ARTICLES

Medical Care Cost Savings from Adolescent Contraceptive Use

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An analysis of the economic benefits of adolescent contraceptive use utilizes information from a national private payer database and from the California Medicaid program to compare private- and public-sector costs and savings. The study estimates the costs of acquiring and using 11 contraceptive methods appropriate for adolescents, treating associated side effects, providing medical care related to an unintended pregnancy during method use and treating sexually transmitted diseases (STDs) and compares them with the costs of using no method. The average annual cost per adolescent at risk of unintended pregnancy who uses no method is $1,267 ($1,079 for unintended pregnancy and $188 for STDs) in the private sector and $677 ($541 for unintended pregnancy and $137 for STDs) in the public sector under the most conservative assumptions. At one year of use, private-sector savings from adolescent contraceptive use range from $308 for the implant to $946 for the male condom; public-sector savings rise from $60 for the implant to $525 for the male condom. Both the use of male condoms with another method and the advance provision of backup emergency contraceptive pills provide additional savings.

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One of every eight women aged 15–19 become pregnant each year, a proportion that has changed little since the 1970s;[1] 85% of these pregnancies are unintended.[2] The social and economic consequences of the estimated one million teenage pregnancies each year are substantial.[3] Unintended births to adolescents, which account for about 40% of teenage pregnancies,[4] cost more than $1.3 billion in direct health care expenditures each year, while induced and spontaneous abortions among teenagers cost more than $180 million.* Additional resources are required to treat sexually transmitted diseases (STDs), acquired by about three million teenagers annually,[5] and for programs such as the Special Supplemental Program for Women, Infants and Children.

Most sexually active female adolescents are trying to avoid pregnancy: In 1995, 81% of women aged 15–19 at risk of unintended pregnancy were using contraceptives,[6] and many reported using two methods—one to protect themselves from STDs and another to prevent pregnancy.[7] Among those using a contraceptive method, most use either oral contraceptives (44%), male condoms (46%) or both (8%).[8] However, success with these methods depends heavily on user compliance, and many adolescents do not take pills correctly or fail to use condoms each time they have intercourse.

With the introduction of the implant, the injectable and the female condom in the 1990s, more contraceptive choices became available to adolescents. Hormonal methods such as the implant and the injectable are highly effective at preventing pregnancy. They do not, however, offer protection against STDs, and the implant's initial cost is high. The female condom provides protection against STDs but is much less effective at preventing pregnancy during typical use (which includes imperfect use as well as consistent and correct use). In addition, the female condom costs more to acquire than the male condom, although it is less expensive than hormonal methods. Given the growing emphasis on cost containment, these factors raise interesting issues for both private- and public-sector third-party payers that offer services related to pregnancy and for family planning or STD prevention programs that serve adolescents.

Six studies on the costs of using contraceptives have recently been published.[9] Two of those studies, which addressed costs for all women of reproductive age (15–44 years), demonstrate that use of contraceptives saves health care dollars in both private- and public-sector settings.[10] They also show that both male condoms used in combination with another contraceptive method and emergency contraceptive pills provided in advance as backup for nonhormonal contraceptive methods reduce health care expenditures.[11]

None of the six studies, however, specifically addressed contraceptive use among female adolescents. Teenagers experience higher than average rates of contraceptive failure and higher than average rates of STDs; in addition, the proportion of unintended teenage births that are reported as mistimed (as opposed to unwanted) is higher than average. Therefore, in this study we examine the costs and savings of contraceptive use among women aged 15–19, estimating both the costs of methods used individually and the costs of dual method use.

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*Calculated using public payer model costs for pregnancy outcomes reported in J. Trussell et al., "The Economic Value of Contraception: A Comparison of 15 Methods," *American Journal of Public Health*, **85:**494–503, 1995.

Table 1. Cost components of contraceptive use under three scenarios

Scenario 1
- Acquiring and using a contraceptive method.
- Treating side effects associated with contraceptive use or avoiding reproductive diseases (noncontraceptive beneficial side effects).
- Caring for an unintended pregnancy (birth, spontaneous abortion, induced abortion or ectopic pregnancy), assuming all unintended births are unwanted in the sense that, if prevented now, they will never occur.

Scenario 2
- Acquiring and using a contraceptive method.
- Treating side effects associated with contraceptive use or avoiding reproductive diseases.
- Caring for an unintended pregnancy (birth, spontaneous abortion, induced abortion or ectopic pregnancy), assuming all unintended births are unwanted in the sense that, if prevented now, they will never occur.
- Treating STDs.*

Scenario 3
- Acquiring and using a contraceptive method.
- Treating side effects associated with contraceptive use or avoiding reproductive diseases.
- Caring for an unintended pregnancy (birth, spontaneous abortion, induced abortion or ectopic pregnancy), assuming unwanted births will never occur but mistimed births will be postponed for two years.*
- Treating STDs.

*Change from the previous scenario.

Methodology

Using models developed for an earlier study,[12] we compare the direct medical costs of contraceptive use among female adolescents aged 15–19 with costs for all women aged 15–44. The methodology used in that study is described in detail elsewhere.[13] Included in the models are the cost of using the method (required physician visits or supplies), the cost of treating negative side effects (as well as the cost avoided due to beneficial side effects such as cancer prevention) and the cost of the unintended pregnancies (births, spontaneous abortions, induced abortions and ectopic pregnancies) that occur during typical use of the method.

Table 2. Estimated annual contraceptive failure rates (%), by method and age-group

Method	Age-group	
	15–19	15–44
Oral contraceptives	5.9	5.0
Implant	0.3	0.3
Injectable	0.4	0.3
Diaphragm	23.7	20.0
Male condom	16.6	14.0
Female condom	24.8	21.0
Sponge	26.4	33.3
Spermicides	30.7	26.0
Cervical cap	26.4	33.3
Withdrawal	22.5	19.0
Periodic abstinence	29.6	25.0
No method	90.0	85.0

Sources: **Women aged 15–44**—J. Trussell, "Contraceptive Efficacy," in R.A. Hatcher et al., Contraceptive Technology: Seventeenth Revised Edition, Irvington Publishers, New York, 1998, in press. **Women aged 15–19**—adjusted from rates for women aged 15–44 to reflect higher risk of failure among adolescents.

We analyze costs from two payer perspectives—the private sector and the public sector. We drew costs for the private-sector analysis from Medstat's 1993 MarketScan database, which contains payment information from large employer programs, Blue Cross/Blue Shield plans and other third-party payer plans, most of which use negotiated or discounted payment schedules. The public-sector costs were drawn from the California Medicaid program for 1993.

The main outcome measures are one-year and five-year costs per woman for use of each method compared to the total cost for use of no method. We use first-year contraceptive failure rates for all women for each year, except in the case of long-term methods, for which more detailed information is available.[14] In addition, we examine the impact of contraceptive use on STDs (see Appendix for detailed methodology) and the impact of recognizing that some unintended births are mistimed rather than unwanted; that is, even if avoided now, they will occur later and be classified as intended births.

Using the public-sector and private-sector models described above, we analyze the data for female adolescents and for all women under three different scenarios (Table 1). The first two scenarios assume that all unintended births are unwanted; they differ in that the second scenario includes the costs of STDs. Scenario three includes the cost of STDs and lowers the cost of an unintended birth to reflect the reported proportions of unwanted and mistimed births, producing the most conservative estimates of costs and cost savings.

We then compare the results for adolescents with those for all women, emphasizing scenario three. Finally, we perform two additional analyses to assess the overall cost of male condoms used with other contraceptive methods and the advance provision of emergency contraceptive pills as a backup method for nonhormonal methods.

Data for Adolescents

•*Contraceptive methods.* We estimate the costs of the 11 contraceptive methods considered appropriate for use by most sexually active teenagers—the cervical cap, the diaphragm, the female condom, the implant, the injectable, the male condom, oral contraceptives, periodic abstinence, spermicides, the sponge and withdrawal. (Although the sponge is not currently marketed in the United States, we include it because it may be reintroduced.) Tubal ligation, vasectomy and the IUD are excluded from the analyses because they are inappropriate contraceptive choices for most adolescents.

•*Contraceptive failure rates.* We use first-year failure rates as a proxy for annual failure rates in this study (Table 2). Decreases in failure rates frequently observed in studies because less motivated users become pregnant and are removed from observation are not relevant in our study, which assumes that all women continue to choose only the method being evaluated so that costs of different methods can be directly compared. We ignore the distinction between annual probabilities of failure and annual failure rates because the two are nearly identical.*

We estimate first-year method-specific failure rates for women aged 15–19 by adjusting the first-year failure rates for all women[15] to reflect the higher risk of failure documented for teenagers. Using data from the 1988 National Survey of Family Growth corrected for underreporting of abortion,[16] we obtain the 12-month probabilities of pregnancy during use of oral contraceptives and the male condom among teenagers and among all women. The ratio of probabilities among teenagers to those among all women is 1.1798 for oral contraceptives and 1.1850 for the male condom.

Estimates for other methods are highly unstable because the sample sizes for teenagers are very small. For this reason, and because estimates for oral contraceptives and male condoms are similar, we multiply the average of these two ratios (1.1824) by each of the method-specific contraceptive failure rates for all women to obtain failure rates among teenagers.

We treat the sponge and the cervical cap differently to reflect the fact that an adolescent is far more likely than the average

*Consider the following simple birth-interval model for women aged 15–44 using spermicides. An annual probability of failure during typical use of 0.26 implies an average monthly probability of 0.0248 ($1.0–\{1.0–0.26\}^{1/12}$). Assuming this probability is constant over time, the average waiting time to conception during spermicide use is 40.4 months (1/0.0248). Then, ignoring ectopic pregnancies, spontaneous abortions and stillbirths, and assuming that every other pregnancy ends in induced abortion, the waiting time to a conception leading to a live birth would be 84.8 months—40.4 months to get pregnant the first time, three months' gestation until the abortion, one month of postpartum nonsusceptibility following the abortion and 40.4 months to get pregnant again. The entire interval from one birth to the next would be 95.8 months—two months of postpartum nonsusceptibility following the birth (assuming minimal breastfeeding), 84.8 months of waiting time to the next live-birth conception and nine months for gestation. Hence, a birth occurs every 95.8 months, or 7.98 years, so the birthrate per year is 0.125 (1/7.98). Because there are two pregnancies for each birth, the pregnancy rate per year is 0.25 (2x0.125), a rate very close to the annual probability of failure (0.26). Differences are even smaller for more effective methods. For use of no method, the pregnancy rate is 0.84 versus an annual probability of failure of 0.85.

Table 3. Among women using no method, estimated incidence of STDs, by age-group, and treatment cost per case, by source of payment

STD	Incidence (%)		Cost per case*	
	15–19	15–44†	Private sector	Public sector
HIV	0.06	0.02	$119,274	$119,274
HSV	1.50	0.51	126	74
HPV	3.61	1.23	341	319
Syphilis	0.39	0.13	97	60
Gonorrhea	3.53	1.20	105	61
Chlamydia	17.18	5.85	105	98
Trichomoniasis	17.30	5.90	81	37
PID	2.75	2.09	2,216	1,026

*Cost derivations are available from the first author on request. †See Appendix.

woman to be nulliparous,[17] and to account for the difference in contraceptive failure rates between nulliparous and parous women.[18] For these methods, we first calculate the typical-use failure rate, assuming that all women have a parity distribution identical to that for adolescents,[19] and then multiply the failure rates by 1.1824. We do not adjust the failure rate for the implant because its effectiveness is not dependent on user compliance. The first-year pregnancy rate for adolescents using no contraceptive method comes directly from the literature.[20]

•*Sexually transmitted disease incidence.* We estimate the annual incidence of the following STDs among sexually active women aged 15–19: pelvic inflammatory disease (PID), HIV, herpes simplex virus (HSV), human papillomavirus (HPV), syphilis, gonorrhea, chlamydia and trichomoniasis (Table 3). For all of these STDs, we calculate the rates for sexually active female adolescents and then adjust the rates for methods that provide some protection against STDs.

Disease-specific incidence data are not available by age, except for PID. Therefore, to calculate the number of cases of each of the other diseases occurring among female adolescents, we multiply the number of new cases occurring annually among males and females in the United States[21] by the percentage of total STDs that occur among teenagers[22] and by the disease-specific percentage of STDs that occur among females.[23]* To determine an annual rate, we divide the number of annual cases by the total number of sexually active women aged 15–19. For the latter, we use 1988 national survey data on the number of women in that age-group who reported having had intercourse in the last three months as a proxy for the number who did so during a one-year period.[24]

Condoms are assumed to reduce the rate of STDs among adolescents by 88%, while spermicide or any method used with spermicide (such as the diaphragm) is assumed to reduce STD acquisition rates by 41%.† The incidence of STDs among women using all other contraceptive methods is assumed to be the same as that among women using no method.

To calculate the incidence of PID among sexually active adolescents, we divide the number of PID cases among women aged 15–19 who have ever had intercourse[25] by the number of women aged 15–19 who have had intercourse in the last three months[26] (again using three months as a proxy for a one-year period). We then use relative risks reported in the literature for each of the contraceptive methods (compared to no method) to calculate method-specific rates of PID.[27]

•*Pregnancy outcomes.* We use special tabulations of data from the 1988 National Maternal and Infant Health Survey, the 1988 National Survey of Family Growth and the 1987 Alan Guttmacher Institute (AGI) Abortion Patient Survey[28] to estimate the fractions of unintended pregnancies following contraceptive failure that end in spontaneous abortion, induced abortion and birth. We assume that all induced abortions are the result of unintended pregnancies. We utilize the AGI algorithm for computing the number of spontaneous abortions—20% of births plus 10% of induced abortions. We assume that 1% of pregnancies occurring during use of the 11 contraceptive methods appropriate for adolescents are ectopic. According to these calculations, 1% of unintended pregnancies following contraceptive failure among women aged 19 or younger are ectopic, 12% end in spontaneous abortion, 54% in induced abortion and 33% in birth.‡

•*Cost of a birth.* When we assume that all unintended births are unwanted (scenarios one and two), the cost of a teenage birth is $8,619 in the private-sector setting and $3,623 in the public-sector setting. However, only 21% of unintended births to women aged 15–19 are reported as unwanted, while 79% are reported as mistimed (higher than the 69% reported among all women).[29] When we assume that mistimed births will occur two years later (scenario three), cost savings occur only because payment for such births is deferred; thus, the average cost of an unintended birth among adolescents drops to $2,443 in the private-sector setting and to $1,027 in the public-sector setting.

Results

Our results show that contraception saves health care dollars under each of the three scenarios, regardless of the setting. We describe results from scenarios one and two briefly (full results are available from the first author on request). However, we focus on scenario three because we believe it reflects most realistically the economic impact of contraceptive use both among adolescents and among all women.

Adolescents

•*Scenario one.* In the private-sector setting, the injectable is the least costly method at one year of use, and the implant is the least costly at five years. For methods with relatively high typical-use failure rates, such as the female condom or the cervical cap, the cost of unintended pregnancy represents a substantial portion of total expenditures. Conversely, for methods with relatively low failure rates, such as the implant or the injectable, the expense of acquiring the method is the largest cost. Savings over no method range from a low of $1,794 for spermicides at one year of use ($2,895 cost of using no method minus $1,101 cost of using spermicide) to a high of $12,318 for the implant at five years. In the public-sector setting, savings over no method range from a low of $779 for spermicides at one year of use to a high of $5,420 for the implant at five years.

*To illustrate our estimation process, we calculate the number of new cases of gonorrhea occurring among female adolescents annually. A total of 1.1 million gonorrhea cases occur among males and females each year in the United States. About 25% of all STDs occur among adolescents. (Disease-specific proportions are unavailable.) The annual proportion of gonorrhea cases occurring among females is estimated at 50% by the Centers for Disease Control and Prevention (W. Cates, Jr., personal communication, Aug. 18, 1994; age-specific data are unavailable). Multiplying these statistics together yields 137,500 (1,100,000x0.25x0.5) cases of cervical gonorrhea among female adolescents annually. The annual incidence is 3.525% (137,500/3,901,075).

†As we explain in the Appendix, we assume that condoms reduce the risk of STDs among all women by 90% and that methods used with a spermicide do so by 50%. To calculate the reduction in risk among teenagers, we multiplied the failure rates for STD prevention by the same factor used to inflate the contraceptive failure rates (1.1824). For example, condoms reduce the risk among teenagers by 88% (1.0–0.1x1.1824) and methods utilizing a spermicide do so by 41% (1.0–0.5x1.1824).

‡The corresponding results among all women aged 15–44 are 1%, 13%, 47% and 40%, slightly different from the distribution used in our earlier paper (see J. Trussell et al., 1995, reference 9), which was taken from S. Harlap, K. Kost and J. D. Forrest, 1991 (see reference 20).

Table 4. Cumulative costs of contraceptive use for adolescents and all women, by source of payment and year of use, according to method

Age-group and method	Private sector					Public sector				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Adolescents										
Cervical cap	$ 591	$1,083	$1,587	$2,033	$2,458	$ 346	$ 640	$ 944	$1,210	$1,465
Diaphragm	548	1,009	1,462	1,885	2,287	326	605	883	1,139	1,383
Female condom	615	1,201	1,759	2,291	2,797	269	525	769	1,001	1,222
Implant*	959	1,112	1,259	1,399	1,533	617	734	847	954	1,056
Injectable	436	850	1,245	1,621	1,978	312	609	892	1,161	1,417
Male condom	321	626	917	1,194	1,457	152	296	433	564	689
Oral contraceptives	529	996	1,442	1,866	2,269	394	754	1,096	1,422	1,733
Periodic abstinence	542	1,059	1,550	2,019	2,465	314	613	898	1,170	1,428
Spermicides	592	1,144	1,669	2,169	2,646	345	669	977	1,270	1,549
Sponge	544	1,050	1,531	1,990	2,427	306	592	864	1,123	1,370
Withdrawal	457	893	1,307	1,702	2,078	272	530	776	1,011	1,234
No method	1,267	2,473	3,622	4,716	5,758	677	1,322	1,937	2,522	3,079
All women										
Cervical cap	758	1,412	2,069	2,662	3,226	393	735	1,082	1,391	1,686
Copper T IUD*	609	714	822	918	1,010	268	334	400	460	517
Diaphragm	538	989	1,433	1,846	2,240	293	540	788	1,015	1,232
Female condom	649	1,267	1,856	2,416	2,950	271	530	776	1,011	1,234
Implant*	869	936	1,002	1,065	1,125	543	589	634	677	718
Injectable	346	673	986	1,283	1,566	238	463	678	882	1,077
Male condom	336	655	960	1,250	1,526	149	290	425	554	676
Oral contraceptives	452	846	1,221	1,579	1,920	325	618	898	1,164	1,417
Periodic abstinence	502	981	1,436	1,870	2,283	253	494	723	941	1,150
Progesterone T IUD	541	1,056	1,546	2,014	2,458	258	504	738	961	1,174
Spermicides	592	1,143	1,668	2,168	2,644	314	608	887	1,154	1,407
Sponge	713	1,380	2,015	2,620	3,196	356	689	1,006	1,308	1,596
Tubal ligation	2,621	2,699	2,769	2,837	2,900	1,286	1,339	1,385	1,431	1,473
Vasectomy	849	934	1,016	1,093	1,167	413	469	522	572	621
Withdrawal	403	787	1,153	1,501	1,833	206	403	590	768	937
No method	1,493	2,915	4,269	5,558	6,786	720	1,405	2,058	2,680	3,272

*The cumulative cost for each year includes the cost of removal at the end of the last year of use. Note: Results are based on scenario 3.

•*Scenario two.* When STD costs are added to the analysis, they represent between 4% (for the female condom) and 46% (for the implant) of total costs in the private-sector setting at five years of use and between 6% and 52% in the public-sector setting. The least costly method at one year of use is the injectable in the private-sector setting and the male condom in the public-sector setting; the implant is the least costly method at five years of use in both models.

At five years of use, the cost of no method in the private-sector setting is $14,015, and savings brought about by contraceptive use range from a low of $8,549 for spermicides to a high of $12,457 for the implant. In the public-sector setting, the cost of using no method is $6,550 at five years of use, and savings due to contraceptive use range from $3,815 for spermicides to $5,484 for the implant.

•*Scenario three*. In both settings, the male condom is the least costly method at one year and five years of use (Table 4). In the private-sector setting, the female condom is the second most costly method at one year of use and the most costly at five years of use; although it reduces a teenager's risk of acquiring an STD, the device prevents fewer pregnancies than hormonal methods during typical use and is more expensive than nonhormonal methods with similar contraceptive efficacy. In the public-sector setting, oral contraceptives are the second most costly method at one year of use and the most costly at five years.

The proportion of total costs attributable to each of the four cost components—method, side effects, unintended pregnancy and STDs—varies tremendously by method (Figures 1 and 2, page 252), but not—except for the implant—by length of use. For example, in the private-sector setting, the cost of acquiring the implant represents 83% of the total cost at one year of use but only 52% at five years of use (not shown) because implant use involves one initial purchase that does not have to be repeated for five years. In the private-sector setting, STD costs range from 7% of total costs for the female condom to 47% of costs for the implant at five years of use (not shown). The cost of side effects is generally negligible for all of the contraceptive methods in both settings.

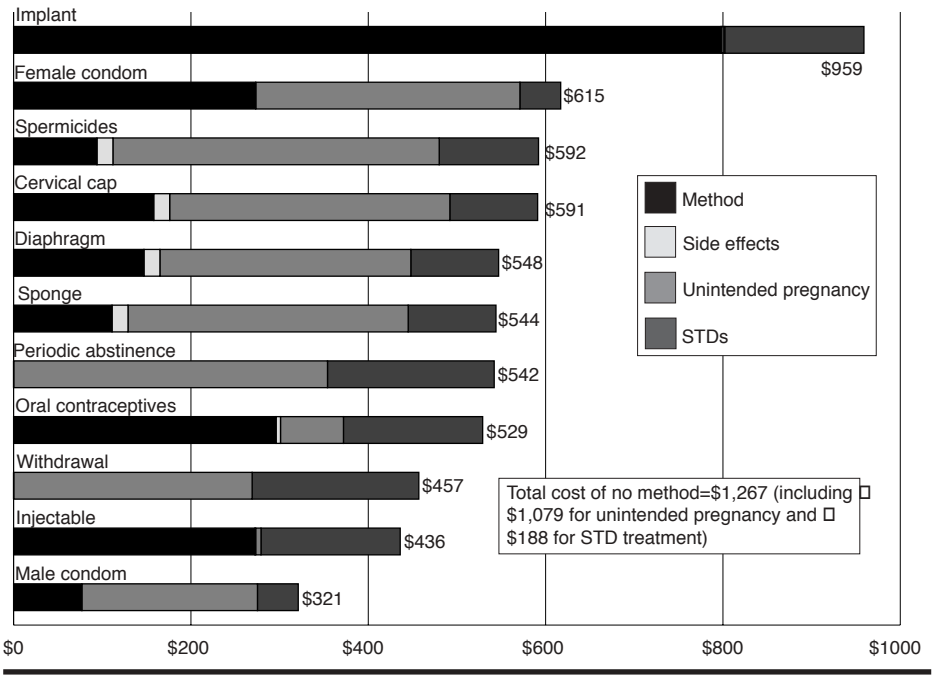
In both settings, use of each method of contraception saves health care dollars because pregnancy is very costly; total savings (like total costs) are lower in the public sector. In the private-sector setting, savings range from $308 for the implant at one year of use ($1,267 total cost of using no method minus $959 cost of using the implant) to a high of $4,301 for the male condom at five years of use. In the public-sector setting, total savings rise from $60 for the implant at one year of use to $2,390 for the male condom at five years of use (not shown). The female condom is more cost saving relative to other methods in the public-sector setting than in the private-sector setting because acquiring the female condom is relatively less expensive than acquiring other methods in the public sector.

Adolescents Compared to All Women

•*Scenarios one and two.* There are several interesting differences in these scenarios between the results for adolescents and those for all women in both settings. First, the cost of using no method is lower among adolescents than among all women, despite teenagers' higher pregnancy and STD rates. This cost difference reflects two facts: Teenagers are more likely than all women to terminate an unintended pregnancy, and abortions are far less expensive than births.

In addition, the total costs for most contraceptive methods are slightly higher for adolescents than for all women because of teenagers' higher contraceptive failure and STD rates. In fact, in scenario two, STDs represent only 3–30% of total costs among all women at five years of use versus 4–52% among adolescents. Still, the sponge and the cervical cap are less costly for teenagers than for all women. Contraceptive failure rates for these two methods are actually lower for adolescents than for all women

Figure 1. One-year cost in a private-sector setting of contraceptive use among adolescents under scenario 3, by method



because they are more effective among nulliparous than among parous women, and teenagers are much more likely than all women to be nulliparous. In scenario two in the private-sector setting, the costs of the cervical cap at one and five years of use for adolescents are $1,123 and $4,876, respectively, while the corresponding costs for all women are $1,468 and $6,454.

•*Scenario three*. The differences found in scenarios one and two apply to scenario three as well. In the private-sector setting, the cost of using no method for all women is $1,493 for one year and $6,786 for five years, versus $1,267 and $5,758 for teenagers (Table 4). As in the first two scenarios, the cervical cap and the sponge are less costly for adolescents than for all women because they have lower contraceptive failure rates among adolescents.

All other methods have higher contraceptive failure rates among teenagers than among all women, but the cost of unintended pregnancy is lower among teenagers because teenagers are more likely to obtain an abortion. Still, the overall cost of using any of these methods but the male and female condom is higher among adolescents than among all women because the higher cost of treating STDs among teenagers outweighs the lower cost of unintended pregnancy. STDs represent 7–47% of total costs among adolescents at five years of use, compared with only 4–27% among all women.

In the public-sector setting, use of no method costs $720 at one year and $3,272 at five years for all women, compared with $677 and $3,079 for teenagers. As in the private-sector setting, the sponge and the cervical cap remain more costly to use for all women than for adolescents. STDs represent a smaller proportion of total costs among all women than among adolescents. Savings realized by contraceptive use are higher for all women than for adolescents for all methods except the sponge and the cervical cap, ranging from $177 for the implant at one year to $2,596 for the male condom at five years. (When methods not appropriate for use by teenagers are included, the Copper T IUD is the most cost-saving method at five years of use for all women, saving $2,755 over no method in the public-sector setting and $5,776 in the private-sector setting.)

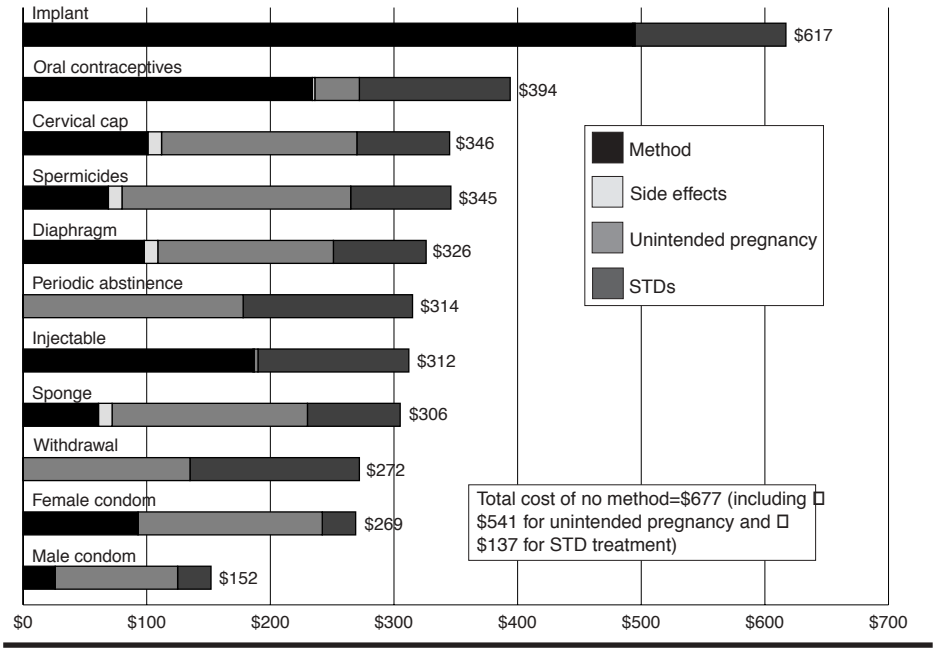
Dual Method Use

To assess the overall effectiveness of using male condoms in conjunction with other methods and of using emergency contraceptive pills as a backup for nonhormonal methods, we perform two additional analyses under the assumptions for scenario three. Table 5 shows results for each analysis for adolescents.

•*Male condoms used in conjunction with other methods*. Combining male condoms with any other method (except for the female condom)* reduces medical care costs for adolescents. This dual use of methods substantially reduces the incidence of unintended pregnancy and therefore increases savings. Annual pregnancy rates are less than 4% for male condoms used in conjunction with other methods.

The costs of unintended pregnancy drop substantially for methods that, when used alone, have relatively high contraceptive failure rates. For methods that are highly effective at preventing pregnancy, such as the

Figure 2. One-year cost in a public-sector setting of contraceptive use among adolescents under scenario 3, by method



*Male and female condoms cannot be used simultaneously because friction can cause the female condom to be pulled from the vagina.

implant or the injectable, there is little additional reduction in risk of pregnancy, and the decrease in the cost of treating STDs is partially offset by the cost of condoms. However, total savings for use of these methods in combination with the male condom still increase in both the private-sector and the public-sector setting. At one and five years of use, male condoms combined with withdrawal or periodic abstinence are the least costly methods in both settings. STDs represent only 15% of total costs for combined use of the implant and condom at five years in the private-sector setting, compared with 47% when the implant is used without a male condom (data not shown).

• *Emergency contraceptive pills (ECPs) used as a backup for other methods*. ECPs reduce the risk of pregnancy following unprotected intercourse by 74%.[30] We estimate the effectiveness of use of ECPs as a backup for methods for which user compliance plays a large role in avoiding pregnancy—barrier methods, spermicides, periodic abstinence and withdrawal.

Women relying on male or female condoms could use ECPs whenever condoms were used imperfectly (not used or used incorrectly) or were used perfectly but nevertheless broke or slipped. In contrast, women relying on other methods would use ECPs only when they did not use their contraceptive or used it incorrectly; only at such times would they know that intercourse was unprotected.

Therefore, we assume that use of ECPs prevents 74% of the pregnancies during typical (both perfect and imperfect) use of condoms and during imperfect use of other methods.* We add $71 per year in the private-sector setting and $49 per year in the public-sector setting to cover the cost of an office visit and a prescription for a packet containing enough pills for up to five treatments. For the diaphragm and the cervical cap, we exclude the cost of the office visit because a visit is already required to obtain the method.

Advance provision of ECPs to back up nonhormonal methods would be extremely cost-effective for adolescents because pregnancy rates would drop substantially. For example, the annual pregnancy rate during typical use of the male condom would drop from 17% when used alone to 4% when combined with ECPs. Savings over no method increase for all methods used with ECPs as backup.

Table 5. Among 15–19-year-old women, contraceptive failure rates for use of male condoms or emergency contraceptive pills with another method, costs at one and five years and five-year savings over use of no method, by source of payment

Dual method use	Combined failure rate (%)	Private sector			Public sector		
		1-year costs	5-year costs	5-year savings	1-year costs	5-year costs	5-year savings
Male condom with*							
Cervical cap	2.55	$334	$1,270	$4,488	$183	$ 715	$2,364
Diaphragm	2.25	318	1,226	4,532	178	697	2,382
Implant	0.03	923	1,343	4,415	467	720	2,359
Injectable	0.03	396	1,798	3,960	240	1,087	1,992
Oral contraceptives	0.52	443	1,882	3,876	304	1,322	1,757
Periodic abstinence	2.90	188	855	4,903	85	382	2,697
Spermicides	3.04	283	1,243	4,515	158	693	2,386
Sponge	2.55	282	1,236	4,522	139	610	2,469
Withdrawal	2.13	178	812	4,946	80	361	2,718
Emergency contraception with†							
Cervical cap	13.70	482	1,950	3,808	308	1,287	1,792
Diaphragm	10.15	429	1,736	4,022	284	1,185	1,894
Female condom	6.46	489	2,223	3,535	215	977	2,102
Male condom	4.30	249	1,131	4,627	128	582	2,497
Periodic abstinence	10.18	381	1,731	4,027	247	1,120	1,959
Spermicides	11.99	447	1,984	3,774	288	1,286	1,793
Sponge	13.70	470	2,089	3,669	283	1,262	1,817
Withdrawal	8.51	361	1,640	4,118	237	1,074	2,005

*For methodology, see P. Kestelman and J. Trussell, "Efficacy of the Simultaneous Use of Condoms and Spermicides," Family Planning Perspectives, **23**:226–227 & 232, 1991. †For methodology, see J. Trussell et al., 1997, reference 9.

Discussion

One in five adolescents at risk of unintended pregnancy use no method of contraception, resulting under the most conservative assumptions in an average annual cost of $1,267 ($1,079 for unintended pregnancy and $188 for STDs) in the private sector and $677 ($541 for unintended pregnancy and $137 for STDs) in the public sector. Use of contraceptives by adolescents prevents unintended pregnancy, which is very costly. Some methods also reduce the risk of STDs, thereby avoiding additional medical costs. Our results, based on multiple analyses, conclusively demonstrate that use of contraceptives by teenagers saves health care dollars.

By focusing on scenario three, which counts only a fraction of the total cost of an unintended birth because most such births are mistimed rather than unwanted, we obtain realistic, conservative results. It could be argued that assuming a delay of longer than two years would be realistic for mistimed births because many women today wait longer to have their first child.

One might question the reliability of data collected from adolescents on unwanted births. The 21% of unintended births reported by adolescents as unwanted[31] seems unrealistically high. Can any adolescent really know that she will never want children in the future? Therefore, we reanalyzed contraceptive savings for adolescents under scenario three, assuming that all births were mistimed and none unwanted. Although this assumption reduced the cost of a birth to $801 in the private-sector setting and $337 in the public-sector setting, all contraceptives remained less costly than no method at one and five years of use, with one exception. The implant, with its high acquisition cost, was more costly than no method at one year of use in each setting, but by year two savings exceeded costs.

Public health officials have emphasized how important it is for adolescents to use condoms for protection against STDs in addition to any other contraceptive method they might be relying on; our analysis shows that this strategy also reduces medical costs. Savings would be increased even further if the two methods were used consistently and correctly.

In addition, our results demonstrate that use of emergency contraception is a cost-saving approach to prevention of unintended pregnancy. Few Americans know about emergency contraceptive pills,[32] although the therapy has been available for over two decades, has recently been endorsed by the American College of Obstetricians and Gynecologists[33] and has been declared safe and effective by the U.S. Food and Drug Administration.[34]

In addition to emergency situations such as condom breakage or slippage, or those when a method is not used at all, many teenagers experience nonconsensual intercourse.[35] Adolescents need to know not only that preventing pregnancy after sex is possible but also where to obtain treatment. One way to provide

*The pregnancy rate for methods other than condoms is $P_p f_p + (1.0–0.74)(f_t – P_p f_p)$, where f_t is the typical-use failure rate, f_p is the perfect-use failure rate and P_p is the proportion of menstrual cycles where perfect use occurs. We conservatively assumed P_p to be 90%. The pregnancy rate for condoms is $(1.0–0.74)f_t$.

them with this information is to make sure they know about the Emergency Contraception Hotline (1–888–NOT–2–LATE), a national, toll-free hotline, offered in English and Spanish and available 24 hours a day, and the Emergency Contraception Website (http://opr.princeton.edu/ec/), both of which provide brief descriptions of treatment options and the names and telephone numbers of local providers.

Several caveats are in order when interpreting our results. First, we did not specifically account for discontinuing use of any method. However, the cost estimates shown in Table 4 can be used to compare methods used for different durations. If a method is typically used for x years, then its annualized cost is the cumulative cost at x years divided by x.

Second, although there is some evidence to support the hypothesis that births to teenagers are more costly than births to the average woman,[36] we did not account for this difference in our models because we lacked data on relative costs. Had we adjusted upward the cost of an unintended birth for adolescents, however, savings over no method would have increased.

Third, for adolescents and all women, we have assumed that the incidence of STDs other than PID among sexually active women using no method is the same as the incidence among all sexually active women in each group, whereas actual incidence would be higher among those using no method. Consequently, we have understated the costs of STDs and the cost savings for methods that protect against STDs and understated the differential in STD costs between teenagers and all women.

Fourth, we have probably underestimated the incidence of PID among sexually active teenagers using no method of contraception and therefore have both underestimated the savings among adolescents who use contraceptives that reduce the risk of PID and distorted the difference between the costs among teenagers and those among all women. We assumed that the incidence of PID among sexually active adolescents who use no method is the same as the incidence among all sexually active teenagers (2.8%). Among all sexually active women, however, the incidence of PID is estimated to be 59% higher among those using no method than among the group as a whole (2.088% vs 1.314%).[37] If the incidence among sexually active adolescents using no method is assumed to be 59% higher than the incidence among all sexually active teenagers, the annual cost of using no method would rise by $36 in a private-sector setting and $17 in a public-sector setting.

Fifth, we assumed that the lifetime cost of treating HIV ($119,274) is the same in the public sector as in the private sector, whereas the overall ratio of MediCal costs to private-sector costs for all procedures is only 57%.[38] Because the cost of treating HIV is an average for those with public and private insurance,[39] we have probably overstated the cost in the public sector of using no method and overstated the cost savings of using methods that reduce the risk of HIV; consequently, the costs and cost savings in the private-sector setting are understated.

If the cost of treating HIV in the public-sector setting were reduced by 43%, the annual cost of using no method would be reduced by $33 among teenagers and $11 among all women. Alternatively, if the cost of treating HIV in the private-sector setting were raised by 75% (1.0/0.57), the annual cost of using no method would be raised by $57 among adolescents and by $20 among all women. These extremes bracket the overstatement and understatement of the cost of treating HIV in the public and private sectors, respectively.

Finally, although our analysis included the costs of treating women with STD infections, it did not include the costs of treating their partners. Had we done so, the cost savings associated with the use of barrier contraceptives, particularly male and female condoms, would have been greater.

Use of contraceptive methods—alone or in conjunction with condoms or emergency contraceptive pills—by adolescents reduces medical costs in both public- and private-sector settings. Therefore, providing insurance coverage for contraception could be a cost-effective strategy. Insurers in both the public and the private sector generally cover the medical costs of unintended pregnancy, with coverage for abortion showing the most variation. Some private insurers provide broad coverage for all contraceptive methods, but most do not.[40] Public payers generally provide broader contraceptive coverage than do private payers, although payment levels often are low, perhaps low enough to limit access.[41] Whether insurers would actually save money by providing contraceptive coverage would depend on whether enough women moved from less effective methods, including no method, to more effective methods.

A few calculations based on the most conservative results in scenario three illustrate the savings potential of contraceptive coverage. An increase of 29% in the number of male condom users, drawn from the pool of sexually active adolescents currently using no method, in a public-payer setting and of 34% in a private-payer setting would save enough to offset the full costs of contraceptives, side effects, unintended pregnancy and STD care for all old and new condom users. Similarly, an increase of 36% in the number of teenagers using the implant for five years in a private-payer setting and of 52% in a public-payer setting would pay for all old and new implant users.

Even smaller increases would be cost-effective among all women, for whom unintended pregnancies are more costly. For example, an increase of 17% in the number of women using the Copper T IUD for five years, drawn from the pool of women currently using no method, would save enough health care dollars to pay the full costs for all old and new users in a private-payer setting; if use continued for the full 10 years for which this method is approved, an increase of only 13% in the number of users would be required. In the public-payer setting, the corresponding increases would be 19% and 15%, respectively.

These calculations illustrate the increase in contraceptive use required to offset full costs for all old and new users with no increase in premiums by the insurer. For employers, who are concerned about improving employee well-being as well as lowering health care costs, ensuring that their employees have access to the widest possible range of contraceptive and other reproductive health services has additional advantages. Regardless of how many health care dollars are saved or other costs to society are avoided by use of contraceptives, policies that help to reduce the occurrence of unintended pregnancy and STDs are important because of their personal, social and health benefits for the individual and for society. Accidental pregnancies, which account for almost all unwanted pregnancies and teenage pregnancies, and for many pregnancies to unmarried couples, are widely recognized as a serious problem in the United States, as are STDs (especially HIV).

Current coverage policies constitute a significant disincentive for effective contraceptive use: Methods can be expensive for an individual without health insurance coverage or even for the individual with insurance coverage when substantial out-of-pocket expenditures on deductibles or coinsurance are involved.[42] Instituting insurance coverage for contraception that is adequate and fair, even and equal, is a minimum requirement for ensuring reproductive health care for American women and is a sensible private-sector policy as well as public-sector policy goal.[43]

Appendix

Calculation of STD Incidence

The incidence of STDs among women aged 15–44 (Table A1) was calculated as follows:

•*PID*. The annual incidence of PID among users of method m was computed as the product of the annual incidence among users of no method (2,088 cases per 100,000 sexually active women[44]) and the relative risk among women using method m (compared with no method). Relative risks for tubal ligation, oral contraceptives, the Copper T IUD, the diaphragm, the male condom, the sponge, spermicides and periodic abstinence were taken directly from the literature.[45] The relative risks for withdrawal and vasectomy were assumed to be 1.0, and those for the implant and the injectable were assumed to be equal to the risk for oral contraceptives (0.5). The relative risk for the cervical cap was assumed to be the same as that for the sponge and the diaphragm (0.4), while the relative risk for the female condom was set equal to that for the male condom (0.5). We assumed that the annual relative risk for the progesterone T IUD (which must be replaced each year) is equal to that of the Copper T IUD in the first year (1.833 each year). The relative risk for the Copper T IUD was set at 1.833 for the first year and 1.4 for years two through five.[46] The risks for withdrawal, vasectomy and the progesterone T IUD may be overstated.[47]

•*Other STDs*. We estimated that 45.8 million women are at risk of contracting an STD. We derived this number by multiplying the number of reproductive-age women (59 million[48]) by the proportion of such women who are sexually active (78%[49]).

We then identified the number of new cases of each STD estimated by the Centers for Disease Control and Prevention.[50] We assumed that 67% of all cases of herpes simplex virus and chlamydia occur among women, as well as 50% of syphilis and gonorrhea cases, 75% of human papillomavirus cases and 90% of trichomoniasis cases; we also assumed that 10,000 new sexually transmitted cases of HIV occur among women each year.[51]

We calculated incidence for each method by dividing the number of new cases of each STD among women by the number of sexually active women (45.8 million). Condoms were assumed to reduce the incidence of each STD by 90%, while spermicide or any method using a spermicide was assumed to reduce the incidence of each STD by 50%. The effectiveness of methods using a spermicide may be overestimated.[52] All other methods have an incidence equal to that for no method.

Table A1. Annual incidence (%) of STDs among sexually active women aged 15–44

Method	PID	HIV	HSV	HPV	Syphilis	Gonorrhea	Chlamydia	Trichomoniasis
Tubal ligation	1.04	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Vasectomy	2.09	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Oral contraceptives	1.04	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Implant	1.04	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Injectable	1.04	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Progesterone T IUD	3.83	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Copper T IUD	2.92	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Diaphragm	0.84	0.01	0.26	0.61	0.07	0.60	2.93	2.95
Male condom	1.04	0.00	0.05	0.12	0.01	0.12	0.59	0.59
Female condom	1.04	0.00	0.05	0.12	0.01	0.12	0.59	0.59
Sponge	0.84	0.01	0.26	0.61	0.07	0.60	2.93	2.95
Spermicides	1.25	0.01	0.26	0.61	0.07	0.60	2.93	2.95
Cervical cap	0.84	0.01	0.26	0.61	0.07	0.60	2.93	2.95
Withdrawal	2.09	0.02	0.51	1.23	0.13	1.20	5.85	5.90
Periodic abstinence	2.09	0.02	0.51	1.23	0.13	1.20	5.85	5.90
No method	2.09	0.02	0.51	1.23	0.13	1.20	5.85	5.90

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