Sexuality



GS - knowledge about general sexuality; PREG - knowledge about pregnancy; CONT - knowledge about contraception; STD - knowledge about sexuality transmitted disease; FL - knowledge about family life; and AIDS - knowledge about HIV/AIDS

sented in Figure 1 are as follows. Twenty-nine (43%) studies reported outcomes regarding knowledge about general sexuality. The weighted effect sizes of knowledge about general sexuality ranged from 0.10 to 2.49. Seven (10%) studies reported outcomes regarding knowledge about pregnancy. The weighted effect sizes of knowledge about pregnancy ranged from 0.08 to 1.59. Seven (10%) studies reported outcomes regarding knowledge about family life. The weighted effect sizes of knowledge about family life ranged from 0.14 to 2.61. Sixteen (24%) studies reported outcomes regarding knowledge about HIV/AIDS. Weighted effect sizes of knowledge about HIV/AIDS ranged from -0.06 to 1.95. Eleven (16%) studies reported outcomes regarding knowledge about contraception. Weighted effect sizes of knowledge about contraception ranged from 0.00 to 3.10. Only two (3%) studies reported outcomes regarding knowledge about sexually transmitted diseases. Weighted effect sizes of knowledge about sexually transmitted diseases ranged from 0.07 to 0.66.

Weighted Average Effect Size and Confidence Interval

Among the 67 studies, five reported two outcomes for different knowledge dependent variables. One weighted effect size for one study was calculated to estimate aggregate weighted effect size for knowledge about sexuality. Weighted average effect size on sexual knowledge across all studies was 0.41 with a variance of 0.000145. The 95% confidence interval for the population effect size δ fell between 0.39 and 0.43.

Because the confidence interval does not include zero, the effect size δ differs significantly from zero at the 5% level of significance, meaning a significant difference exists between the control groups' and the experimental groups' mastery of objectives related to sexual knowledge. The sign of the aggregate population effect size estimate was positive; therefore, sexuality education programs positively affect overall knowledge about sexuality. Weighted average effect sizes for each of six knowledge dependent variables

also were calculated. These six weighted average effect sizes and their corresponding confidence intervals are provided in Figure 2.

Because the confidence interval for each of the six variables did not include zero, all six effect sizes differed significantly from zero at the 5% level of significance. Moreover, the sign of the population effect size estimate in each case was positive; therefore, sexuality education programs significantly increased knowledge about general sexuality, pregnancy, family life, HIV/AIDS, contraception, and sexually transmitted diseases.

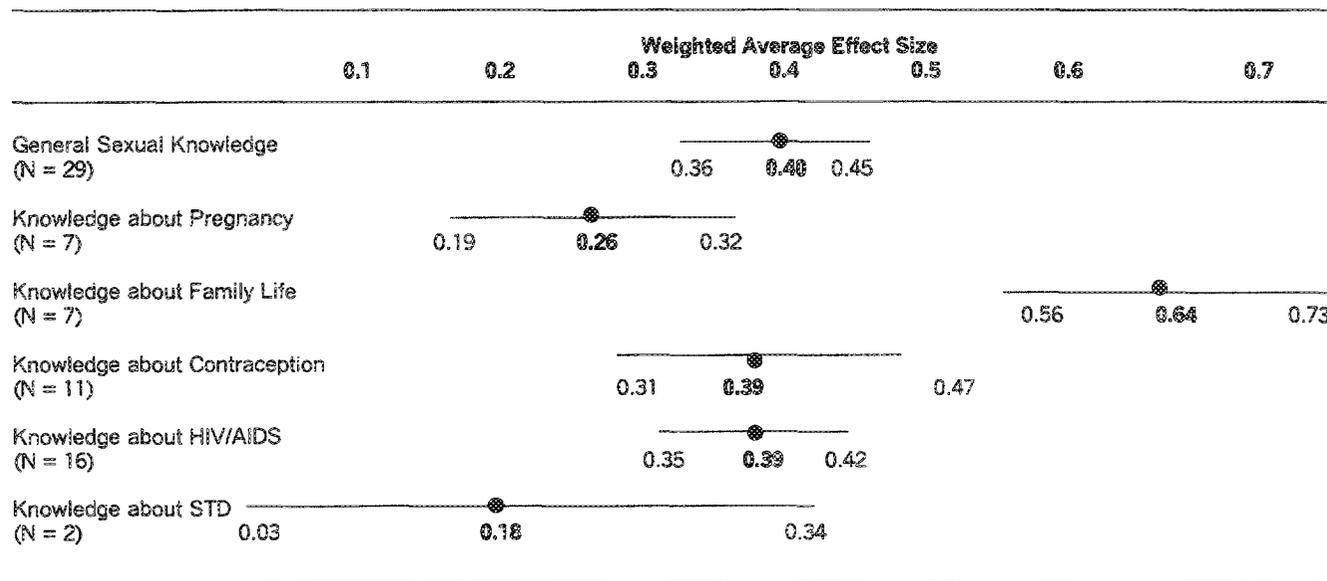
DISCUSSION

This study provides valid empirical information regarding effectiveness of school sexuality education programs. The key finding confirmed that the weighted effect sizes of 65 (97%) studies were positive, with an overall weighted average effect size on sexual knowledge of 0.41 (variance 0.000145). Therefore, school-based sexuality education programs for adolescents contribute to increasing sexual knowledge.

In agreement with previous studies,^{8,17} no study reported empirical data regarding effectiveness of school sexuality education programs before 1960. For the past 40 years, however, many studies have been conducted. Unfortunately, even among the most up-to-date studies, the problem of failing to report effectiveness data persists. Results from this meta-analysis study show that most studies (69%) did not report basic information to estimate effect sizes. Though researchers understand the importance of meta-analysis in health science, they often do not report mean, standard deviation, and sample sizes.

Results from this meta-analysis suggest that the effects of school sexuality education programs on six outcomes regarding sexual knowledge are large, with the exception of STD knowledge. Outcomes measuring family life knowledge had the largest weighted effect size, 0.64. This magnitude of effectiveness on family life knowledge may exist in

Figure 2
Weighted Average Effect Sizes and 95% Confidence Interval for Knowledge about Sexuality



part to the fact that "family life" has been addressed by other curricula such as biology, home science, and physical education.

IMPLICATIONS

Implications of this study on the future of sexuality education are significant in two respects. First, they offer direction to those involved in evaluating sexuality education programs. Second, they offer direction for those involved in developing sexuality education programs.

Experience gained from conducting this study suggests three recommendations for sexuality education researchers evaluating program effectiveness or conducting meta-analyses on the effects of sexuality education programs. First, report all basic information needed to estimate weighted effect size, including mean, standard deviation, and sample sizes for both control and treatment groups. Second, report all program and study characteristics that can affect program effectiveness. This information can help researchers determine moderator variables of effective sexuality education programs. Third, conduct meta-analyses to verify effective characteristics and moderator variables likely to affect the outcome of sexuality education programs. Such analyses always should be conducted when a basic meta-analysis yields positive results. Taken collectively, incorporating these three specific recommendations in future evaluations of sexuality education programs can significantly increase the ability to interpret findings from individual studies, and permit accurate and timely syntheses of findings across all studies.

With regard to future development of sexuality education programs, this study confirmed that knowledge can be changed. While some may question the effectiveness of educational programs on the knowledge level of participants, this study demonstrated that education which intends to change knowledge can do so.

This study also confirmed that models of educational intervention designed to change knowledge about sexuality are available. The researchers thought far more studies would be available for inclusion in the meta-analysis process than the number found. Yet, those located were of quality, with regard to knowledge change, that assure the availability of models of effectiveness. As program developers search for examples of effective programs, those examples should be easily found.

A final study implication suggests program developers should begin to experiment with innovative approaches to education about sexually transmitted diseases. Apparently, this specific area of sexuality education intervention needs the most development with regard to effectiveness of

knowledge change. One means of improving effectiveness involves the development of carefully evaluated innovative approaches.

This study demonstrated the effectiveness of sexuality education in changing knowledge about sexuality. However, knowledge change alone does not assure behavior change. Therefore, studies on the effectiveness of sexuality education programs in changing attitudes about sexuality, and ultimately in changing sexual behavior, should be conducted. The meta-analysis methodology provided an excellent means of examining sexuality education program effectiveness. This methodology should be applied to examination of other outcomes of sexuality education programs. ■

References

1. Dawson D. The effects of sex education on adolescent behavior. *Fam Plann Perspect.* 1986;18:162-170.
2. Jorgensen S, Potts V, Camp B. Project taking charge: six-month follow-up of a pregnancy prevention program for early adolescents. *Fam Relations.* 1993;42:401-406.
3. Kirby D. School-based programs to reduce sexual risk-taking behaviors. *J Sch Health.* 1992;6:280-287.
4. Kirby D. The effects of selected sexuality education programs: toward a more realistic view. *J Sex Educ Theory.* 1985;11:28-37.
5. Ku I., Sonenstein F, Pleck J. Factors affecting first intercourse among young men. *Public Health Rep.* 1993;108:680-694.
6. Zeinik M, Kim Y. Sex education and its association with teenage sexual activity, pregnancy and contraceptive use. *Fam Plann Perspect.* 1982;14:117-126.
7. Gilchrist L, Schinke S. Coping with contraception: cognitive and behavioral methods with adolescents. *Cognitive Ther Res.* 1983;7:379-388.
8. Kirby D, Short L, Collins J, et al. School-based programs to reduce sexual risk behaviors: a review of effectiveness. *Public Health Rep.* 1994;109:339-360.
9. Walter H, Vaughan R. AIDS risk reduction among a multiethnic sample of urban high school students. *JAMA.* 1993;270:725-730.
10. Ausherman J. *A meta-analysis of selected K through 12 sexuality education studies.* Doctoral dissertation, University of Tennessee: Knoxville, Tenn; 1994.
11. Lagana L, Hayes D. Contraceptive health programs for adolescents: a critical review. *Adolesc.* 1993;28:347-359.
12. Voss J. Sex education: evaluation and recommendations for future study. *Arch Sex Behav.* 1980;9:37-59.
13. Hyde J, Linn M. *The Psychology of Gender: Advances Through Meta-Analysis.* Baltimore, Md: Johns Hopkins University Press; 1986.
14. Glass G. Primary, secondary and meta-analysis. *Educ Researcher.* 1976;5:3-8.
15. Hedges L, Olkin I. *Statistical Methods for Meta-Analysis.* New York, NY: Academic Press; 1985.
16. Ray J, Shadish W. How interchangeable are different estimators of effect size? *J Consult Clin Psychol.* 1996;64:1316-1325.
17. Kirby D. *No Easy Answers: Research Findings on Programs to Reduce Teen Pregnancy.* Washington, DC: National Campaign to Prevent Teen Pregnancy; 1997.