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ABSTRACT

Noting that rates of teen pregnancies and births have declined over the past decade, this analysis examined how much of the progress is due to fewer teens having sex and how much to lower rates of pregnancy among sexually active teens. The analysis drew on data from the federal government's National Survey of Family Growth (NSFG), a large, periodic survey of women ages 15-44 on issues related to childbearing. With regard to the decline in teen pregnancy rates between 1990 and 1995, the analysis found that the proportion attributable to less sexual experience among teens ranges from approximately 40 to 60 percent, with the remaining 60 or 40 percent attributable to decreased pregnancy rates for sexually experienced teens. However, it was noted that limitations of the data make the exact contribution of each factor very difficult to determine. (Appendices present analyses using alternate pregnancy rates and an explanation of how analyses are affected by sampling error.) (EV)

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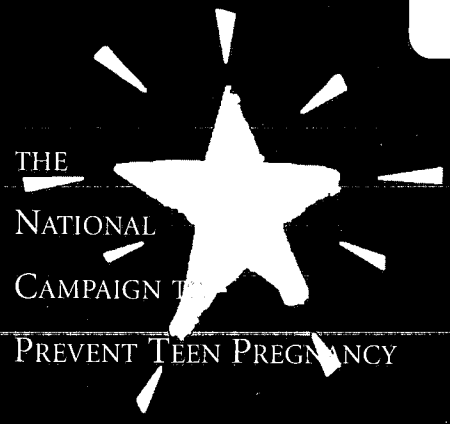

THE NATIONAL CAMPAIGN TO PREVENT TEEN PREGNANCY

What's Behind The Good News:

The Decline in Teen Pregnancy Rates During the 1990s

Christine Flanigan

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THE NATIONAL CAMPAIGN TO PREVENT TEEN PREGNANCY

FEBRUARY 2001

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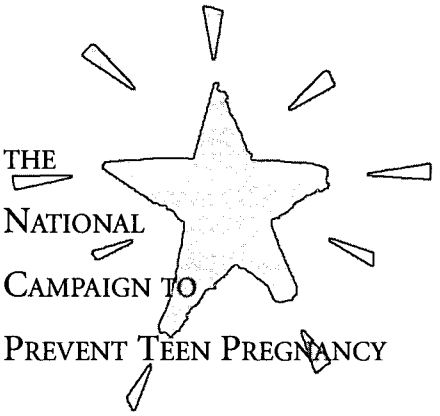

What's Behind The Good News:

The Decline in Teen Pregnancy Rates During the 1990s

Christine Flanigan
National Campaign to Prevent Teen Pregnancy Research Analyst

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THE NATIONAL CAMPAIGN TO PREVENT TEEN PREGNANCY

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Introduction

Declining rates of teen pregnancies and births are becoming old news in the United States. Over the past decade, both have declined dramatically. But two important questions remain: (1) how much of this progress is due to fewer teens having sex and how much to lower rates of pregnancy among sexually active teens and, (2) why are teens being more careful, as they obviously are? The paper published here by Christine Flanigan, the National Campaign's Research Analyst, explores the first question in great detail while this introduction offers some likely answers to question two.

First, a little background. Teen pregnancy rates increased by 22 percent between 1972 and 1990 before decreasing 17 percent between 1990 and 1996 (the year for which the most recent data are available). Similarly, teen birth rates have also plummeted in the 1990s. Between 1991 and 1999, the birth rate for teens aged 15-19 decreased 20 percent (with a parallel decrease in abortion rates). The data set analyzed here to help understand the factors that explain these declines is the federal government's National Survey of Family Growth (NSFG), a large, periodic survey of women aged 15-44 on issues related to childbearing. The analysis relies on the NSFG because it offers the most complete picture of the issues at hand.

As noted at the outset, at least two dynamics seem to be at play: a smaller proportion of teens having sex at all, and a declining pregnancy rate among sexually active teens. This second factor, in turn, reflects better contraceptive use and also, perhaps, less sexual activity among those with some sexual experience. It is not readily apparent from the NSFG, however, what the *precise* contribution of each of these factors is to the good news of declining teen pregnancy. This muddiness is due to the limitations of the data, the large role that judgement plays in its analysis (meaning that different research teams using different assumptions can come up with varying answers), and the simple fact that many of the changes in behavior reported in the NSFG are not statistically significant.

A reasonable conclusion, however, is that both less sex and more contraception are making important contributions to the decline, and more of both should be encouraged. Interestingly, pub-

lic opinion about how to reduce teen pregnancy supports such a two-pronged strategy. For example, several polls conducted by the Campaign reveal a strong preference (among both adults and teens) for teens to avoid sexual intercourse altogether, coupled with a practical view that those young people who are sexually active should have information about, and access to, contraception.

Given that teenagers are already driving the rates down by changing their behavior in a variety of ways, many wonder *why* they are doing so? Presumably, if we could pinpoint the reasons that have motivated teens to avoid pregnancy more successfully, we could build on those insights to sustain and accelerate the decline. Likely explanations for the changes in behavior, include greater public awareness, fear of AIDS and other STDs, more cautious attitudes among teens, more effective contraceptive methods, welfare reform, a robust economy, and greater parental involvement.

Increased Attention: There has unquestionably been an increase during the 1990s in overall national efforts to reduce teen pregnancy and childbearing. This should not be surprising given that it was in the late 1980s and early 1990s that the nation gradually woke up to the fact that after years of declines, both these rates were rising rapidly. In 1987, the teen pregnancy rate was 107 pregnancies per 1,000 girls aged 15-19, but climbed in the rest of that decade to its peak of 117 pregnancies per 1,000 girls aged 15-19 in 1990. Alarm bells went off nationwide, leading to numerous, intense actions at the state, local and national level (including the formation of the National Campaign) to shine a spotlight on this problem and take action to bring the rates down. For example, Child Trends reports that in 1990, only 16 states had an official policy requiring or encouraging pregnancy prevention programs in public schools; by 1999, this had increased to 28.[1] Similarly, there was an increase in active teen pregnancy prevention coalitions at the state level, some privately funded, others publicly financed. Nationwide, organized teen pregnancy coalitions at the state level continue to increase. At present, some 41 exist in the 50 states and the District of Columbia, up from about 32 in 1995, with countless more now in existence at the city and county level. In a similar vein, the U.S. Department of Health and Human Services (DHHS) estimates that in 1997, 30 percent of communities in the US had HHS- funded teen pregnancy prevention programs, whereas in 1999, the number was 35 percent; an upward trend that probably started earlier in the decade.[2]

Reflecting the growing prominence of teen pregnancy on the nation's radar screen during the 1990s, entertainment media leaders in both print and broadcast industries were increasingly inclined to address teen pregnancy directly. For example, twice in the last six years, *People Magazine* has done cover stories on teen pregnancy and child-bearing; the first cover, in 1995, led to one of the highest single issue sales that entire year; this stunning success in turn led to a followup cover on the same topic in 1999. Similarly, in its flagship issue, *Teen People* included an article on sexual abstinence among teens (Can You Spot the Virgin?). For its part, the National Campaign has worked with 42 media partners — including Black Entertainment Television and the WB Network — on a variety of projects reaching approximately 250 million people since 1997 with a wide variety of messages about preventing teen pregnancy. The Campaign's outreach to the press has led to numerous articles, editorials, and opinion pieces while the Campaign's webpage (**www.teenpregnancy.org**) averages over one million hits each month.

Education and Fear Regarding STDs/AIDS: In conversations with the Campaign, teens say time and again that fear of STDs, and AIDS in particular, factors heavily into their sexual decision- making. And it should — approximately one in four sexually active teens contract a STD every year and about one-quarter of new HIV infections in the U.S. are among teens.[3] In fact, a

recent survey shows that while teens and their parents differ on many issues of concern to teens, fear of AIDS and STDs ranks first on both their lists.[4] For many teens, this fear of STDs translates into delaying sex; for some it means having fewer partners; and for others it means using condoms more consistently. Many suggest that the primary reason why teen condom use has increased so dramatically recently (condom use at first sex among girls aged 15-19 increased from 48 percent in 1988 to 63 percent in 1995) is due at least in part to fear of AIDS and STDs.

It is also clear that more — and more detailed — sexuality education is available to more teens now than ever before. Consider the following:

- A 1999 Kaiser Family Foundation survey reports that almost all secondary school students report receiving some information about HIV/AIDS (97%) as well as other STDs (93%) in their most recent sex education class.[5]
- The percentage of 17- to 19-year-old urban males receiving AIDS education increased from 64 percent in 1988 to 96 percent in 1995.[6]
- In a survey released by the Alan Guttmacher Institute (AGI/1999), sexuality education teachers report that they were more likely in 1999 than in 1988 to teach about STDs (95.2% vs. 82.1%).[7]

More Cautious Attitudes: It still comes as a surprise to many that rates of teen pregnancy and births have been declining over the past decade. One of the factors contributing to declining rates of teen pregnancy in the 1990s is that many teens are taking an increasingly cautious attitude toward sex, especially casual sex. A number of surveys and polls support this idea. For instance, the proportion of college freshmen who agree that "it's all right to have sex if two people have known each other for a short time" declined from 52 percent in 1987 to a record low 40 percent in 1999, according to an annual survey conducted by UCLA.[8]

Recent National Campaign polling of teens (ages 12-17) also reflects these more conservative attitudes. Over 90 percent of teens surveyed said that it is important for teens to be given a strong message from society that they should abstain from sex until they are at least out of high school. Close to six of ten teens said that sexual activity for high school-age teens is not acceptable, *even if* precautions are taken against pregnancy and STDs. Nearly nine out of ten teens surveyed said that it is not embarrassing to admit being a virgin.[9] And, of those teens under 18 who have had sex, nearly two- thirds said they wish they had waited longer.[10]

Contrary to what many believe, this shift in attitudes is not limited to females alone. A recent Urban Institute study showing the proportion of adolescent men aged 17-19 who approve of premarital sex when a couple does not plan to marry decreased from 80 percent in 1988 to 71 percent in 1995. These more conservative attitudes about premarital sex are strongly correlated with sexual activity and explained a majority of the decline in sexual activity among young men between 1988 and 1995. Another finding from this same study was that the percentage of teenage boys aged 17-19 who have ever had sex decreased from 76 percent in 1988 to 68 percent in 1995.[11]

Such data suggests that something even more powerful than a slight shift in attitudes may be afoot — a change among teens in their basic view about sexual intercourse in the high school years and before. A new norm may be emerging that does not view abstinence and sexual activity (or safe sex) as being equally acceptable or simply a matter of personal preference. Rather, there may

well be emerging a new social norm: that sexual intercourse is not the right choice for teenagers in middle school and high school, due to its risks and its significance.

Contraceptive Use: Better and more consistent contraceptive use — as well as more effective and "teen-friendly" contraceptives — have also probably contributed to the recent decline in the teen pregnancy rate, although the picture is a bit mixed. Data from the NSFG show that contraceptive use at *first* sex has improved. But there has also been a downward trend in contraceptive use at *most recent* sex (among teens who have had sex at least once in the past three months).

The greater availability of long-lasting, highly-effective, hormonal methods of contraception (Norplant and Depo Provera) has played a role in declining rates of teen pregnancy. About nine percent of sexually active teen girls aged 15-19 using a contraceptive method (in 1995) said they were using one of these methods (Please see Table 4, page 15). The biggest users of these previously-unavailable methods of contraception are unmarried teen mothers. Some 33 percent of unmarried teen mothers said they used one of the methods in 1995.[12] The heavy reliance by teen mothers on this method has surely helped to reduce repeat teen pregnancies and births among this group. It is important to note here that until the mid-1990s, about two-thirds of the decline in teen birth rates was due to reductions in *repeat* teen births.

The Economy and Welfare Reform: Recent economic prosperity in the United States and enhanced opportunities for education and work may also have played a role in encouraging teens to delay pregnancy and childbearing. A long-term economic expansion, low unemployment rates, higher earnings may have helped give young people a sense of opportunity. And while teen pregnancy and childbearing rates have historically shown little direct correlation with business cycles, it is possible that teens with enhanced opportunities are less likely to jeopardize their futures by engaging in risky behavior.

In addition, a number of recent economic and social policy initiatives may have played a role in declining teen pregnancy and childbearing rates. In the early 1990s, states began experimenting with changing their welfare systems under federal waivers, and there was increased attention paid at both the federal and state levels to paternity establishment and child support enforcement. The federal welfare reform law in 1996 included a number of provisions aimed at reducing out-of-wedlock childbearing, including requirements that teen mothers receiving benefits must live at home (or in supervised settings) and finish school, performance bonuses for states that reduce their out-of-wedlock childbearing rates, increased efforts to establish paternity and collect child support, new monies for abstinence education, and, perhaps most importantly, a stated commitment to reducing out-of-wedlock and teen pregnancy combined with the availability of flexible funding for states in the form of block grants. Many of these initiatives were in place in various states before the federal law was signed. Other federal and state efforts to help the working poor — including a greatly expanded Earned Income Tax Credit, more child care subsidies and a higher minimum wage — may also have helped to send a message to young people that "work pays," giving them more reason to delay pregnancy and childbearing.

Parents and other Adults: Many parents feel that when it comes to their children's decisions about sex, their influence has been eclipsed by peers and popular culture. Too many parents believe that what their children see on TV and in the movies, read in magazines or on the Internet, and hear on their radios and walkmans or from their friends simply negates anything positive they may have instilled in their children. But it may be that a different dynamic is at work. That is, teens tend

to turn to peers and popular culture for answers about sex not as their first choice, but because parents or other adults have failed to provide relevant information and guidance. As one teen told us, "parents have to talk to their children about sex and tell them what they think is right. Parents are the ones that we listen to the most. Even if parents don't think their kids are listening, you'd be amazed at how many really are." In addition, a consensus appears to have emerged that if we want to reduce teen pregnancy, parents need to talk not just to their daughters, but also to their sons.

Over two decades of research confirms what common sense and experience suggest, namely that families, and particularly parents, are an important influence on whether their teenagers become pregnant or cause a pregnancy. Simply put, the quality of parents' relationships with their children can make a real difference when it comes to teens' sexual activity and use of contraception.[13] And there are indications that parents are increasingly fulfilling their role as their children's first and best teachers about love, sex, and values. For instance, a 1999 survey conducted for the Kaiser Family Foundation indicates that 78 percent of parents say they have discussed AIDS with their 10- to 12-year-olds and 73 percent say they have discussed with teens how girls get pregnant. A recent analysis by Jennifer Manlove and Elizabeth Terry of Child Trends suggests that improved communication between parents and teens about sex has contributed to declines in the teen birth rate in the 1990s.[14]

Taken individually, each of these factors — advocacy, education, more cautious attitudes, contraceptive use, the economy and parents — has probably not had a large impact. But together, we think these factors are the primary building blocks that have *motivated* teens to reduce their risk of pregnancy and to achieve the declines achieved during the 1990s.

Now for the caveats. Despite much good news in reducing teen pregnancies and births, clearly there is much work to be done. The United States still has — by far — the highest rates of teen pregnancies and births among comparable countries. Some teens may also be having sex earlier. Among teen girls for example, the only age group showing an increase in the proportion who have ever had sex are those *under* age 15. In fact, the proportion of girls under age 15 who have engaged in sex almost doubled from 11 percent in 1988 to 19 percent in 1995. When it comes to contraceptive use, the picture is mixed as well. Between 30 and 38 percent of teen girls who use contraception are not consistent users. And, while more teen girls are using contraception the *first* time they have sex, as noted earlier, the rate of teen girls using contraception the most *recent* time they had sex has declined.

As this paper makes clear, if we are to make continued and lasting progress in our efforts to reduce adolescent pregnancy, we must fight a two-front war. That is, our first priority should always be to encourage teens to delay sexual activity in order to protect their physical health, their emotional health, and their opportunities for the future. Still there will be many teens who will become sexually active and, as the majority of parents and teens agree, they need information about and access to contraception to help protect them against pregnancy and disease.

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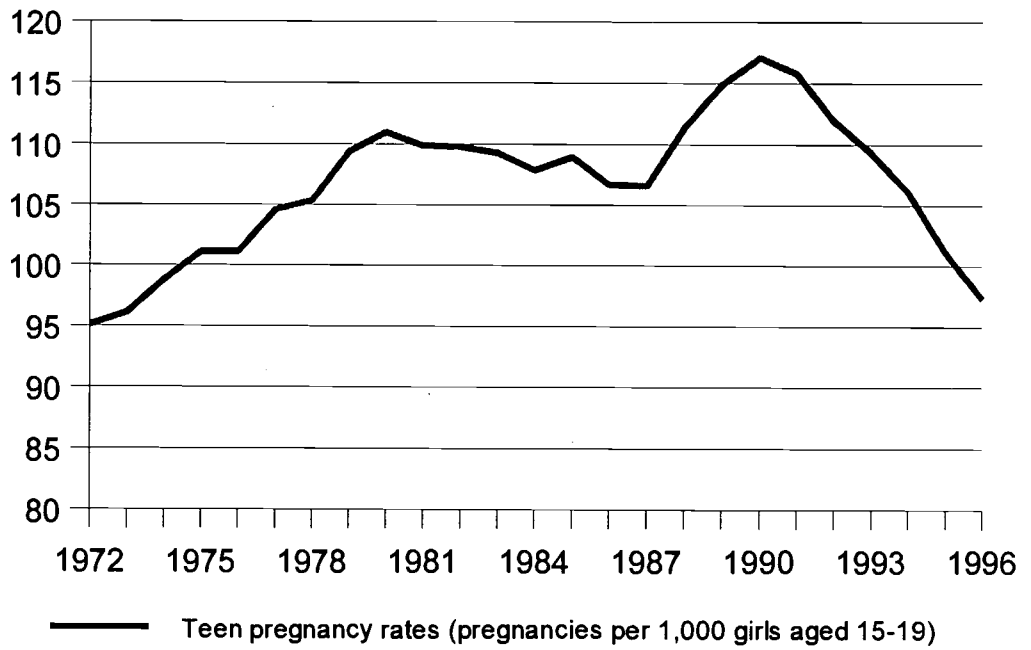
What's Behind the Good News: The Decline in Teen Pregnancy Rates During the 1990s

Between 1990 and 1996, the U.S. teen pregnancy rate declined 17 percent. This decline was welcome news after the increases of the 1970s and 80s [Figure 1].[1] Not surprisingly, many people have asked *why* the rates have declined. Though some ask simply out of curiosity, most want answers so that future efforts to reduce teen pregnancy can build on lessons learned from past success.

At the most basic level, two major forces can drive pregnancy rates down: decreased sexual activity or increased contraceptive use, or some combination of the two.[2] This paper explores these possible explanations, using data from the National Survey of Family Growth. But it is important to note what is *not* explained here: namely, the reasons why young people might have decreased their sexual activity or increased their contraceptive use in the first place. In some way, this is the more interesting question: what combination of forces — economic factors (including welfare reform), school- and community-based programs, messages in the media, fear of AIDS and other STDs, and attitudes generally — is at the root of changes in sexual behavior and contraceptive use? Have some of these factors been more influential than others? These intriguing issues, however, are not the focus of this paper (though they are briefly addressed in the introduction).[3] Rather, the question is posed: how much of the recent decline in teen pregnancy rates can be explained by less sexual activity, more contraceptive use, or both?

Figure 1: Teen pregnancy rates increased 23 percent between 1972 and 1990, then decreased 17 percent between 1990 and 1996.[1]



After a brief discussion of terms, the paper describes the data available to answer the question at hand ("Data Sources"). In "Examining the Data," the paper reviews what the numbers show. The final section, "Explaining the Decline," examines the available data to try and explain the overall decline in teen pregnancy rates as well as declines by age, race, and marital status.

Decreased Sexual Activity

Obviously, a teenaged girl who has never had sex cannot become pregnant. A teen who delays first sex also decreases her risk of becoming pregnant during adolescence. A girl who becomes sexually active on her 15th birthday, for example, has a full 5 years in which she might become pregnant as a teen, but a girl who becomes sexually active on her 19th birthday has only a one-year time span when this might happen. Both of these behaviors are measured at the population level by the same statistic, the percent of teens who have ever had sex. Note that throughout this paper "sex" refers to heterosexual vaginal intercourse, and that survey questions are designed to distinguish this particular behavior from other sexual behaviors.

All other things being equal, every act of intercourse carries a risk of pregnancy. Therefore, a decrease in *how often* a teen has sex (frequency of sex) also decreases the risk of becoming pregnant. Keep in mind that sexual activity among teens can be very sporadic. For example, the 1995 National Survey of Family Growth found that 10 percent of *sexually experienced* teen boys had not had sex at all in the previous year, and an additional 42 percent had had sex fewer than 10 times in the previous year.[4] So, overall sexual activity can decrease by fewer teens ever having sex and/or by less sexual activity among sexually experienced teens.

Better Use of Contraception

The second broad factor that might reduce pregnancies is better overall contraceptive use. This, in turn, can derive from one or more factors: using some form of contraception rather than none at all, using a method or methods *every* time rather than just some of the time, using the method(s) correctly and avoiding various "user errors," and moving from relatively less effective methods to more effective methods (typical first-year failure rates, for example, range from 0.05 percent for Norplant to 14 percent for condoms to 26 percent for spermicides[5]).

Moreover, both postponement of first sex or decreases in frequency of sex may have an effect on contraceptive use. Younger teens may have different patterns of contraceptive use than older ones. Similarly, those who have sex more frequently may use contraception differently than those who have sex less frequently. So, in some sense, these two broad factors — sexual activity and contraceptive use — are quite interrelated.

Data Sources

Pregnancy and Birth Rates

National birth rates almost invariably come from the National Center for Health Statistics (NCHS), U.S. Department of Health and Human Services (DHHS). National pregnancy rates, on the other hand, are compiled and released by three different entities: NCHS; the National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), Centers for Disease Control

and Prevention (CDC), DHHS; and the Alan Guttmacher Institute (AGI), a nonprofit research organization. Generally speaking, each organization uses its own calculation method, so rates released by one organization cannot be compared to rates released by another. The analyses below use pregnancy data from AGI. See Appendix 1 for information on the differences between the pregnancy rates available from each organization and for an example of how using alternate pregnancy rate sets would affect these analyses.

Rates of Sexual Activity and Contraceptive Use

Published statistics on teen sexual activity and contraceptive use usually come from one of three national surveys: the National Survey of Family Growth, the National Survey of Adolescent Males, and the Youth Risk Behavior Surveillance. The data analyzed in this report are from the National Survey of Family Growth (NSFG), a periodic survey of non-institutionalized, civilian women aged 15-44 on issues related to childbearing. Recent NSFG data are available for 1988, 1990 (a follow-up via telephone to the 1988 survey), and 1995. The following tables contain data for all three years.

The timing of the 1990 survey makes it ideal for analyses of the recent declines in teen pregnancy rates, since the teen pregnancy rate peaked in 1990. However, the 1990 survey may be less reliable than the 1988 survey. The response rate for the 1990 survey (54 percent for the follow-up with women aged 17-44,[6] and 52 percent for new interviews with girls aged 15-17[7]) was much lower than the response rates for either 1988 or 1995 (in both cases, 79 percent for women aged 15-44[6,8]). The teen sample size in 1990 is also much smaller than either 1988 or 1995. Finally, the fact that the 1990 survey was conducted by telephone instead of in person (as the 1988 and 1995 surveys were) may also make the 1990 survey less comparable to both the 1988 and the 1995 surveys.

Data from the National Survey of Adolescent Males (NSAM), a survey of boys aged 15-19 that includes questions similar to the NSFG, are not used here because this report focuses on the behavior of teen girls.[9] It is not known how a change in male contraceptive use or sexual activity, when not connected to a corresponding change in female behavior and/or female reporting about such behavior, affects teen pregnancy rates.

Similarly, this report does not include data from the Youth Risk Behavior Surveillance (YRBS), a survey of students in public and private high schools, grades 9 through 12, about a variety of health issues.[10] The YRBS is not an ideal survey to measure trends for the general population because it does not include young people who are not in school or students who are absent/truant when the survey is conducted and because results from the survey are reported by grade instead of by age, as pregnancy and birth rates are.

Examining the Data

How much have teen pregnancy and birth rates decreased?

Overall teen pregnancy rates decreased 17 percent between 1990 and 1996. Each age subgroup also experienced declines during this time period: pregnancy rates for girls aged 18-19 declined 12 percent, rates for girls aged 15-17 declined 17 percent, and rates for girls under 15 declined 24 percent.[11] Among the three racial/ethnic groups with pregnancy rates available, non-

Hispanic White and African-American teens experienced declines of 24 and 20 percent, respectively, between 1990 and 1996. The pregnancy rate for Hispanic teens was actually 0.7 percent higher in 1996 than the 1990 rate — rates for this group increased between 1990 and 1994, then decreased 6 percent between 1994 and 1996.[12]

Teen birth rates also began declining in the early 1990s after increasing in the late 1980s. The overall teen birth rate (for girls aged 15-19) had decreased 18 percent by 1998 from its peak in 1991. Teen birth rates declined for all age subgroups — 13 percent for girls aged 18-19, 21 percent for girls aged 15-17, and 29 percent for girls aged 10-14 — during the same time period. Rates for all five of the major racial/ethnic groups also declined, with the teen birth rates for African-Americans declining the most (26 percent), rates for Hispanics declining the least (12 percent), and declines for Non- Hispanic White, American Indian, and Asian/Pacific Islander teens falling in between at 19, 15, and 16 percent, respectively.[13] Birth rates for married teens aged 15-19 dropped 23 percent between 1990 and 1998, while the birth rate for unmarried teens in the same age bracket was only 2 percent lower in 1998 than it was in 1990 because rates for unmarried teens increased between 1990 and 1994, and only then began to decrease (11 percent between 1994 and 1998).[14] The percent of all teen births that are to unmarried teens actually increased 17 percent between 1990 and 1998, continuing to increase between 1994 and 1998 even as the unmarried teen birth rate was declining. Two possible explanations exist for this seeming paradox: either the birth rate for married teens declined more steeply than the birth rate for unmarried teens, or married teens made up a smaller proportion of the total teen population — and it appears that only the latter was true for the 1994-98 period.[15] The first birth rate (births to teens who have not had a child) remained constant in the early 1990s and declined only 14 percent between 1991 and 1998.[16] The second birth rate (to teens who have had a first birth) declined 21 percent in the same time period, and the proportion of teen births that were repeat births decreased 12 percent.[17]

In summary, teen pregnancy and birth rates began decreasing in the early 1990s for almost every subgroup, although a few measures such as the unmarried teen birth rate and the pregnancy rate for Hispanic teens only began decreasing in the mid-1990s.

Has teen sexual activity decreased?

The first step in trying to answer the question, "has teen sexual activity decreased?" is to ask, "has the *percentage* of teens who have *ever had* sex decreased?" This question is not as simple to answer as one might expect because one must first define precisely how "ever had sex" is measured. The measurement of sexual experience in the NSFG is affected by three factors: (1) whether one counts all sex or only voluntary sex, (2) whether one counts only sex after menarche, and (3) how one measures age.

- *Voluntary sex versus all sex:* Both voluntary and nonvoluntary sex can lead to pregnancy, but they are obviously very different situations requiring vastly different prevention strategies. Only in 1995 did the NSFG ask questions about nonvoluntary sex; comparison statistics from 1988 or 1990 are not available.

- *Sex after menarche versus all sex:* As a general matter, sex before menarche cannot lead to pregnancy. But if one's interest is in the incidence of sex per se, then the declines in sexual activity may be relevant regardless of their potential to create a pregnancy.

- *Age at interview versus age on a central date:* The central date is a point approximately halfway through the survey process. Weights for the sample are calculated so that the sample accurately represents the female population on this day. In practical terms, this means that some girls may be 19 when interviewed, but 20 on the central date or vice versa.[18] The 1988 and 1995 surveys also included a few girls who were 14 when interviewed, but 15 on the central date for the survey.

As Table 1 shows, the proportion of teen girls who have ever had sex differs slightly depending on the variables used. While the first two calculation methods showed declines in the percentage of teen girls who reported ever having had sex between both 1988-95 and 1990-95, the magnitude of the decline varies (1.9-4.7 percent decreases between 1988-95 and 5.8-8.0 percent decreases between 1990-95) depending on the method used to calculate sexual experience. (As noted earlier, the other two calculation methods cannot be used to plot trends because the necessary questions were not added until 1995.) Note that none of the decreases in sexual experience between 1988 and 1995 or 1990 and 1995 is statistically significant,[19] meaning that there is no way of knowing whether or not the trend observed among the girls who were surveyed is true for the whole population of teen girls. This last point is important — the implications are discussed later in the section "Sampling Error and Other Potential Biases."

Table 1: Measures of Sexual Experience in the National Survey of Family Growth

	1988	1990	1995	% Change 1988-95	% Change 1990-95
Girls aged 15-19 at time of interview					
ever had sex[20]	52.7%	54.9%	51.7%	-1.9%	-5.8%
ever had sex after menarche[21]	52.6%	54.7%	51.3%	-2.5%	-6.2%
ever had voluntary sex[22]	N/A	N/A	51.1%	N/A	N/A
ever had voluntary sex after menarche[23]	N/A	N/A	50.9%	N/A	N/A
Girls aged 15-19 on a given "central" date (March 15, 1988, for the 1988 survey, August 15, 1990, for the 1990 survey, and April 1, 1995, for the 1995 survey)					
ever had sex[20]	53.0%	54.9%	50.8%	-4.2%	-7.5%
ever had sex after menarche[21]	52.9%	54.8%	50.4%	-4.7%	-8.0%
ever had voluntary sex[22]	N/A	N/A	50.3%	N/A	N/A
ever had voluntary sex after menarche[23]	N/A	N/A	50.1%	N/A	N/A

N/A – not asked or not available

The next question to ask is: among those who have had sex, has the *frequency* of teen sexual activity decreased? The most obvious way to ask this in a survey might be something like, "how many times have you had sex in the past year?" However, it is generally believed that individuals would not be able to answer such a question precisely. The most common measure of frequency is, instead, the percent of teens who had sex in the *three months* before the survey. These teens are often referred to as being "sexually active," as opposed to "sexually experienced," which refers to anyone who has ever had sex, even if only once. Using this definition, note that about one-fifth of sexually experienced teens are not sexually active. The percent of all teens who are sexually

active decreased slightly, but not significantly, between 1988 and 1995, as shown in Table 2. (None of the variables measuring frequency of sex is available for 1990.)

Another available statistic is the average number of months in the past year in which sexually experienced teens had sex. There was no change in this number between 1988 and 1995: teen girls had sex (at least once), on average, 8.6 months out of the past year (Table 2).

Finally, the results from a question about average frequency of sex in the past three months shows an interesting trend between 1988 and 1995: the percent of girls choosing the high and low extremes ("four or more times per week" and "once a month or less," respectively) increased, while the percent of girls who chose one of the other three middle options decreased. (These trends cannot be tested for significance — see endnote 26 for more information.)

Table 2: Measures of Frequency of Sex in the National Survey of Family Growth

	1988	1990	1995	% Change 1988-95	% Change 1990-95
Girls aged 15-19 at time of interview					
have had sex in the three months before the survey ("sexually active")[24]	42.8%	N/A	40.4%	-5.6%	N/A
mean number of months in the past year in which sexually experienced girls had sex[25]	8.6 months	N/A	8.6 months	no change	N/A
average frequency of sex in the past three months, among "sexually active" girls who responded to the survey question:[26]					
• four or more times per week	3.7%	N/A	9.5%	+156.8%	N/A
• two or three times per week	29.0%	N/A	24.1%	-16.9%	N/A
• once a week	18.0%	N/A	16.7%	-7.2%	N/A
• two or three times per month	29.1%	N/A	27.0%	-7.2%	N/A
• once a month or less	20.2%	N/A	22.6%	+11.9%	N/A
Girls aged 15-19 on a given "central" date (March 15, 1988, for the 1988 survey, August 15, 1990, for the 1990 survey, and April 1, 1995, for the 1995 survey)					
have had sex in the three months before the survey ("sexually active")[24]	42.7%	N/A	39.9%	-6.6%	N/A
mean number of months in the past year in which sexually experienced girls had sex[25]	8.6 months	N/A	8.6 months	no change	N/A
average frequency of sex in the past three months, among "sexually active" girls who responded to the survey question:[26]					
• four or more times per week	N/A	N/A	9.2%	N/A	N/A
• two or three times per week	N/A	N/A	24.3%	N/A	N/A
• once a week	N/A	N/A	17.7%	N/A	N/A
• two or three times per month	N/A	N/A	26.7%	N/A	N/A
• once a month or less	N/A	N/A	22.1%	N/A	N/A

N/A – not asked or not available

In summary, the proportion of teen girls who were sexually experienced was lower in 1995 than in 1988 or 1990, and between 1988 and 1995 some measures of recent sexual activity decreased, some increased, and some showed no change. Additionally, since none of the changes that could be tested is statistically significant, one cannot know for sure that the trends observed among the survey participants actually reflect changes occurring in the population as a whole.

Has teen contraceptive use improved?

Ideally, to measure contraceptive use accurately one would evaluate use at each act of intercourse (or systematic use for methods that are not coitus-dependent, such as the pill and Depo-Provera) along the various dimensions noted above, such as whether a method was used at all, whether or not the method was used correctly, whether more than one was used simultaneously, etc. However, it is unlikely that survey respondents could accurately remember such detailed information about their histories of contraceptive use. Instead, the most commonly used measures of contraception capture information about use at three points in time: at first sex, at most recent sex, and in the month of the survey (see Table 3).

Table 3: Measures of Contraceptive Use in the National Survey of Family Growth

	1988	1990	1995	% Change 1988-95	% Change 1990-95
Girls aged 15-19 at time of interview					
used any method at first sex, among teens who have had sex after menarche[28]	65.1%	66.4%	70.7%	+8.6%	+6.5%
used any method at first voluntary sex, among teens who have had voluntary sex after menarche[29]	N/A	N/A	75.3%	N/A	N/A
used any method at most recent sex, among "sexually active" teens[30]	77.4%	N/A	68.2%	-11.9%§	N/A
current use in the month of interview, among teens "at risk of unintended pregnancy"[31]	77.1%	N/A	76.8%	-0.4%	N/A
Girls aged 15-19 on a given "central" date (March 15, 1988, for the 1988 survey, August 15, 1990, for the 1990 survey, and April 1, 1995, for the 1995 survey)					
used any method at first sex, among teens who have had sex after menarche[28]	65.3%	66.1%	71.8%	+10.0%	+8.6%
used any method at first voluntary sex, among teens who have had voluntary sex after menarche[29]	N/A	N/A	75.9%	N/A	N/A
used any method at most recent sex, among "sexually active" teens[30]	78.2%	N/A	68.6%	-12.3%§	N/A
current use in the month of interview, among teens "at risk of unintended pregnancy"[31]	77.8%	N/A	77.3%	-0.6%	N/A

N/A – not asked or not available; § – statistically significant at p = .05

In an encouraging trend, contraceptive use at first sex increased steadily between 1988 and 1995, although the increases were not statistically significant. Use at first *voluntary* sex for 1995 was significantly higher than use at first sex ever for 1988 and 1990. (For 1995, contraceptive use at first voluntary sex is higher than use at first sex ever because contraception was not used in the vast majority of cases where first sex was nonvoluntary — see endnote 28 for more information.)

Use of a contraceptive method at most recent sex, however, shows the opposite trend: between 1988 and 1995 it actually *decreased*, and this trend *is* statistically significant. Note that a convention for measuring contraceptive use at most recent sex is to limit the sample to those who have had sex in the past three months ("sexually active" teens) on the assumption that they will better remember their use of contraception than those whose most recent sex was further in the past.

Current contraceptive use by teens at risk of unintended pregnancy[27] also decreased slightly, but not significantly, between 1988 and 1995. (As for "use at most recent sex," current use is not available for 1990 because it cannot be determined whether or not survey respondents had sex in the past three months.)

While these "point-in-time" measures of contraceptive use provide interesting information, they by no means provide all of the data needed to evaluate contraceptive use fully. The 1995 NSFG, for example, asked about *consistency* of use in the three months before the interview, and found that only 70 percent of teens relying on contraceptive pills never missed a pill in the three months before the interview, and only 62 percent of teens relying on coitus-dependent methods, such as condoms, used the method every time they had sex in the previous three months.[32] Unfortunately, comparable data from earlier cycles of the NSFG are not available.

Similarly, no other national survey information about the degree to which teens use contraception *correctly* is available. Several smaller research projects, however, have discovered that teens — like many adults — often use contraception incorrectly. One survey of teen family planning clinic clients found not only that many pill users did not take the pill every day, but that relatively few pill users took their pills at the same time every day, took all of their pills, or used a backup method if they forgot their pills.[33] A small survey of college-aged, male condom users found that 34 percent had experienced some form of "user error" in the previous month, such as putting the condom on midway through intercourse.[34] While this research is instructive, there is no way of knowing the prevalence of such errors in the general teen population, or whether or not correct use of contraception has increased over time.

The third aspect of contraceptive use that helps reveal whether or not contraceptive use has improved is choice of method. Table 4 provides contraceptive use in the month of interview among teens who were "at risk of unintended pregnancy," displayed by method, for 1988 and 1995. The vast majority of teens in both 1988 and 1995 used either no method at all, a hormonal method, or condoms. Pill use declined significantly between 1988 and 1995, but this was mostly offset by increased use of Norplant and Depo-Provera (the overall decrease in hormonal methods was not statistically significant). Condom use increased slightly (but not significantly) in the same time period. Use of other methods also decreased slightly, but not significantly. One should also note that this chart presents only primary contraceptive use in the month of interview; some individuals may have used more than one method (either switching from one to another or using more than one method simultaneously).

To evaluate the impact of changes from one method of contraception to another, one must take into account the failure rates of various methods. Table 4 also provides method-specific failure rates, both for perfect use and for typical use (either from clinical studies or estimated from the NSFG). If true for the whole population, the greater use of Norplant and Depo-Provera instead of contraceptive pills should lead to fewer pregnancies, while the condom use that supplants another portion of pill use should lead to more pregnancies, given the relative effectiveness of these methods. However, with the wide range of possible failure rates depending on consistency and correctness of use, and with most of the trends in method use not being statistically significant, it is hard to come to clear conclusions about the effects of changes in method choice.

Table 4: Current Method Choice Among Those "at Risk of Unintended Pregnancy" Who Had Sex in the Three Months Before the Survey

				First-Year Failure Rates		
	1988[35]	1995[35]	% Change 1988-95	Perfect Use[36]	Typical Use[36]	Teens, NSFG[37]
Girls aged 15-19 at time of interview						
NO METHOD	22.9%	23.2%	+1.2%	85%	85%	N/A
hormonal methods:	45.8%	43.6%	-4.8%			
Norplant/Depo-Proverat	N/A	9.0%	N/A	0.05%, 0.3%	0.05%, 0.3%	4.0%
the pill	45.8%	34.6%	-24.5%§	0.1-0.5%	5%	9.8%
male condom	25.0%	27.9%	+11.7%	3%	14%	17.6%‡
other	6.2%	5.2%	-15.8%	N/A	N/A	N/A
Girls aged 15-19 on a given "central" date (March 15, 1988, for the 1988 survey, August 15, 1990, for the 1990 survey, and April 1, 1995, for the 1995 survey)						
NO METHOD	22.2%	22.7%	+2.3%	85%	85%	N/A
hormonal methods:	46.0%	42.9%	-6.7%			
Norplant/Depo-Proverat	N/A	8.8%	N/A	0.05%, 0.3%	0.05%, 0.3%	4.0%
the pill	46.0%	34.2%	-25.8%§	0.1-0.5%	5%	9.8%
male condom	24.7%	28.7%	+16.2%	3%	14%	17.6%‡
other	7.1%	5.7%	-20.0%	N/A	N/A	N/A

Columns may not add to 100 percent due to rounding. N/A – not asked or not available; † – approved by the Food and Drug Administration after 1988; § – statistically significant at p=.05; ‡ – combined failure rate for condoms and the diaphragm

To summarize, trends in teen girls' contraceptive use between 1988/90 and 1995 were mixed: use at first sex appears to have increased, while use at most recent sex and in the month of the interview decreased. Current use of condoms increased, while current use of the pill (and hormonal methods taken as a whole) decreased. Most of these changes lack statistical significance, however, making interpretation difficult. In addition, a lack of longitudinal data on consistency and correctness of method use also adds to the difficulty of understanding teen contraceptive use.

Explaining the Decline

Given that the only statistically significant changes in teen girls' sexual activity or contraceptive use between 1988/90 and 1995 were the decreases between 1988 and 1995 in contraception at most recent sex and pill use in the month of interview (neither of which one would expect to predict a decrease in teen pregnancy rates!), how can one explain the decline in teen pregnancy rates that began in the early 1990s?

The formula presented below was developed to analyze changes in the teen pregnancy rate and relies on two key pieces of information: the percent of teens who are sexually experienced and the pregnancy rate for sexually experienced teens.*

percent of all teen girls who are sexually experienced	x	pregnancy rate for sexually experienced teen girls	=	teen pregnancy rate

Calculation of the first variable in the formula, the percent of all teens who are sexually experienced (which is calculated by dividing the number of sexually experienced teens by the total number of teen girls), was discussed earlier and presented in Table 1. However, as stated previously, there are many ways one can define "sexually experienced." Therefore, the analyses presented below are repeated for *each* of the four different methods of estimating sexual experience that have longitudinal data available, since the magnitude of the change in sexual experience depends in part on the definition used and this would likely alter the proportion of the total decline in teen pregnancy rates that was due to decreased sexual experience. The analyses discussed in this section of the paper assume that the observed changes in sexual experience truly occurred in the entire teen population, even though they are not statistically significant. How this assumption might affect the results is discussed later.

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* This formula may look odd to those familiar with the typical method of calculating the pregnancy rate (dividing the number of pregnancies by the teen population). In fact, the two formulas are equivilant. The terms in the above formula are defined as follows:

$$\frac{\text{number of sexually experienced teen girls}}{\text{total number of teen girls}} \times \frac{\text{number of pregnancies}}{\text{number of sexually experienced teen girls}} = \frac{\text{number of pregnancies}}{\text{total number of teen girls}}$$

Algebraic rules allow us to "cancel out" the number of sexually experienced teen girls from the two terms so that their product is the same teen pregnancy rate as is yielded by the traditional calculation method.

$$\frac{\cancel{\text{number of sexually experienced teen girls}}}{\text{total number of teen girls}} \times \frac{\text{number of pregnancies}}{\cancel{\text{number of sexually experienced teen girls}}} = \frac{\text{number of pregnancies}}{\text{total number of teen girls}}$$

One should also note that the variable used here, the proportion of teens who have ever had sex, is not ideal for such an analysis. Because these analyses look at pregnancy risk over a single year (1988, 1990, or 1995), in some respects the ideal measure of sexual activity would be the percent of teens who have had sex in the past year. For example, a sexually experienced teen who last had sex in 1993 (according to the 1995 NSFG) was not truly at risk of becoming pregnant in 1995. On the other hand, a 12-month period of sexual activity would not cover all at-risk teens, either, since pregnancies are counted by year of outcome: a full-term birth occurring in January 1995 would have been conceived in April 1994, while an early abortion or miscarriage occurring in December 1995 might have been conceived in November 1995 (potentially, a 19- or 20-month time period of risk).

The second term of the equation in the box is the pregnancy rate for sexually experienced teens (which is calculated by dividing the number of pregnancies by the number of sexually experienced teens). The pregnancy rate for sexually experienced teens, in turn, really captures two sets of behaviors: if it decreases, it may be because contraceptive use has improved, or it may be because frequency of sex has decreased (because each act of intercourse carries a risk of pregnancy). Use of this variable as opposed to an actual measures of contraception and frequency of sex has several advantages. As shown in Table 3, contraceptive use varies substantially depending on which of the three common "point-in-time" measures used; method choice also varies among the three measures.[38] In addition, longitudinal data on consistency and correctness of use do not exist. Likewise, available measures of frequency are less than ideal for this type of analysis, and different measures show different trends between 1988 and 1995 (and none are available for 1990). Of course, the major disadvantage is that if we find that some of the decline in the teen pregnancy rate is due to a decline in the pregnancy rate for sexually experienced teens, we won't really know what this means, whether frequency of sex has decreased or contraceptive use has improved, or both.

How can this formula be used to analyze the change in teen pregnancy rates? Assuming that the percent of teens who are sexually experienced and the pregnancy rate for sexually experienced teens are both decreasing as the teen pregnancy rate decreases, then both variables are contributing to the decline. To determine what proportion of the total change in rates is attributable to each factor, the formula in the box above is used to calculate what the 1995 teen pregnancy rate would have been if only one factor or the other had changed, and then these two hypothetical teen pregnancy rates are compared with the actual pregnancy rate in 1995. To illustrate this process, an analysis of the change in the teen pregnancy rate between 1990 and 1995 follows.

Table 5 displays the two variables used in the formula for 1988, 1990, and 1995. The figures for the percent of all teen girls who have ever had sex are simply repeated from Table 1. The pregnancy rates for sexually experienced teens were calculated based on the formula in the box above (by dividing the teen pregnancy rate as published by the Alan Guttmacher Institute — 0.111 for 1988, 0.117 for 1990, and 0.101 for 1995 — by the percent of teen girls who are sexually experienced).

Table 5: Variables Needed for an Analysis of the Decline in Teen Pregnancy Rates

Methods of calculating sexual experience	Percent of all girls aged 15-19 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 15-19		
	1988	1990	1995	1988	1990	1995
Method 1: percent sexually experienced, girls aged 15-19 when interviewed	52.7%	54.9%	51.7%	0.211	0.213	0.195
Method 2: percent sexually experienced, girls aged 15-19 on a central date	53.0%	54.9%	50.8%	0.209	0.213	0.199
Method 3: percent sexually experienced after menarche, girls aged 15-19 when interviewed	52.6%	54.7%	51.3%	0.211	0.214	0.197
Method 4: percent sexually experienced after menarche, girls aged 15-19 on a central date	52.9%	54.8%	50.4%	0.210	0.214	0.200

The first row in Table 6 shows what the 1995 teen pregnancy rate would have been if just the percent of teen girls who report being sexually experienced changed (calculated by multiplying the 1995 rate of sexual experience and the 1990 pregnancy rate for sexual experienced teens). The third row shows the same calculation, assuming that only the pregnancy rate for sexually experienced teens changed between 1990 and 1995 (calculated by multiplying the 1990 rate of sexual experience and the 1995 pregnancy rate for sexual experienced teens).

Rows six and seven calculate the proportion of the actual change in teen pregnancy rates (row five) that is due to either the decrease in the proportion of teens who are sexually experienced or the decrease in the pregnancy rate for sexually experienced teens (calculated by dividing the point change attributed to the relevant factor — from rows two and four — by the total actual point change). Note that the proportions attributed to the two factors add up to more than 100 percent. As explained previously, some changes in sexual activity (initiation or frequency) may also have an effect on contraceptive use, making a "double contribution" to declining teen pregnancy rates. The final row in Table 6 shows the impact of this interaction effect, measured as the sum of the two attributed proportions subtracted from 100 percent.

Table 6: Analysis of the Decline in Teen Pregnancy Rates, 1990-95

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.110	0.108	0.110	0.108
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.007	0.009	0.007	0.009
1995 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.107	0.109	0.108	0.110
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.010	0.008	0.009	0.007
total point change in the actual teen pregnancy rate, 1990-95	0.016	0.016	0.016	0.016
percent change due to a change in the proportion of teens who are sexually experienced	42.6%	54.6%	45.5%	58.7%
percent change due to a change in the pregnancy rate for sexually experienced teens	60.9%	49.1%	58.2%	44.9%
interaction effect	-3.6%	-3.7%	-3.6%	-3.6%

Not surprisingly, separate analyses using the four NSFG measures of sexual experience yield varying results. At one extreme (using Method 1 to calculate the percent of teens who are sexually experienced) approximately 40 percent of the decline is due to fewer teens becoming sexually active and the other 60 percent is due to decreased pregnancy rates among sexually experienced teens (in turn due to some combination of decreased frequency of sex and increased contraceptive use). At the other extreme (using Method 4), the proportion of the decline in teen pregnancy rates explained by fewer teens becoming sexually experienced increases to nearly 60 percent while the proportion due to decreased pregnancy rates for sexually experienced teens decreases to just over 40 percent. (Using alternate pregnancy rates can result in slightly different allocations; see Appendix 1 for more information.)

Remember that the 1990 survey is generally regarded as weak, and many analysts shy away from including it in studies using time trends. Analyses of changes between 1988 and 1995, shown in Table 7, yield results that are somewhat similar to the 1990-95 analysis, but with the allocation of the decline shifted in favor of decreasing pregnancy rates for sexually experienced teens by 5-20 percent. So the proportion of the decline in teen pregnancy rates between 1988 and 1995 attributable to fewer teens having had sex ranges from approximately 20-50 percent, while the

proportion of the decline attributable to decreased pregnancies among sexually experienced teens range from 50-80 percent.

Table 7: Analysis of the Decline in Teen Pregnancy Rates, 1988-95

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.109	0.106	0.108	0.106
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.002	0.005	0.003	0.005
1995 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.103	0.105	0.104	0.106
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.008	0.006	0.007	0.005
total point change in the actual teen pregnancy rate, 1988-95	0.010	0.010	0.010	0.010
percent change due to a change in the proportion of teens who are sexually experienced	21.1%	46.1%	27.4%	52.5%
percent change due to a change in the pregnancy rate for sexually experienced teens	80.5%	56.3%	74.4%	49.9%
interaction effect	-1.5%	-2.3%	-1.8%	-2.4%

In summary, results from this type of analysis of the overall teen pregnancy rate decline vary widely depending on the definition of "sexual experience" and the beginning point for the analyses. In looking at the ranges of possible allocation, it appears that neither decreased sexual experience nor decreased pregnancy rates for sexually experienced teens is responsible for all of the decline. However, the exact proportion of the total decline explained by each factor is unclear. In addition, it is not known how much of the second factor, decreased pregnancy rates for sexually experienced teens, is due to decreased frequency of sex and how much to improved contraceptive use.

The next question is whether or not analyses of changes in rates for subgroups (i.e., groups defined by age or race/ethnicity) yield more definitive results.

Breakdowns by Race/Ethnicity

While it would be helpful to know if different factors were responsible for rate changes among the different racial/ethnic groups, the data needed to perform separate analyses for White, Black, and Hispanic teens are not available, and neither AGI nor the federal government publishes teen pregnancy rates for Asians/Pacific Islanders or Native Americans.[39]

Breakdowns by Age Subgroup

Teen pregnancy rates declined for both older and younger teens between 1988 and 1995. For younger teens (aged 15-17), the teen pregnancy rate declined 12 percent between 1988 and 1995, from 74 per 1,000 to 65 per 1000. The rate for older teens, those aged 18 or 19, decreased from 164 per 1,000 in 1988 to 157 per 1,000 in 1995, a decline of 4 percent.[1] Like the above analyses, one can calculate the percentage of teens aged 15-17 and 18-19 who were sexually experienced, compare the change in sexual experience to the change in the pregnancy rates, and calculate what proportion of the declines for the two age groups was due to declines in sexual experience versus declines in pregnancy rates for sexually experienced teens. Note that, due to its relatively small sample size, the 1990 survey is not included in these analyses.

Table 8 presents the variables needed for an analysis of the decline in teen pregnancy rates for teens aged 15-17. The sexual experience rates, calculated using the same methods described above, show either small decreases (the two rates based on age at a "central" date) or small *increases* (the two rates based on age at interview) between 1988 and 1995. Like the rates for teens 15-19, neither the increases nor the decreases in the percent of teens who are sexually experienced were statistically significant, so these trends should be interpreted with caution.

Table 8: Variables Needed for an Analysis of the Declines for Younger Teens

	Percent of all girls aged 15-17 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 15-17		
Methods of calculating sexual experience	**1988**	**1995**	**% change**	**1988**	**1995**	**% change**
Method 1: percent sexually experienced, girls aged 15-17 when interviewed	37.8%	38.6%	+2.1%	0.196	0.168	-14.0%
Method 2: percent sexually experienced, girls aged 15-17 on a central date	38.4%	38.0%	-1.0%	0.193	0.171	-11.2%
Method 3: percent sexually experienced after menarche, girls aged 15-17 when interviewed	37.6%	38.3%	+1.9%	0.197	0.170	-13.8%
Method 4: percent sexually experienced after menarche, girls aged 15-17 on a central date	38.2%	37.6%	-1.6%	0.194	0.173	-10.8%

Since the first and third methods of calculating sexual experience yielded increases in sexual experience, analyses using these methods attribute all of the decrease in teen pregnancy rates to

decreases in the pregnancy rate for sexually experienced teens (Table 9). (The percentages generated in the analyses are actually greater than 100 percent, indicating that the improvement in the pregnancy rate for sexually experienced teens was responsible for all of the decline, plus it improved an additional amount which offset increases in sexual experience that otherwise would have caused an increase in the actual teen pregnancy rate). Analyses using the other two calculation methods result in the vast majority — about 90 percent — of the decrease in teen pregnancy rates for teens aged 15-17 being attributed to improved pregnancy rates for sexually experienced teens (either because of decreased frequency of sex or improved contraceptive use), and only approximately 10 percent allocated to decreases in sexual experience.

Table 9: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 15-17, 1988-95

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.076	0.073	0.075	0.073
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	-0.002	0.001	-0.001	0.001
1995 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.064	0.066	0.064	0.066
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.010	0.008	0.010	0.008
total point change in the actual teen pregnancy rate, 1988-95	0.009	0.009	0.009	0.009
percent change due to a change in the proportion of teens who are sexually experienced	-17.4%	8.6%	-15.3%	12.9%
percent change due to a change in the pregnancy rate for sexually experienced teens	115.0%	92.4%	113.2%	88.5%
interaction effect	2.4%	-1.0%	2.1%	-1.4%

While it appears that a decrease in pregnancies among sexually experienced teens is largely responsible for the decline in teen pregnancy rates for younger teens, the opposite appears to be true for older teens. Table 10 presents sexual experience rates for teens aged 18-19, showing modest declines for all four calculation methods (none of these declines was statistically significant, however). The pregnancy rate for sexually experienced teens, on the other hand, *increased* slightly for all four calculation methods. Therefore, as shown in Table 11, the *entire* decrease in

pregnancy rates for teens aged 18-19 between 1988 and 1995 was due to a decrease in the percent of teens who had sex, no matter how sexual experience was defined.

Table 10: Variables Needed for an Analysis of the Declines for Older Teens

	Percent of all girls aged 18-19 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 18-19		
Methods of calculating sexual experience	**1988**	**1995**	**% change**	**1988**	**1995**	**% change**
Method 1: percent sexually experienced, girls aged 18-19 when interviewed	74.4%	71.1%	-4.4%	0.220	0.221	+0.2%
Method 2: percent sexually experienced, girls aged 18-19 on a central date	73.9%	70.7%	-4.3%	0.222	0.222	+0.1%
Method 3: percent sexually experienced after menarche, girls aged 18-19 when interviewed	74.3%	70.8%	-4.7%	0.221	0.222	+0.5%
Method 4: percent sexually experienced after menarche, girls aged 18-19 on a central date	73.9%	70.4%	-4.7%	0.222	0.223	+0.5%

In summary, analyses for age subgroups appear to yield much more definitive results than analyses of the overall decline. For teens aged 18-19, 100 percent of the decline is due to fewer teens in this age group ever having had sex. For teens aged 15-17, 90-100 percent of the decline was due to a decreased pregnancy rate for sexually experienced teens.

Breakdowns by Marital Status

It would also be interesting to know if different factors were behind the declines in teen pregnancy rates for married and unmarried teens, especially given the difference in the magnitude of the declines in birth rates by marital status (the birth rate for married teens declined 23 percent between 1990 and 1997 while the birth rate for unmarried teens declined only 2 percent[40]). However, such an analysis would be much more complicated than the analyses above, because any analysis of changes in teen birth rates must take into account a third factor (in addition to sexual experience and the pregnancy rate for sexually experienced teens): the proportion of pregnancies that end in a birth.[41] The resulting formula to use for an analysis of changes in the unmarried teen birth rate would be:

percent of all unmarried teen girls who are sexually experienced	x	pregnancy rate for unmarried, sexually experienced teen girls	x	the percent of pregnancies to unmarried teen girls that end in an out-of-wedlock birth	=	unmarried teen birth rate

Table 11: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 18-19, 1988-95

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.157	0.157	0.156	0.156
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.007	0.007	0.008	0.008
1995 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.164	0.164	0.165	0.165
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.000	0.000	-0.001	-0.001
total point change in the actual teen pregnancy rate, 1988-95	0.007	0.007	0.007	0.007
percent change due to a change in the proportion of teens who are sexually experienced	103.9%	101.4%	110.4%	111.0%
percent change due to a change in the pregnancy rate for sexually experienced teens	-4.1%	-1.5%	-10.9%	-11.5%
interaction effect	0.2%	0.1%	0.5%	0.5%

The problem is getting the number of pregnancies conceived by unmarried girls (needed for the second and third terms), a number that is not published. An attempt was made to estimate this number. First, estimations were created, based on reported pregnancies in the NSFG, of the proportion of reported pregnancies that fell into three possible marital status categories: conceived by a married teen, conceived by an unmarried teen who married before the pregnancy ended, and conceived by an unmarried who remained unmarried throughout the pregnancy. Then, these proportions were applied to the actual birth, abortion, and miscarriage statistics for 1988 and 1995 in order to find the number of pregnancies to unmarried teens. However, this approach turned out to have two severe limitations: (1) too few pregnancies were reported to analyze by outcome and marital status, and (2) abortions are severely underreported (by about one-half) in the NSFG, compared to abortion figures from AGI. Further research is needed to identify data sets that are adequate for this type of analysis.

Why did teen pregnancy rates increase in the first place?

Analyses of the recent declines in the overall teen pregnancy rate do not yield a definitive explanation about which behavioral changes have driven the rates down, but what about looking further into the past, to the increases in teen pregnancy rates of the 1970s and 1980s?

The method of analyzing changes in pregnancy rates used in this paper can be applied to increases as well as decreases. However, there is one problem: the National Survey of Family Growth did not fully include teen girls until the Cycle 3 survey in 1982. To get rates of sexual experience for 1972, this analysis used 1990 data: specifically, dates of first sex for women aged 33-37 (who would have been 15-19 in 1972) were compared to what their interview dates would have been in 1972 to generate the percent of teen girls who can be considered to have been sexually experienced in 1972. The 1990 survey data were used instead of 1988 or 1995 in order to eliminate any possible incomparabilities due to different survey methods and question wordings among the three survey years.

The various ways of calculating sexual experience among teen girls aged 15-19 in 1972 yield estimates of 39.4-39.9 percent (Table 12). With all four calculation methods, sexual experience increased dramatically between 1972-90 (about 40 percent, increases that are statistically significant) while the pregnancy rate for sexually experienced teens declined about 11 percent.

Table 12: Variables Needed for an Analysis of the 1972-90 Teen Pregnancy Rate Increase

	Percent of all girls aged 15-19 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 15-19		
Methods of calculating sexual experience	**1972**	**1990**	**% change**	**1972**	**1990**	**% change**
Method 1: percent sexually experienced, girls aged 15-19 when interviewed	39.4%[42]	54.9%	+39.3%	0.241	0.213	-11.6%
Method 2: percent sexually experienced, girls aged 15-19 on a central date	39.9%[38]	54.9%	+37.6%	0.238	0.213	-10.5%
Method 3: percent sexually experienced after menarche, girls aged 15-19 when interviewed	39.4%[43]	54.7%	+38.8%	0.241	0.214	-11.3%
Method 4: percent sexually experienced after menarche, girls aged 15-19 on a central date	39.8%[39]	54.8%	+37.7%	0.239	0.214	-10.6%

Unlike the decline in teen pregnancy rates in the 1990s, where both decreases in sexual experience and decreases in pregnancies among sexually experienced teens were contributing to the decline, in the 1970s and 1980s the teen pregnancy rate increased solely because of an increase in sexual experience among teens (Table 13). The pregnancy rate for sexually experienced teens was decreasing (implying that contraceptive use was improving or frequency of sex was decreasing), but this was not enough to offset the increases in sexual experience.

Table 13: Analysis of the Increase in Teen Pregnancy Rates for Teens Aged 15-19, 1972-90

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1990 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.132	0.131	0.132	0.131
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	-0.037	-0.036	-0.037	-0.036
1990 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.084	0.085	0.084	0.085
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.011	0.010	0.011	0.010
total point change in the actual teen pregnancy rate, 1972-90	-0.022	-0.022	-0.022	-0.022
percent change due to a change in the proportion of teens who are sexually experienced	169.9%	162.3%	167.7%	162.7%
percent change due to a change in the pregnancy rate for sexually experienced teens	-50.1%	-45.3%	-48.8%	-45.6%
interaction effect	-19.7%	-17.0%	-18.9%	-17.2%

Sampling Error and Other Potential Biases

In order to gather the data used in this analysis, the federal government did not attempt to survey every single teen in the nation — this would be prohibitively expensive. Instead, randomly selected "samples," or groups, of teens were surveyed (between approximately 750 and 1,400 teens, depending on the survey year).[44] While such a sample of the population generally yields good estimates of the behavior of population as a whole, the measures may be a little too high, or a little too low. And without surveying every teen in America, there is no real way of knowing whether estimates are accurate or not.[45] This element of uncertainty can be expressed with what is called a *confidence interval*, a range of possible values. For example, the 1995 NSFG estimate for the percent of 15- to 19-year-olds who have had sex after menarche (based on age at interview) is 51.3%, and the 95% confidence interval is 48.4-54.2% (meaning that there is a 95% probability that the true proportion of girls aged 15-19 who have had sex after menarche falls somewhere between these two values).

This element of uncertainty comes into play when looking at changes in a measure over time. Take the example of the percent of teens who have had sex after menarche. Table 14 shows the estimated values and confidence intervals for 1990 and 1995. The right-hand column illustrates what it means when a change is not "statistically significant" — it is within the realm of possibility (as established by the 95 percent confidence intervals) that the percent of teens who had sex after menarche may not have decreased, that it may have increased by as much as 7.8 percent. On the other hand, the decrease in sexual experience may have been larger than measured, as high as an 18.2 percent decrease. Even using 68 percent confidence intervals,[46] which have a smaller range of possible values, it is possible that sexual experience decreased by as much as 12.6 percent or increased by as much as 0.1 percent.

Table 14: Estimates and Confidence Intervals for the Percent of Teens Aged 15-19 Who Have Had Sex After Menarche

	1990	1995	Change
percent of teens aged 15-19 (at interview) who have had sex after menarche	54.7%	51.3%	6.2% decrease
95 percent confidence interval	50.3%- 59.2%	48.4%- 54.2%	best case: 18.2% decrease worst case: 7.8% increase
68 percent confidence interval	52.5%- 57.0%	49.8%- 52.8%	best case: 12.6% decrease worst case: 0.1% increase

How does this uncertainty affect this analysis? The original calculations using the measured values for 1990 and 1995 found that approximately 55 percent of the decline in the teen pregnancy rate was due to fewer pregnancies among sexually experienced teens and 45 percent was due to decreased levels of sexual experience. However, it could be that the decrease in sexual experience was a bit more, or a bit less, than measured. Tables 15 and 16 analyze four hypothetical cases, two with the "best case" (in that they produce the largest decrease in sexual experience) and "worst case" endpoints from the 68 percent confidence interval, and the other two with the best and worst case endpoints from the 95 percent confidence interval.

Table 15: Variables Needed for an Analysis of the Declines for 1990-95, Assuming Some Sampling Error Occurred

Methods of calculating sexual experience	Percent of all girls aged 15-19 (at int.) who report ever having had sex after menarche			Pregnancy rates for sexually experienced teen girls aged 15-19		
	1990	1995	% change	1990	1995	% change
As measured (repeat of "method 3" from Table 5)	54.7%	51.3%	-6.2%	0.214	0.197	-8.0%
68% C.I., best case: using endpoints from 68% confidence interval for largest decrease in sexual experience	57.0%	49.8%	-12.6%	0.205	0.203	-1.2%
68% C.I., worst case: using endpoints from 68% confidence interval for largest *increase* in sexual experience	52.5%	52.8%	+0.6%	0.223	0.191	-14.2%
95% C.I., best case: using endpoints from 95% confidence interval for largest decrease in sexual experience	59.2%	48.4%	-18.2%	0.198	0.209	+5.6%
95% C.I., worst case: using endpoints from 95% confidence interval for largest *increase* in sexual experience	50.3%	54.2%	+7.8%	0.233	0.186	-19.9%

Using the "best case" endpoints from the 95 percent confidence interval that produce the largest decrease in sexual experience results in all of the decline being attributed to this factor, while the "worst case" endpoints' analysis attributes all of the decline to decreased pregnancy rates for sexually experienced teens (Table 16). Even using the endpoints from the 68 percent confidence interval, possible combinations of factors behind the rate decline range from 100 percent due to decreases in pregnancies among sexually experienced teens using the "worst case" endpoints, to 90 percent due to decreases in sexual experience and 10 percent due to decreased pregnancy among sexually experienced teens using the "best case" endpoints. In other words, what appeared to be close to a "50-50" split could possibly be attributed to virtually any combination of decreases in sexual experience and decreases in pregnancy rates for sexually experienced teens, once sampling error is taken into account. So, the results of the analysis of the overall decline in teen pregnancy rates during the 1990s, which already produced a wide range of estimates by varying the definition of sexual experience, produces even less definitive results once possible sampling error is taken into account.

Table 16: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 15-19, 1990-95, Assuming Some Sampling Error Occurred

	As measured	68% C.I., best case	68% C.I., worst case	95% C.I., best case	95% C.I., worst case
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.110	0.102	0.118	0.096	0.126
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.007	0.015	-0.001	0.021	-0.009
1995 pregnancy rate assuming only pregnancy rate for sexually experienced teens changed	0.108	0.116	0.100	0.124	0.094
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.009	0.001	0.017	-0.007	0.023
total point change in the actual teen pregnancy rate, 1990-95	0.016	0.016	0.016	0.016	0.016
percent change due to a change in the proportion of teens who are sexually experienced	45.5%	92.4%	-4.2%	133.4%	-56.7%
percent change due to a change in the pregnancy rate for sexually experienced teens	58.2%	8.7%	103.6%	-40.9%	145.4%
interaction effect	-3.6%	-1.1%	0.6%	7.5%	11.3%

How would potential sampling error affect the other analyses presented here? Appendix 2 provides analyses using confidence interval endpoints to show the range of possible results, but here are some answers in brief:

- The 1988-95 analysis is affected in the same way the 1990-95 analysis is: using the extreme endpoints from the 95 percent confidence intervals, the factors behind the decline could be 100 percent due to either factor or any combination in between. At a 68 percent confidence level, the reasons behind the decline could be anything from 100 percent due to decreased pregnancies among sexually experienced teens to only 10 percent due to this factor and 90 percent due to decreased sexual experience.

- A similar situation exists for the analyses of rate changes for age subgroups, for which the changes in sexual experience were not significant. For teens aged 18-19, the analyses using the measures themselves yield a result of 100 percent of the decline being due to less sexual experience, but at both 68 and 95 percent confidence levels the "worst case"

endpoints yield a result of 100 percent of the decline being due to fewer pregnancies among sexually experienced teens. Likewise, while rates as measured for 15- to 17-year-olds produce analyses that say 90 to 100 percent of the decline was due to decreased pregnancy rates for sexually experienced teens, analyses using the 68 and 95 percent "best case" endpoints attribute most (70 percent, for the 68 percent confidence interval) or all (for the 95 percent confidence interval) of the decline to fewer teens ever having had sex.

- In contrast, the 1972-90 increase in sexual experience was statistically significant, and even using the values at the extreme ends of the 95 percent confidence intervals in order to make the increase in sexual experience as small as possible, this increase would still be responsible for 75 to 80 percent of the total increase in teen pregnancy rates.

In addition to sampling error, other sources of potential bias exist. The information presented above is calculated based on surveys with teens, with the assumption that they understand the questions and are telling the truth about their behavior. However, some studies have found that self-reports by teens about sensitive behavior may not be completely reliable or accurate.[47] For example, one longitudinal survey found that, in the final round of the survey, over one-quarter of the young adults reported an age at first intercourse that was more than one year earlier or later than what they reported as a teen.[48] A comparison of the NSFG, the YRBS, and the National Longitudinal Survey of Adolescent Health found statistically significant differences in the estimated proportion of girls who have had sex, indicating that survey format and question wording may have a significant impact on results.[49] These issues make the answer to what is behind the declines in teen pregnancy even more uncertain.

Conclusions

The decline in teen pregnancy and birth rates in the 1990s tell us that the sexual behavior of teens is changing, but using the NSFG to identify which behaviors are changing and how much is extremely difficult — is it decreased sexual activity? improved contraceptive use? both? Even defining the proportion of teen girls who have had sex is problematic, and while this statistic appears to have declined no matter what the definition, these declines were not statistically significant in this data set. As to measures of contraceptive use and frequency of sexual activity during the 1990s, different measures show different trends. Again, the vast majority of these changes are not statistically significant, so one can't be certain that these trends occurred in the entire population.

Given the issues around data definitions and statistical significance, it is not surprising that various investigators have come up with widely varying views about the relative contributions of less sexual activity and improved contraceptive use to the decline in teen pregnancy rates.[50] With regard to the decline in teen pregnancy rates between 1990 and 1995, this analysis finds that the proportion attributable to less sexual experience among teens ranges from approximately 40 to 60 percent, with the remaining 40 to 60 percent attributable to decreased pregnancy rates for sexually experienced teens.

Because the U.S. teen pregnancy rate began declining after 1990, changes in behavior tracked between 1990 and 1995 are of obvious temporal interest. But given the problems with the 1990 survey, many experts are reluctant to focus on 1990-1995 trends, and instead study 1988 versus 1995. The problem with this latter interval, of course, is that the period does not map a consistent trend in rates of teen pregnancy, which increased between 1988 and 1990 and only then began to decline. Keeping this caveat in mind, this analysis shows that for the decline in teen pregnancy rates between 1988 and 1995, explanations range from a 50-50 split to 20 percent of the decline being due to decreased sexual experience and 80 percent due to decreased pregnancy rates for sexually experienced teens. So, although it appears that both decreases in the percent of teens who were sexually experienced and deceased pregnancies among sexually experienced teens played a role in the recent declines in teen pregnancy rates, the exact proportion each played (or even which played a greater role) is unclear based on the available data from the National Survey of Family Growth.

Finally, two cautionary notes are needed regarding these analyses. First, all of the analyses except for the analysis of the increase in pregnancy rates between 1972 and 1990 rely on changes in sexual experience that are not statistically significant, and, once possible sampling error is taken into account, the range of possible allocations widens dramatically. Second, the formula used in this paper utilizes one term, the pregnancy rate for sexually experienced teens, to measure changes in *both* contraceptive use and frequency of sex. Further research is needed on what proportion of declines in this statistic during the 1990s was due to decreased frequency of sex and what proportion was due to improved contraceptive use.

Endnotes

1. The Alan Guttmacher Institute. (1999). *Special report: U.S. teenage pregnancy statistics: With comparative statistics for women aged 20-24*. New York: Author. Note that several other sets of teen pregnancy rates exist; for more information on this topic, see the section, "Data Sources," and Appendix 1.
2. Decreased fertility can also affect pregnancy rates. This factor is not addressed in this paper.
3. Some of these factors are addressed in: Manlove, J., Terry, E., Gitelson, L., Papillo, A.R., & Russell, S. (2000). Explaining demographic trends in teenage fertility, 1980-1995. *Family Planning Perspectives* 32(4), 166-75; Hogan, D.P., Sun, R., & Cornwell, R.T. (2000). Sexual and fertility behaviors of American females aged 15-19 years: 1985, 1990, and 1995. *American Journal of Public Health* 90(9), 1421-5.
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5. Hatcher, R.A., Trussell, J., Stewart, F., Cates, W., Jr., Stewart, G.K., Guest, F., & Kowal, D. (1998). *Contraceptive technology: Seventeenth revised edition*. New York: Ardent Media, Inc.
6. National Center for Health Statistics. (1997). National Survey of Family Growth, cycle IV: 1988 and 1990 telephone reinterview. *CD-ROM Series 23*(2).
7. J. Abma, personal communication, July 2000.
8. National Center for Health Statistics. (1997). National Survey of Family Growth, cycle V: 1995. *CD-ROM Series 23*(3).
9. According to NSAM data, the proportion of never-married males aged 1519 who had ever had sex decreased from 60 percent in 1988 to 55 percent 1995 (p=.06). In the same time period, the proportion of teen boys using condoms at most recent sex increased from 57 to 67 percent, an increase that was statistically significant at p=.05. For more information, see: Sonenstein, F.L., Ku, L., Lindberg, L.D., Turner, C.F., & Pleck, J.H. (1998). Changes in sexual behavior and condom use among teenaged males: 1988 to 1995. *American Journal of Public Health*, 88(6), 956-9.
10. According to YRBS data, the proportion of students who were sexually experienced declined 11 percent between 1991 and 1997 from 54 to 48 percent. Both this decrease and the 15 percent decline for male students (from 58 to 49 percent) were statistically significant. For female students, on the other hand, the decline in sexual experience was smaller and not statistically significant (from 51 percent in 1991 to 48 percent in 1997). Condom use increased significantly for all students (from 46 percent in 1991 to 57 percent in 1997), male students (from 55 percent to 63 percent), and female students (from 38 percent to 51 percent). For more information, see: Centers for Disease Control and Prevention. (1998). Trends in sexual risk behaviors among high school students: United States, 1991-1997. *Morbidity and Mortality Weekly Report*, 47(36), 749-52.
11. The Alan Guttmacher Institute. (1999). *Special report: U.S. teenage pregnancy statistics: With comparative statistics for women aged 20-24*. New York: Author.
12. Darroch, J.E., & Singh, S. (1999). Why is teenage pregnancy declining? The roles of abstinence, sexual activity and contraceptive use. *Occasional Report, 1*.
13. Ventura, S.J., Curtin, S.C., & Mathews, T.J. (2000). Variations in teenage birth rates, 1991-98: National and state trends. *National Vital Statistics Reports*, 48(6).
14. Ventura, S.J., & Bachrach, C.A. (2000). Nonmarital childbearing in the United States, 1940-99. *National Vital Statistics Reports*, 48(16).

15. Saluter, A.F. (1996). Marital status and living arrangements: March 1994. *Current population reports, P20-484*. Lugaila, T.A. (1998). Marital status and living arrangements: March 1998 (update). *Current population reports, P20- 514*.

16. Moore, K.A., Papillo, A.R., Williams, S., Jager, J., & Jones, F. (1999). *Facts at a glance*. Washington: Child Trends. Ventura, S.J., Martin, J.A., Curtin, S.C., Mathews, T.J., & Park, M.M. (2000). Births: Final data for 1998. *National Vital Statistics Reports, 48*(3).

17. Moore, K.A., Papillo, A.R., Williams, S., Jager, J., & Jones, F. (1999). *Facts at a glance*. Washington: Child Trends. Ventura, S.J., Martin, J.A., Curtin, S.C., Mathews, T.J., & Park, M.M. (2000). Births: Final data for 1998. *National Vital Statistics Reports, 48*(3). Ventura, S.J., & Bachrach, C.A. (2000). Nonmarital childbearing in the United States, 1940-99. *National Vital Statistics Reports, 48*(16).

18. For example, interviews for the 1995 survey took place between January and October, and the central date was April 1. If a 19-year-old was interviewed in January, and then turned 20 in February or March, she would be included in the 15-19 age bracket based on age at interview, but not the based on age on the central date (because she would be 20 on this date). Similarly, a 19-year-old who turned 20 in June and was interviewed in September would be a teen according to age on the central date, but not according to age at interview. What's important is that using age at central date can misclassify an individual. Take our second example. If this individual had sex for the first time, say, in August, she would be classified as a sexually experienced 19-year-old even though she did not have sex until after her 20th birthday. The extent to which changing the method of age calculation affects a rate depends on how many girls shift in and out of the 15-19 age bracket, whether or not they are sexually experienced, and the particular statistical weights attached to those girls (individual weights vary widely within a survey, and a girl with a relatively large weight will affect an average more than a girl with a relatively small weight).

19. The difference between two statistics was considered statistically significant if the statistics' 95 percent confidence intervals did not overlap. Standard errors for Cycle IV data were calculated using WESVAR, and EpiInfo was used to calculate standard errors for Cycle V data.

20. For 1988, "ever had sex" was calculated as anyone who said that they had ever had sex or was coded as ever having had sex after menarche (because women who had ever been pregnant or married were not asked if they had ever had sex). For 1990 and 1995, "ever had sex" was calculated based on standard variables included in the data sets.

21. For 1988, "ever had sex after menarche" was calculated based on a standard variable included in the data set. The 1988 figure based on age at interview was also published in: Singh, S., & Darroch, J.E. (1999). Trends in sexual activity among adolescent American women: 1992-1995. *Family Planning Perspectives, 31*(5), 212-19.

    For 1990, this statistic was calculated based on the following formula: if "age at menarche" is coded "96" (periods haven't started), then new variable equals "no," else new variable equals the value for "ever had sex." Note that this may overestimate the percent who have had sex after menarche. Of the 432 cases that have had sex (in the pool of girls aged 15-19, either at interview or on the central date), there are 22 cases (3.1% of the total sample, 5.6% of the "yeses" for "had sex after menarche") in which sex after menarche cannot be ascertained with certainty (although it is probable that they have had sex after menarche), even though they are coded "yes" for this variable, because one of four situations arises: first sex was before menarche (4), first sex and first period both occurred when the girl was the same age and no question was asked on which event came first (15), age at first sex is missing (1), or age at first period is missing (2). These conditions also occurred for an additional 12 cases, but these girls reported at least one pregnancy so it can be assumed that they had sex after menarche. Note

that there are variables labeled "age at first sex after first period" and "date of first sex after first period," but it seems clear that these variables actually refer to first sex ever, based on the questions in the actual survey, the recode specifications, and a check of the data (i.e., first sex "after menarche" occurs before age at first period).

For 1995, "ever had sex after menarche" was calculated based on the following formula: if age at first intercourse is less than age at first period and "ever had voluntary sex after menarche" equals "no," then new variable equals "no;" else if age at first sex and age at first period are the same, "ever had voluntary sex after menarche" equals "no," and first sex was nonvoluntary then new variable is unknown; else if age at first sex and age at first period are the same then the new variable takes the value of "ever had voluntary sex after menarche;" else the new variable takes the value of "ever had sex." (Source: personal communication, Joyce Abma, National Center for Health Statistics, 1999). The 1995 figure based on age on April 1, 1995, was also published in: Abma, J., Chandra, A., Mosher, W., Peterson, L., & Piccinino, L. (1997). Fertility, family planning, and women's health: New data from the 1995 National Survey of Family Growth, *Vital and Health Statistics*, *23*(19).

22. For 1995, "ever had voluntary sex" was calculated based on a standard variable included in the data set. This statistic is not available for 1988 or 1990.

23. The 1995 data set contains a standard recoded variable for "ever had voluntary sex after menarche." However, two cases have inconsistent answers between this variable and the previous variable, "ever had voluntary sex:" they are coded as never having had voluntary sex, but having had voluntary sex after menarche. Therefore, the following formula was used to create a corrected estimate for "ever had voluntary sex after menarche" in 1995: if first sex was nonvoluntary and "ever had voluntary sex" (not the recode, but a direct question asked of those whose first intercourse was nonvoluntary) equals "no," then the corrected "ever had voluntary sex after menarche" variable equals "no;" otherwise the value for the corrected variable is the same as the value for the standard recoded variable "ever had voluntary sex after menarche." This formula codes the two inconsistent cases as "no" and leaves all other cases the same as the standard recode. This statistic is not available for 1988 or 1990.

24. For 1988, sex in the past three months was based on the following formula: if the recode variable "had sex in the past three months" equals "yes" or another recoded variable, "duration of the current abstinent period" has the code for the person currently being in a sexual relationship, then "had sex in the past three months" equals "yes," otherwise it equals "no." This formula returns the same value as the recoded variable except for four cases where the recoded variable is coded 9 ("not ascertained"). In all 4 cases, the actual question "have you ever had sex" was refused, thus the majority of questions on sexual experience were not asked. However, other recoded variables have imputed values, and this formula attempts to make the value for "ever had sex in the past three months" consistent with these values, two to "no" because they are coded as never having had sex after menarche, and two to "yes" because they are coded as currently being in a sexual relationship.

    For alternate 1988 figures (based on age at interview), which assume all four unknown cases have not had sex in the past three months, see: Singh, S., & Darroch, J.E. (1999). Trends in sexual activity among adolescent American women: 1992-1995. *Family Planning Perspectives*, *31*(5), 212-19.

    For 1995, a standard recoded variable exists for "had sex in the past three months." However, inconsistencies between this variable and other survey questions regarding recent sexual activity have been noted. The variable is intended to reflect results from the question "Since (January 1991/the first time you had [voluntary] intercourse), have there been any times when you were not having intercourse at all for one month or more?" — with start and end dates for up to four abstinent periods recorded in the data set (i.e., if an abstinent period covered all

three months before the month of interview). However, inconsistencies exist between a constructed variable based on these periods and the actual variable in the data set. Most of the 35 inconsistent cases are caused by missing start or end dates of the abstinent period(s), while a few are caused by other situations, such as the individual not being asked the series of questions about abstinent periods.

For the cases affected by these problems, other data must be used. Several other sets of variables exist that can shed light on recent sexual activity, including the method calendar that record month-by-month contraceptive use, partner histories that include the number of sexual partners and dates of first and last sex with these partners, and a question about frequency of sex in the past three months (that should have been asked only of individuals who had sex in the past three months, but may have been asked of others). Beyond the scope of this paper is the fact that these sets of variables do not always yield consistent results — an individual may have said that she had no sexual partners in the past year, for example, but then may also have said that she had sex on average once a week in the past three months, or that she used condoms in the month of the interview.

Instead, this data was examined on a hierarchical basis, and once a definitive answer for a given case could be determined using one set of questions, further data were not analyzed. The first set of data analyzed was the abstinent periods themselves: for 4 cases, the missing data did not affect the determination of whether or not the individual had sex in the three months before the interview (i.e., there was more than one abstinent period, dates for the first period were missing but dates for the most recent were sufficient for determination.) The next set of data analyzed was the partner histories. This data confirmed the status for 15 cases, because the dates of first or last sex with the most recent partner definitively fell within or beyond three months of the interview. An additional 12 cases were confirmed as "yes" via the frequency of sex in the past three months variable (by having a value between 2 and 5; since there was no option for "not at all," individuals asked the question who did not actually have sex in the past three months would have been forced to choose 1, "once a month or less"). For the remaining four cases, the recoded variable was used — in three out of these four cases, the recoded result was imputed.

25. For 1988 and 1995, "average number of months in which sexually experienced females had sex" was calculated based on standard variables included in the data sets. NOTE: in 1988, this variable is only available for girls who had ever had sex after menarche, whereas in 1995 it is available for anyone who had ever had sex. In this paper, the 1995 responses are limited to those who have ever had sex after menarche (see endnote 21) for consistency between the two time periods. The 1988 and 1995 figures based on age at interview were also published in: Singh, S., & Darroch, J.E. (1999). Trends in sexual activity among adolescent American women: 1992-1995, *Family Planning Perspectives*, *31*(5), 212-19. This statistic is not available for 1990.

26. For 1995, "average frequency of sex in the past three months" was based on a single survey question (but note that this was not a recoded variable). The calculation was limited to individuals who had had sex in the past three months and who answered the question.

    The 1988 statistics for this variable are taken from a published report: Darroch, J.E., & Singh S. (1999). Why is teenage pregnancy declining? The roles of abstinence, sexual activity and contraceptive use. *Occasional Report*, *1*. The 1988 NSFG included a question on average frequency of sex in the past three months, but this question was deemed "too sensitive" and was not provided in the public-use data file in order to protect the anonymity of survey respondents. Researchers can petition NCHS for access to omitted variables; thus, AGI was able to include the data in its report. Data for teens aged 15-19 on the central date are not included in this report because only data based on age at interview was included in the AGI report. Also

note that measures for 1988 and 1995 may not be precisely comparable, and, since standard errors for the 1988 frequency measures are not available (they were not included in the report), one cannot know whether some changes between 1988 and 1995 were significant. 1988 responses for "once a week," "two or three times per month," and "once a month or less" fell within the 95 percent confidence intervals for the 1995 estimates. The statistics for the other two choices, "two or three times per week" and "four times a week or more," fell outside the confidence intervals for their 1995 counterparts, so they may be statistically significant.

27. "At risk of unintended pregnancy" are those who are "sexually active" and not pregnant, postpartum, sterile for non-contraceptive reasons, or seeking pregnancy. Measuring recent contraceptive use only among those "at risk of unintended pregnancy" avoids problems such as the fact that some teens are actually pregnant at the time of the survey, so one would not expect them to be using contraception (except as protection from STDs).

28. For 1988 and 1990, "contraceptive use at first sex" was computed using a standard recoded variable, "method used at first sex." Specifically, it was calculated as the sum of females with any method (from a list of choices plus an "other" category) used at first sex over the sum of all females who have had sex after menarche. In 1988, questions about contraceptive use were only asked of respondents who had had sex after menarche. In 1990, this information was available for women who had ever had sex at all, but the calculation was limited to women who had had sex after menarche for comparability. Note that in 1990 the 0.6 percent of cases marked "not ascertained" for this variable are treated as not having used contraception at first sex.

    In the 1995 data set, a standard recoded variable exists for "contraceptive use at first sex." However, this variable is not comparable to the variables for 1988 and 1990 described above. As mentioned previously, the 1995 survey was the first to include questions that distinguish sex as voluntary or nonvoluntary. For respondents whose first intercourse was nonvoluntary, the wording of the series of questions used to determine contraceptive use at first sex was altered to capture contraceptive use at first *voluntary* sex, as opposed to first sex ever. In addition, the standard recoded variable has data available only for individuals who had ever had voluntary sex after menarche, leaving out individuals who had had nonvoluntary sex after menarche who would have been included in previous surveys.

    While it makes sense to measure contraceptive use at first voluntary sex, comparing this statistic to "use at first sex" from previous years will overstate any improvement in contraceptive use since one would generally not expect that contraception would be used during nonvoluntary sex. The following formula was used to create a new 1995 "contraceptive use at first sex" variable designed to be as comparable as possible to variables for 1988 and 1990: if first sex was nonvoluntary and "first method ever used" is blank, then the new variable equals "95" (never used a method); if first sex was nonvoluntary and the first contraceptive use occurred sometime after first (voluntary) sex, then new variable equals "96" (no method at first sex); if first sex was nonvoluntary, contraception was used for the first time before first (voluntary) sex (pill use in the 3 cases affected by this criteria), and date of first contraceptive use was after date of very first (nonvoluntary) intercourse, then the new variable equals "96"; if first sex was nonvoluntary, individual has never had voluntary sex, but there is a method chosen for first method ever used and the respondent indicated that this method was used at first (voluntary) sex, then the code for the method used at first (voluntary) sex was converted to the appropriate method code for the new variable; and if none of these conditions held true, then the method indicated in the recoded variable "contraceptive use at first sex" was used.

    The final set of criteria for those who had nonvoluntary first sex may be troubling to some readers. It applied to four cases out of the total 1,432 girls who were aged 15-19 at interview and/or on April 1, 1995. In all four cases, the individual said that her first intercourse was non-

voluntary and that she had never had voluntary sex. However, the four individuals also indicated that they had used contraception, and that first use of a method was at first (voluntary) sex. In three out of four cases the method chosen was the male condom; the fourth case indicated dual use of the male condom and the pill. This apparent inconsistency could be interpreted in several ways. One obvious conclusion is that the individuals lied about never having had voluntary sex, and that the reported contraceptive use refers to some act of voluntary sex not otherwise recorded by the survey. On the other hand, these cases may illustrate the fine line between nonvoluntary and voluntary but unwanted sex. The inconsistency may even be capturing HIV concerns on the part of a subset of rapists. Given the lack of evidence to the contrary, these cases were left in as contraceptive users. Changing the four cases to "no contraception used at first sex" alters the results only marginally, by about 0.5%.

29. For 1995, contraceptive use at first voluntary sex was calculated using a standard recoded variable included with the data set. This variable is not available for 1988 or 1990. The rate based on age at the central date was also published in: Terry, E., & Manlove, J. (2000). *Trends in sexual activity and contraceptive use among teens*. Washington, DC: The National Campaign to Prevent Teen Pregnancy.

30. In 1988 "contraceptive use at most recent sex" was computed using a standard recoded variable, "method used at most recent sex." Specifically, it was calculated as the sum of females with any method (from a list of choices plus an "other" category) used at most recent sex divided by the sum of all females who have had sex in the past three months. Note that the variable "method used at most recent sex" has data for anyone who ever had sex after menarche. However, the convention is to limit the calculation of this variable to those who have had sex in the past three months, on the assumption that these individuals should be able to recall which contraceptive method was used, if any, whereas an individual whose most recent sexual intercourse was many months (or even years) before the interview may not be able to accurately recall which contraceptive method was used. This statistic is not available for 1990 because questions used to ascertain whether or not the individuals had sex in the past three months were not included in the survey.

    For 1995, the standard recoded variable for "method used at most recent sex" is not correct in that it codes many users of systematic methods such as sterilization or Norplant as nonusers. In order to correct this problem, the following formula is used: if the individual has indicated that she is sterile, then method used at most recent sex is "yes;" if the individual indicated that she used a method at last sex when asked, then method used at most recent sex equals "yes;" if the individual indicated that she did not use a method at most recent sex or never used a method, then the value for this variable equals "no method;" if the individual indicated that no methods were used in the three months before the interview then the value for "method used at most recent sex" equals "no;" else if the individual refused to answer the question about use at most recent sex or didn't know the answer, then the value for this variable is "unknown;" otherwise the value for this variable equals "yes." The approximately 20 cases coded "unknown" are screened out, as are cases where "sex in the past three months" is coded "no."

    Note that there is an alternate approach to calculating contraceptive use at most recent sex. AGI researchers noticed inconsistencies between responses to this question and contraception listed on the method calendars for some pill users in 1995. The theory is that the questions on consistency of use led some women to conclude that, because they had not taken the pill every day, that they were really not protected the last time they had sex, so they answered that they did not use a method at most recent sex. AGI adds these pill users back in as pill users at last sex in order to make the 1995 variable comparable to 1988 when questions about consistency were not asked. For more information, see Darroch, J.E., & Singh, S. (1999). Why is teenage pregnancy declining? The roles of abstinence, sexual activity and contraceptive use. *Occasional Report, 1.*

31. In 1988, "current contraceptive status" was based on a standard recoded variable, with a correction to remove the code "had sex only once," a designation that was not provided in 1995. To make the 1988 and 1995 measures comparable, these individuals were assigned contraceptive use based on the following formula: if "current contraceptive status" is coded anything other than "had sex once" then the original code is kept; otherwise if the individual has not had sex in the past three months, then the new code is "nonuser, no sex in the past three months"; if first sex occurred in the month of interview, then "current contraceptive status" is the same as method used at first sex (affected one case); otherwise the code is "nonuser, had sex in the past three months." (Of these cases, one pill user could have continued using, but there is no way of ascertaining this because many of the questions about contraceptive use were not asked of those who only had sex once. The rest of the cases affected by this rule either used condoms or did not use a method at first and only sex.) Based on this corrected variable, individuals "not at risk of unintended pregnancy" (because they are pregnant, postpartum, seeking pregnancy, have never had sex, have not had sex in the past three months, or are sterile for non-contraceptive reasons) were screened out, and "current use by those at risk of unintended pregnancy" was calculated as the sum of individuals using one of the 15 available method choices (or coded as one of two unknown method categories), divided by all individuals "at risk of unintended pregnancy."

    This statistic is not available for 1990 because questions to ascertain whether or not the individuals had sex in the past three months, one of the criteria used to determine whether or not a person is "at risk of unintended pregnancy," were not included in the survey.

    In 1995, a standard recoded variable for "current contraceptive status" exists. However, two minor problems exist that must be corrected. There are seven cases who had sex in the past three months, but were assigned the code for "nonuser, no sex in the past three months" (which would make them not "at risk of unintended pregnancy"). These cases must be changed to the code for "nonuser, had sex in the past three months." Likewise, there are three cases coded as never having had (voluntary) sex after menarche in "current contraceptive status," but are coded "yes" for the actual variable "ever had voluntary sex after menarche." All three cases also had sex in the past three months, so they must also be changed to the code for "nonuser, had sex in the past three months." Note that this type of problem affects a few other cases, but since they have not had sex in the past three months (and thus will be left out of final calculations) they are not corrected here. The percent of teens who were at risk of unintended pregnancy and used contraception in the month of interview was calculated by screening out those "not at risk" and then dividing the sum of those who used any one of the 18 listed methods (or were coded with the option for "other method") by the sum of all those "at risk."

    One should note that these calculations may differ from other published rates for this statistic. The standard assignment of current use status is based on the following hierarchy: pregnant, sterile (for contraception or other reasons), using a method, postpartum, never had sex, and, finally, non-users are sorted by whether or not they have had sex in the past three months. The problem with this is that some method users may not be "at risk of unintended pregnancy" because they have not had sex in the past three months, or even because they have not had sex at all (i.e., those who take contraceptive pills for other health reasons). In other words, the standard variable provides an accurate percentage of the entire population that is both at-risk and not using contraception — but calculating what proportion of the "at-risk" population is or is not using contraception by this variable is problematic because the proportion of females "at risk" and using contraception would be overestimated if one assumed that everyone coded as a contraceptive user is at risk. Therefore, for both 1988 and 1995 the sample is limited to those who have had sex in the past three months, omitting those who are not otherwise "at risk," and then divide the estimated number of users by the sum of estimated users and non-

users in order to calculate the proportion of teens "at risk of unintended pregnancy" who currently use contraception.

One final note about this variable. As noted above, some individuals who have not had sex in the past three months are coded as using contraception or other codes. Some of these methods are methods, such as the pill, that are not coitus-dependent. However, there are also a few cases of females who have not had sex in the past three months, but who are coded as using a coitus-dependent method, such as the condom, in the month of interview, responses which are clearly inconsistent. It is entirely possible that these cases may be incorrectly coded for sex in the past three months, but it is assumed that the sex in the past three months variable is correct and that the method use variable is incorrect. In 1988, this affects 27 cases (17 pill, 9 male condom, and 1 female sterilization), and in 1995 this affects 47 cases (3 Norplant, 9 Depo-Provera, 19 pill, 1 diaphragm, 14 male condom, and 1 wit

32. Abma, J., Chandra, A., Mosher, W., Peterson, L., & Piccinino, L. (1997). Fertility, family planning, and women's health: New data from the 1995 National Survey of Family Growth. *Vital and Health Statistics, 23*(19).

33. The Alan Guttmacher Institute. (1994). *Sex and America's teenagers*. New York: Author.

34. Warner, L., Clay-Warner, J., Boles, J., & Williamson, J. (1998). Assessing condom use practices: Implications for evaluating method and user effectiveness. *Sexually Transmitted Diseases, 25*(6), 273-277.

35. Current method choice among contraceptive users for 1988 and 1995 uses the same basic calculation methods described in endnote 31. However, instead of users of any method divided by the number of teens at risk of unintended pregnancy, this table presents the number of users of each method (and no method) divided by the total number of girls at risk of unintended pregnancy. Note that the percentage of condom users for 1988 combines the responses for "condoms" and "condoms plus foam." Also note that individuals may have used more than one method in the month of interview, either sequentially or simultaneously, but that use is coded here with the highest priority method as defined within the "current contraceptive status" variable. Finally, note that columns may not add up to 100 percent due to rounding.

36. Hatcher, R.A., Trussell, J., Stewart, F., Cates, W., Jr., Stewart, G.K., Guest, F., & Kowal, D. (1998). *Contraceptive technology: Seventeenth revised edition*. New York: Ardent Media, Inc. Note: range of failure rates for the sponge are for nulliparous and parous women. Range of failure rates for sterilization are for male and female. Range of failure rates for pills are for combined vs. progestin only. Failure rates quoted for "jelly/cream/foam" are actually for "spermicides": foams, creams, gels, vaginal suppositories, and vaginal film. Typical first-year failure rate quoted for calendar rhythm is actually for all forms of periodic abstinence.

37. Ranjit, N., Bankole, A., & Darroch, J.E. (2000). Changes in adolescent contraceptive failure rates in the United States, 1984-88 to 1991-95. Paper presented at the annual meeting of the Population Association of America, Los Angeles, CA.

38. Abma, J., Chandra, A., Mosher, W., Peterson, L., & Piccinino, L. (1997). Fertility, family planning, and women's health: New data from the 1995 National Survey of Family Growth. *Vital and Health Statistics, 23*(19).

39. The 1990 survey included too few teens to perform analyses on subgroups of the whole teen sample, so any analysis by race/ethnicity would have to use only 1988 and 1995 data. However, abortions (needed to calculate pregnancy rates) were first reported by race in 1990, so 1988 pregnancy rates exist only for "White" and "Nonwhite."

40. Moore, K.A., Papillo, A.R., Williams, S., Jager, J., & Jones, F. (1999). *Facts at a glance*. Washington: Child Trends.

41. This third factor, in turn, might be affected by two different sets of behaviors. First, a change in the likelihood that a pregnant teen will give birth — as opposed to miscarrying or having an abortion — can change the birth rate over time even if sexual activity and contraceptive use remain constant. Second, because this would be an analysis of changes in the unmarried teen birth rate, the likelihood that an unmarried, pregnant teen marries before giving birth (or having a miscarriage or an abortion) could also change the unmarried teen birth rate. In other words, a pregnancy conceived out-of-wedlock may result in a birth, abortion, or miscarriage to a married teen.

42. For 1972, "ever had sex" was calculated by analyzing the group of women in the 1990 survey who would have been 15-19 in 1972 (so they were aged 33-37 in 1990), using the following formula: if "ever had sex" equals "no" or first sex occurred after the date when the individual would have been interviewed in 1972, then "ever had sex" (in 1972) equals "no," else if date of first sex is before the hypothetical 1972 interview date, then "ever had sex" (in 1972) equals "yes," else "ever had sex" (in 1972) equals unknown. These unknown cases (22, 1.6% of the weighted population) are all cases where first sex occurs in the same month and year as when the 1972 interview would have occurred. Unlike the previous "unknown" cases in the 1990 survey (see endnote 21), where sex after menarche was fairly likely to have occurred but could not be 100 percent confirmed by the data, in these cases there is an equal probability that first sex occurred after the date of the hypothetical 1972 survey. Since it is truly unknown whether these individuals had had sex when they would have been interviewed in 1972, they are omitted from the calculations.

    For alternate estimates of sexual activity among teens in the early 1970s, see: Hofferth, S.L., Kahn, J.R., & Baldwin, W. (1987). Premarital sexual activity among U.S. teenage women over the past three decades. *Family Planning Perspectives*, *19*(2), 46-53.

43. For 1972, "ever had sex after menarche" was calculated by analyzing the group of women in the 1990 survey who would have been 15-19 in 1972 (so they were aged 33-37 in 1990), using the following formula: "ever had sex" (in 1972) equals "no" (see endnote 42) or age at first period is greater than age at interview (or age on the central date in 1972), then "ever had sex after menarche" (in 1972) equals "no," if "ever had sex" (in 1972) is unknown then "ever had sex after menarche" (in 1972) is also unknown, otherwise "ever had sex after menarche" (in 1972) equals "yes." As in "ever had sex," the 22 unknown cases are omitted from the analyses.

44. Judkins, D.R., Mosher, W.D., & Botman, S. (1991). National Survey of Family Growth: Design, estimation, and inference. *Vital and Health Statistics*, *2*(109); Goksel, H., Judkins, D.R., & Mosher, W.D. (1992). Nonresponse adjustments for a telephone follow-up to a national in-person survey. *Journal of Official Statistics*, *8*(4), 417-21; Potter, F.J., Iannacchione, V.G., Mosher, W.D., Mason, R.E., & Kavee, J.D. (1998). Sample design, sampling weights, and variance estimation in the 1995 National Survey of Family Growth. *Vital and Health Statistics*, *2*(124).

45. However, even if every teen in the nation were surveyed, the results could still be different from the true behavior of the teen population. In addition to sampling error, many forms of non-sampling error can occur. A few examples of non-sampling error are discussed later in this section; for a more complete discussion, see: McClave, J.T., & Benson, P.G. (1991). Survey sampling. In *Statistics for business and economics* (5th ed., pp. 1115-1154). San Francisco: Dellen Publishing Company.

46. The 68 percent confidence interval was chosen simply because it is an easy interval to calculate: the estimate plus or minus one standard deviation.

47. Catania, J.A., Gibson, D.R., Chitwood, D.D., & Coates, T.J. (1990). Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies

of sexual behavior. *Psychological Bulletin, 108*(3), 339-62. Weinhardt, L.S., Forsyth, A.D., Carey, M.P., Jaworski, B.C., & Durant, L.E. (1998). Reliability and validity of self-report measures of HIV-related sexual behavior: Progress since 1990 and recommendations for research and practice. *Archives of Sexual Behavior, 27*(2), 155-80.

48. Lauritsen, J.L., & Swicegood, C.G. (1997). The consistency of self-reported initiation of sexual activity. *Family Planning Perspectives, 29*(5), 215-21.

49. Santelli, J.S., Lindberg, L.D., Abma, J., McNeely, C.S., & Resnick, M. (2000). Adolescent sexual behavior: Estimates and trends from four nationally representative surveys. *Family Planning Perspectives, 32*(4), 156-165, 194.

50. Darroch, J.E., & Singh, S. (1999). Why is teenage pregnancy declining? The roles of abstinence, sexual activity and contraceptive use. *Occasional Report, 1*. Jones, J.M., Toffler, W., Bell, R., Mohn, J.K., Kelton, G., Weeldreyer, R., Wallis, H., Suits, G.S., Diggs, R.J., Cox, H., & Jones, K. (1999). *The declines in adolescent pregnancy, birth and abortion rates in the 1990s: What factors are responsible?* Fanwood, NJ: Consortium of State Physicians Resource Councils.

Appendix 1
Analyses Using Alternate Pregnancy Rates

National pregnancy rates are compiled and released by three different entities: The National Center for Health Statistics (NCHS), U.S. Department of Health and Human Services (DHHS); the National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), Centers for Disease Control and Prevention (CDC), DHHS; and the Alan Guttmacher Institute (AGI), a nonprofit research organization. When this paper was begun, pregnancy rates for the 1990s were only available from AGI and NCCDPHP. The AGI rates were chosen as the primary set of pregnancy rates used throughout this paper because: (1) AGI primarily relies on abortion data from its own surveys of abortion providers, which are widely believed to be more complete than abortion data reported to CDC; (2) the NCCDPHP rates available then did not include any estimate of miscarriages, whereas the AGI data did; and (3) NCCDPHP rates were only available for 1990-95, and some of the analyses required pregnancy rates for earlier years. While this paper was being written, two new pregnancy rate reports were released. In December, 1999, NCHS released national pregnancy rates for 1976-96. In July, 2000, NCCDPHP released national and state-level pregnancy rates for 1995-97, using a different calculation than the 1990-95 series.

Three different sets of pregnancy rates exist that could be used in the analyses performed in this paper (the new set from NCCDPHP cannot be used because data on sexual activity is only available for one year of pregnancy rates in the set). In Table 1, all three sets of rates are shown for 1990 and 1995.

Table 1: Comparison of Teen Pregnancy Rates, 1990 and 1995

Source	1990	1995	Point change, 1990-95	% change, 1990-95
The Alan Guttmacher Institute (AGI)[1]	0.117	0.101	0.016	-14%
National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)[2]	0.096	0.084	0.012	-13%
National Center for Health Statistics (NCHS)[3]	0.116	0.103	0.013	-11%

The question is how using one of the other two available sets of pregnancy rates would have affected these analyses. Table 2 shows the results from the first analysis in this paper, of the decline in teen pregnancy rates for teens aged 15-19 between 1990 and 1995 using AGI pregnancy rates. Results ranged from about a fifty-fifty split of the decline (between less sexual experience among teens and improved pregnancy rates for sexually experienced teens) to results that allocated about 60 percent of the decline to one factor or the other, depending on the definition of sexual experience.

Table 2: Analysis of the Decline in Teen Pregnancy Rates, 1990-95, Using AGI Rates

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
percent change due to a change in the proportion of teens who are sexually experienced	42.6%	54.6%	45.5%	58.7%
percent change due to a change in the pregnancy rate for sexually experienced teens	60.9%	49.1%	58.2%	44.9%
interaction effect	-3.6%	-3.7%	-3.6%	-3.6%

The same analysis using the NCCDPHP pregnancy rates yields fairly similar results (Table 3), but appears to favor less sexual experience by 4-5 percent compared to the analysis using AGI pregnancy rates. The results can be characterized in the nearly the same manner, ranging from "60-40" in favor of less sexual experience to "55-45" in favor of fewer pregnancies among sexually experienced teens.

Table 3: Analysis of the Decline in Teen Pregnancy Rates, 1990-95, Using NCCDPHP Rates

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
percent change due to a change in the proportion of teens who are sexually experienced	46.6%	59.7%	49.7%	64.2%
percent change due to a change in the pregnancy rate for sexually experienced teens	56.7%	43.5%	53.6%	38.9%
interaction effect	-3.3%	-3.2%	-3.3%	-3.1%

Using the NCHS pregnancy rates in the analysis allocates a larger proportion of the decline to less sexual experience (Table 4). The two methods of calculating sex using "age at interview" shift about 10 percent in favor of less sexual experience when using these revised rates (compared to analyses using AGI rates), and the other two methods based on "age on the central date for the survey" shift about 12 percentage points in favor of less sexual experience. The final results using these data would show that the decline in teen pregnancy rates between 1990 and 1995 ranged from a "50-50" split to a "70-30" split in favor of less sexual experience.

Table 4: Analysis of the Decline in Teen Pregnancy Rates, 1990-95, Using NCHS Rates

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
percent change due to a change in the proportion of teens who are sexually experienced	52.0%	66.6%	55.5%	71.6%
percent change due to a change in the pregnancy rate for sexually experienced teens	51.0%	36.1%	47.5%	30.8%
interaction effect	-3.0%	-2.7%	-3.0%	-2.5%

These different results gained by using different pregnancy rates underscore the basic conclusion of this report, that *the* reason for the decline in teen pregnancy rates depends greatly on the assumptions and data used.

Endnotes

1. The Alan Guttmacher Institute. (1999). *Teenage pregnancy: Overall trends and state-by-state information*. New York: Author.
2. Kaufmann, R.B., Spitz, A.M., Strauss, L.T., Morris, L., Santelli, J.S., Koonin, L.M., & Marks, J.S. (1998). The decline in U.S. teen pregnancy rates, 1990-1995. *Pediatrics*, *102*(5), 1141-1147.
3. Ventura, S.J., Mosher, W.D., Curtin, S.C., Abma, J.C., & Henshaw, S. (1999). Highlights of trends in pregnancies and pregnancy rates by outcome: Estimates for the United States, 1976-96. *National Vital Statistics Reports*, *47*(29).

Appendix 2
How the Other Analyses are Affected by Sampling Error

The section, "Sampling Error and Other Potential Biases," showed that the 1990-95 analyses are very unstable once potential sampling error is taken into account. Is this true of other analyses?

1988-95 Analysis

One might think that, since the 1988 National Survey of Family Growth (NSFG) data is of a higher quality than the 1990 data, the 1988-95 analysis might be more stable than 1990-95. However, since the change in sexual activity between 1988 and 1995 was not statistically significant, it means that sexual activity *could* have increased, by as much as 10.2 percent.

Table 1: Estimates and Confidence Intervals for the Percent of Teens Aged 15-19 Who Have Had Sex After Menarche

	1988	1995	Change
percent of teens aged 15-19 (at interview) who have had sex after menarche	52.6%	51.3%	1.9% decrease
95 percent confidence interval	49.2-55.9%	48.4-54.2%	best case: 13.4% decrease worst case: 10.2% increase
68 percent confidence interval	50.9-54.3%	49.8-52.8%	best case: 8.3% decrease worst case: 3.7% increase

Given the wide range of possible values within the confidence intervals, it is not surprising that analyses using some of the possible values allocate very different proportions of the total decline to less sexual experience versus fewer pregnancies among sexually experienced teens (Tables 2 and 3). The actual values as measured for 1988 and 1995 yield results allocating about three-quarters of the decline to decreasing pregnancy rates among sexually experienced teens. Under "worst case" scenarios (both 68 percent and 95 percent confidence intervals), this becomes the sole reason behind the decline. Under "best case" scenarios, declines in the proportion of teens who are sexually experienced explains 90-100 percent of the decline in teen pregnancy rates (68 percent and 95 percent confidence intervals, respectively).

Table 2: Variables Needed for an Analysis of the Declines for 1988-95, Assuming Some Sampling Error Occurred

Methods of calculating sexual experience	Percent of all girls aged 15-19 (at int.) who report ever having had sex after menarche			Pregnancy rates for sexually experienced teen girls aged 15-19		
	1990	1995	% change	1990	1995	% change
As measured (repeat of "method 3" from Table 7)	52.6%	51.3%	-2.5%	0.211	0.197	-6.7%
68% C.I., best case: using endpoints from 68% confidence interval for largest decrease in sexual experience	54.3%	49.8%	-8.3%	0.204	0.203	-0.8%
68% C.I., worst case: using endpoints from 68% confidence interval for largest *increase* in sexual experience	50.9%	52.8%	+3.7%	0.218	0.191	-12.3%
95% C.I., best case: using endpoints from 95% confidence interval for largest decrease in sexual experience	55.9%	48.4%	-13.4%	0.199	0.209	+5.1%
95% C.I., worst case: using endpoints from 95% confidence interval for largest *increase* in sexual experience	49.2%	54.2%	+10.2%	0.226	0.186	-17.4%

Age Subgroups

Unlike the analyses for teens aged 15-19, the separate analyses of younger and older teens appear to be fairly definitive, with 90 to 100 percent of the decline between 1988 and 1995 for teens aged 15-17 being due to decreased pregnancy rates for sexually experienced teens and 100 percent of the decline for teens aged 18-19 due to fewer teens in this age bracket ever having had sex. However, once possible sampling error is taken into account, the results are much less solid.

As is apparent in Table 4, the increase in the percent of teens aged 15-17 who have had sex after menarche is not statistically significant; it is within the realm of possibility that it may have decreased. On the other hand, of course, the increase may also have been larger than measured.

Table 3: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 15-19, 1988-95, Assuming Some Sampling Error Occurred

	As measured	68% C.I., best case	68% C.I., worst case	95% C.I., best case	95% C.I., worst case
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.108	0.102	0.115	0.096	0.122
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.003	0.009	-0.004	0.015	-0.011
1995 pregnancy rate assuming only pregnancy rate for sexually active teens changed	0.104	0.110	0.097	0.117	0.092
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.007	0.001	0.014	-0.006	0.019
total point change in the actual teen pregnancy rate, 1988-95	0.010	0.010	0.010	0.010	0.010
percent change due to a change in the proportion of teens who are sexually experienced	27.4%	92.0%	-41.4%	148.9%	-112.8%
percent change due to a change in the pregnancy rate for sexually experienced teens	74.4%	8.7%	136.3%	-56.5%	193.2%
interaction effect	-1.8%	-0.7%	5.1%	7.6%	19.6%

Table 4: Estimates and Confidence Intervals for the Percent of Teens Aged 15-17 Who Have Had Sex After Menarche

	1988	1995	Change
percent of teens aged 15-17 (at interview) who have had sex after menarche	37.6%	38.3%	2.5% increase
95 percent confidence interval	32.8-42.5%	34.7-41.8%	best case: 18.4% decrease worst case: 27.4% increase
68 percent confidence interval	35.2-40.1%	36.5-40.1%	best case: 9.0% decrease worst case: 13.9% increase

The actual variables as measured already show 100 percent of the decline attributable to the decreased pregnancy rate among sexually experienced teens. An analysis using the "worst case" endpoints, which make the increase in sexual experience much larger, would not change these results any, but would only indicate that pregnancies among sexually experienced teens decreased even more to offset this larger increase in sexual experience. However, the question remains as to what would happen it the "best case" endpoints were used. Table 5 shows the variables needed to analyze the change in teen pregnancy rates for younger teens, assuming that sexual experience really declined instead of increasing as measured.

Table 5: Variables Needed for an Analysis of the Declines for Younger Teens, Assuming Some Sampling Error Occurred

	Percent of all girls aged 15-17 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 15-17		
Methods of calculating sexual experience	**1988**	**1995**	**% change**	**1988**	**1995**	**% change**
As measured: percent sexually experienced after menarche, girls aged 15-17 when interviewed (repeat of "method 3" from Table 8)	37.6%	38.3%	+1.9%	0.197	0.170	-13.8%
68% C.I.: percent sexually experienced after menarche, girls aged 15-17, assume sexual experience decreased, use endpoints from 68% confidence interval	40.1%	36.5%	-9.0%	0.185	0.178	-3.5%
95% C.I.: percent sexually experienced after menarche, girls aged 15-17, assume sexual experience decreased, use endpoints from 95% confidence interval	42.5%	34.7%	-18.4%	0.174	0.187	+7.6%

Table 6 repeats the analysis of the change in teen pregnancy rates, using the rates as measured (which showed that sexual experience increased) and two hypothetical cases within the ranges of possible cases (confidence intervals) where sexual experience decreases. Using the endpoints from the 68 percent confidence interval that produce the largest decrease in sexual experience results in 70 percent of the decline being attributed to less sexual experience, and 30 percent to fewer pregnancies among sexually experienced teens. Using the endpoints from the 95 percent confidence interval, all of the decline in teen pregnancy rates for younger teens is attributed to less sexual experience — which is the opposite of the original finding!

To put it another way, at a 95 percent confidence level, the factors behind the decline in teen pregnancy rates for younger teens could have been anything from 100 percent due to less sexual experience to 100 percent due to fewer pregnancies among sexually experienced teens. Even at a much less certain 68 percent confidence level, anything from 100 percent due to decreased pregnancy rates for sexually experienced teens to a split of 30 percent due to this factor and 70 percent due to less sexual experience is possible. In short, what appeared to be a definitive explanation for declining rates of 90-100 percent due to decreased pregnancy rates for sexually experienced teens is not so clear after all.

Table 6: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 15-17, 1988-95, Assuming Some Sampling Error Occurred

	As measured	Endpoints from 68% C.I.	Endpoints from 95% C.I.
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.075	0.067	0.060
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	-0.001	0.007	0.014
1995 pregnancy rate assuming only pregnancy rate for sexually active teens changed	0.064	0.071	0.080
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	0.010	0.003	-0.006
total point change in the actual teen pregnancy rate, 1988-95	0.009	0.009	0.009
percent change due to a change in the proportion of teens who are sexually experienced	-15.3%	73.8%	150.9%
percent change due to a change in the pregnancy rate for sexually experienced teens	113.2%	28.8%	-62.3%
interaction effect	2.1%	-2.6%	11.4%

Does the same problem occur with the analysis for older teens, which returned results of "100 percent due to less sexual experience" no matter what definition of sex was used? Like the change in sexual experience for younger teens, the decrease among older teens between 1988 and 1995 was not statistically significant; it is possible that sexual activity increased (Table 7).

Table 7: Estimates and Confidence Intervals for the Percent of Teens Aged 18-19 Who Have Had Sex After Menarche

	1988	1995	Change
percent of teens aged 18-19 (at interview) who have had sex after menarche	74.3%	70.8%	4.7% decrease
95 percent confidence interval	69.6-79.1%	67.0-74.7%	best case: 15.3% decrease worst case: 7.3% increase
68 percent confidence interval	71.9-76.8%	68.9-72.8%	best case: 10.3% decrease worst case: 1.3% increase

If one of the "best case" scenarios was true, and the decrease in the proportion of teens who are sexually experienced was actually larger than it appears, the decline would still be totally due to decreased sexual activity, but it would mean the pregnancy rate for sexually experienced teens would have worsened even more. However, using the "worst case" endpoints from the confidence intervals such that sexual experience increases causes the declines in teen pregnancy rates among 18- to 19- year-olds to be due completely to decreased pregnancy rates for sexually experienced teens (Tables 8 and 9). This is true at both a 68 and a 95 percent confidence level. Again, what appeared to be a certain result that 100 percent of the decline in teen pregnancy rates for older teens is due to less sexual experience is not so certain at all. The decline may in fact be due entirely to less sexual experience, due entirely to fewer pregnancies among sexually experienced teens, or any combination in between.

Table 8: Variables Needed for an Analysis of the Declines for Older Teens, Assuming Some Sampling Error Occurred

	Percent of all girls aged 18-19 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 18-19		
Methods of calculating sexual experience	**1988**	**1995**	**% change**	**1988**	**1995**	**% change**
As measured: percent sexually experienced after menarche, girls aged 18-19 when interviewed (repeat of "method 3" from Table 10)	74.3%	70.8%	-4.7%	0.221	0.222	+0.5%
68% C.I.: percent sexually experienced after menarche, girls aged 18-19, assume sexual experience decreased, use endpoints from 68% confidence interval	71.9%	72.8%	+1.3%	0.228	0.216	-5.5%
95% C.I.: percent sexually experienced after menarche, girls aged 18-19, assume sexual experience decreased, use endpoints from 95% confidence interval	69.6%	74.7%	+7.3%	0.236	0.210	-10.8%

1972-90 Analysis

Unlike the analyses of the overall declines and the analyses for age subgroups, the increase in sexual experience between 1972 and 1990 that was found to be responsible for the increased teen pregnancy rate *was* statistically significant. Does this make a difference? Like some of the above examples, one factor (in this case, increased levels of sexual experience) was responsible for all of the increase. If the true statistics for the population are such that the increase was actually larger than measured (because the 1972 rate was a little lower or the 1990 rate a little higher), then this result would not change. However, it could be that the increase in sexual experience was smaller than measured. Table 10 shows the variables needed for a test of this hypothesis, choosing the sexual experience rates at the appropriate ends of the 95 percent confidence intervals such that the increase is as small as possible.

Table 9: Analysis of the Decline in Teen Pregnancy Rates for Teens Aged 18-19, 1988-95, Assuming Some Sampling Error Occurred

	As measured	Endpoints from 68% C.I.	Endpoints from 95% C.I.
1995 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.156	0.166	0.176
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	0.008	-0.002	-0.012
1995 pregnancy rate assuming only pregnancy rate for sexually active teens changed	0.165	0.155	0.146
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	-0.001	0.009	0.018
total point change in the actual teen pregnancy rate, 1988-95	0.007	0.007	0.007
percent change due to a change in the proportion of teens who are sexually experienced	110.4%	-29.3%	-171.7%
percent change due to a change in the pregnancy rate for sexually experienced teens	-10.9%	127.7%	253.1%
interaction effect	0.5%	1.6%	18.5%

Table 10: Variables Needed for an Analysis of the Increases in Teen Pregnancy Rates, 1972- 1990, Assuming Sampling Error Occurred Such that the Increase in Sexual Experience Was Smaller Than Measured*

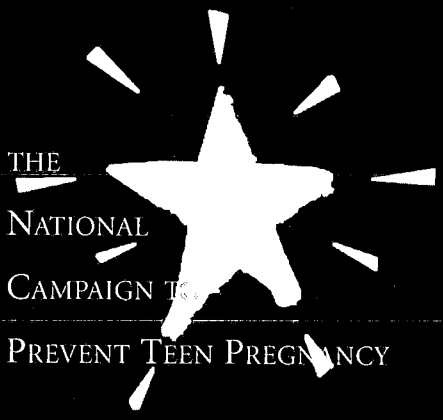
Methods of calculating sexual experience	Percent of all girls aged 15-19 who report ever having had sex			Pregnancy rates for sexually experienced teen girls aged 15-19		
	1972	1990	% change	1972	1990	% change
Method 1: percent sexually experienced, girls aged 15-19 when interviewed	0.426	0.504	+18.3%	0.223	0.232	+4.1%
Method 2: percent sexually experienced, girls aged 15-19 on a central date	0.430	0.504	+17.2%	0.211	0.232	+5.1%
Method 3: percent sexually experienced after menarche, girls aged 15-19 when interviewed	0.425	0.503	+18.4%	0.224	0.233	+4.1%
Method 4: percent sexually experienced after menarche, girls aged 15-19 on a central date	0.429	0.503	+17.2%	0.211	0.233	+5.0%

* This table uses the sexual experience rates at the endpoints of the 95% confidence intervals that minimize the increase in sexual experience between 1972 and 1990.

Table 11 shows the analysis of the increase in teen pregnancy rates between 1972 and 1990, using the endpoints that minimize the increase in sexual experience. Using these values still results in 75 to 80 percent of the increase being due to increased sexual experience (as opposed to the original finding of 100 percent being due to this factor).

Table 11: Analysis of the Increases in Teen Pregnancy Rates, 1972-1990, Assuming Sampling Error Occurred Such that the Increase in Sexual Experience Was Smaller Than Measured

	Method 1 (ever had sex, age at int.)	Method 2 (ever had sex, cen. date age)	Method 3 (sex aft. men., age at int.)	Method 4 (sex aft. men., cen. date age)
1990 pregnancy rate assuming only the proportion of teens who are sexually experienced changed	0.112	0.111	0.112	0.111
point change in pregnancy rate due to a change in the proportion of teens who are sexually experienced	-0.017	-0.016	-0.017	-0.016
1990 pregnancy rate assuming only pregnancy rate for sexually active teens changed	0.099	0.100	0.099	0.100
point change in pregnancy rate due to a change in the pregnancy rate for sexually experienced teens	-0.004	-0.005	-0.004	-0.005
total point change in the actual teen pregnancy rate, 1972-90	-0.022	-0.022	-0.022	-0.022
percent change due to a change in the proportion of teens who are sexually experienced	79.1%	74.3%	79.3%	74.5%
percent change due to a change in the pregnancy rate for sexually experienced teens	17.7%	21.9%	17.5%	21.8%
interaction effect	3.2%	3.8%	3.2%	3.8%



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