Original Investigation

Return on Investment: A Fuller Assessment of the Benefits and Cost Savings of the US Publicly Funded Family Planning Program

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Policy Points:

- The US publicly supported family planning effort serves millions of women and men each year, and this analysis provides new estimates of its positive impact on a wide range of health outcomes and its net savings to the government.
- The public investment in family planning programs and providers not only helps women and couples avoid unintended pregnancy and abortion, but also helps many thousands avoid cervical cancer, HIV and other sexually transmitted infections, infertility, and preterm and low birth weight births.
- This investment resulted in net government savings of $13.6 billion in 2010, or $7.09 for every public dollar spent.

Context: Each year the United States' publicly supported family planning program serves millions of low-income women. Although the health impact and public-sector savings associated with this program's services extend well beyond preventing unintended pregnancy, they never have been fully quantified.

Methods: Drawing on an array of survey data and published parameters, we estimated the direct national-level and state-level health benefits that accrued from providing contraceptives, tests for the human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs), Pap tests and tests for

human papillomavirus (HPV), and HPV vaccinations at publicly supported family planning settings in 2010. We estimated the public cost savings attributable to these services and compared those with the cost of publicly funded family planning services in 2010 to find the net public-sector savings. We adjusted our estimates of the cost savings for unplanned births to exclude some mistimed births that would remain publicly funded if they had occurred later and to include the medical costs for births through age 5 of the child.

Findings: In 2010, care provided during publicly supported family planning visits averted an estimated 2.2 million unintended pregnancies, including 287,500 closely spaced and 164,190 preterm or low birth weight (LBW) births, 99,100 cases of chlamydia, 16,240 cases of gonorrhea, 410 cases of HIV, and 13,170 cases of pelvic inflammatory disease that would have led to 1,130 ectopic pregnancies and 2,210 cases of infertility. Pap and HPV tests and HPV vaccinations prevented an estimated 3,680 cases of cervical cancer and 2,110 cervical cancer deaths; HPV vaccination also prevented 9,000 cases of abnormal sequelae and precancerous lesions. Services provided at health centers supported by the Title X national family planning program accounted for more than half of these benefits. The gross public savings attributed to these services totaled approximately $15.8 billion—$15.7 billion from preventing unplanned births, $123 million from STI/HIV testing, and $23 million from Pap and HPV testing and vaccines. Subtracting $2.2 billion in program costs from gross savings resulted in net public-sector savings of $13.6 billion.

Conclusions: Public expenditures for the US family planning program not only prevented unintended pregnancies but also reduced the incidence and impact of preterm and LBW births, STIs, infertility, and cervical cancer. This investment saved the government billions of public dollars, equivalent to an estimated taxpayer savings of $7.09 for every public dollar spent.

Keywords: family planning services, cost-benefit analysis, contraception, financing.

I N THE UNITED STATES, HALF OF ALL PREGNANCIES ARE unintended, and unintended pregnancy is highly concentrated among low-income women.[1] In response to this disparity, the federal and state governments have worked for decades to expand access to family planning services for young and low-income women and men, channeling public funds for family planning services primarily through 2 programs. Title X of the Public Health Service Act, enacted by Congress in 1970, is the sole federal program devoted entirely to family planning. Medicaid is a joint federal-state public health insurance program, which provides the vast majority of public family planning dollars and covers

millions of women and men of reproductive age. Since the mid-1990s, to further increase access to family planning services for low-income women not eligible for full-benefit Medicaid, 30 states have expanded eligibility under Medicaid specifically for family planning services.[2]

Decades of research have documented the reach and impact of publicly supported family planning services in the United States. Recently, Frost and colleagues found that 8.9 million poor and low-income women received publicly supported contraceptive services in 2010.[3] Such services helped women prevent an estimated 2.2 million unintended pregnancies that year, of which 1.1 million would have resulted in an unplanned birth, 760,000 in an abortion, and 360,000 in a miscarriage. Moreover, publicly funded family planning services resulted in an estimated net public savings of $10.5 billion in 2010.

Although compelling, these findings capture only a portion of the total health impact of and savings generated by public efforts. The analysis by Frost and colleagues and similar previous analyses by Guttmacher Institute researchers[4-8] were limited to the numbers of unintended pregnancies, abortions, and unplanned births averted by clients' increased contraceptive use. They also were limited to a portion of the public savings from averting unplanned births that would have been funded by Medicaid, including only prenatal care, labor and delivery, postpartum care, and 12 months of infant care. Other studies of the benefits and cost savings from publicly funded family planning services went beyond those by Guttmacher in several ways, such as accounting for the medical costs of care for up to 5 years of a child's life, estimating public savings from averted miscarriages and abortions, and including costs for social services for infants and young children.[9-12]

A sizable body of literature indicates that the health impact and public-sector savings of publicly supported family planning services in the United States extend well beyond the impact of preventing unintended pregnancies.[13] Research indicates that by enabling women and couples to plan, delay, and space pregnancies, contraception is linked to improved maternal and child health outcomes.[13-15] Appropriate pregnancy spacing is linked to better birth outcomes, including the reduced likelihood of babies born prematurely, at a low birth weight (LBW), or small for their gestational age.[16,17]

Moreover, the package of care delivered as part of a publicly supported family planning visit extends well beyond contraception. Clients routinely receive screenings for sexually transmitted infections (STIs), such

as chlamydia, gonorrhea, syphilis, and HIV; cervical cancer prevention services, including Pap tests, and testing and vaccination for human papillomavirus (HPV); breast exams for early detection of breast cancer; and screenings for a variety of other health conditions and risks, such as diabetes, high blood pressure, and intimate partner violence. Screening services can lead to early detection, preventive behavior change, and prompt treatment. Some forms of treatment, such as for chlamydia and gonorrhea, are routinely provided on-site; others are facilitated through referrals to specialists. This broader package of preventive services has taken on heightened importance in recent years as policymakers, health care experts, providers, and insurers all have emphasized the importance of prevention, and indeed, the Affordable Care Act, which was enacted in March 2010, requires most private health plans to cover most of these preventive services without any out-of-pocket costs to enrollees. The impact on health and the cost savings of many of the individual preventive services delivered as part of a publicly supported family planning visit have been studied independently; for example, numerous studies have explored the benefits and costs of various HIV prevention strategies, including routine HIV screening.[18-22] But no study has looked at these services together in the context of what care is delivered to publicly supported family planning clients in the United States.

The analysis presented in this article expands on both Frost and colleagues' research[3] and earlier research at Guttmacher[4-8] on the benefits and cost savings of publicly funded family planning services. First, we estimated the direct health benefits and cost savings from several services delivered during a publicly funded family planning visit: testing and treatment for chlamydia and gonorrhea, HIV testing, Pap and HPV testing, and HPV vaccination. Second, we estimated the numbers of averted unplanned births that would have been preterm or LBW and that would have been closely spaced (<18 months interpregnancy interval). Third, in line with other recent cost-benefit studies,[9,10,12] we estimated the public savings from averted unplanned births to include the costs of medical care for children aged 13 to 60 months, factored in the medical costs from averted miscarriages and abortions, and readjusted to account for some averted births that were simply delayed and would not have contributed to public savings over the 5-year period. We concluded with a unified estimate of cost savings from publicly supported family planning care by combining the findings by Frost and colleagues[3] with those from this analysis.

Methods

Overall Approach

In this article, publicly supported providers refer to all health centers that offer publicly funded family planning services, such as health departments, federally qualified health centers, Planned Parenthood affiliates, and hospital outpatient clinics, as well as private doctors who provide family planning services to Medicaid recipients. We followed a similar pattern for each of the specific services covered by this analysis. First, we estimated the number of individuals who received that particular service from publicly supported providers in 2010; for some services (specifically, chlamydia, gonorrhea and HIV testing), we included male clients as well as female clients. Next we calculated how many individuals obtained a direct health benefit from that service that they would not have obtained in the absence of publicly funded care. This usually required comparing the health outcomes for individuals who received services with the anticipated health outcomes for individuals in a counterfactual situation for whom publicly funded services were not available. We assumed that the latter clients would shift to a less effective mix of methods or that some would delay obtaining noncontraceptive preventive services (the specific assumptions for each service are described later). We then calculated the cost of providing care for the medical conditions that would have ensued had family planning services not been available. We refined that calculation further by estimating how much of those savings would have been public savings.

We summed the public savings resulting from each specific service provided to obtain the total amount of public cost savings. We then compared this total with the total public cost of providing publicly funded family planning and related sexual and reproductive health services in 2010, previously estimated at $2.2 billion.[3] (Note that the cost estimates used here for the family planning program differ slightly from those in an earlier report based on different data.[23] For this report, we derived family planning program cost estimates from Title X revenue data in order to apportion the expenditures by provider categories at the state level.) These total public costs already included the costs of providing all the various services studied in this article (ie, contraceptive method provision; STI, Pap, and HPV testing; and HPV vaccination); therefore, no additional costs for noncontraceptive services were factored

into the analysis. Table 1 summarizes the specific services examined, health benefits measured, and public costs averted.

State and National Estimates. When possible, the analyses were carried out at the state level and then summed to produce national totals. We examined data at the state and national levels for all health centers that provide family planning services and for Title X–supported health centers specifically. But as in previous analyses,[3] we could look at data for Medicaid-reimbursed private doctors only at the national level.

Time Frames. The data on services provided and actual costs were for 2010. Because many benefits of the services provided extended beyond a single year, the analysis for each specific service depended on assumptions about how many years of benefits would accrue from services provided in 2010. HIV and cancer prevention services, for example, have lifetime benefits. Because those services avert diseases that would have been identified and treated years or decades later, any analysis of their benefits must use an extended time frame. By contrast, services that prevent curable STIs have more limited, episodic benefits. They avert health consequences and treatment costs that would have occurred only a few months or years later, and they do not prevent future infections. The benefits of contraceptive care in helping women and couples avert unintended pregnancies are fundamentally different from the benefits of other services in that the averted medical costs theoretically could be extended to a child's entire life. For contraceptive services, however, we used a 5-year time frame, which has become widely accepted in the literature focusing on medical costs related to unplanned births.

Expected Receipt of Services in the Absence of Publicly Funded Care. We assumed that in the absence of publicly funded family planning services, many women and men who would have made a family planning visit and obtained contraceptive and related services would have been less likely to make such visits. Some women who would have used more effective contraceptive methods would instead have used less expensive over-the-counter methods or no method; this alternative method-mix scenario was based on the behavior of similar women who did not use publicly funded services but were eligible do so. Both scenarios were calculated using the 2006-2010 National Survey of Family Growth (NSFG) and form the basis for our estimates of the numbers of unintended pregnancies prevented by publicly funded contraceptive services.[24]

Without public funding, many women would forgo family planning visits and thus also forgo the receipt of related services, such as screening

Table 1. Health Benefits Obtained and Public Costs Averted From Specific Services Received During Publicly Funded Family Planning Visits

Service	Health Benefits Obtained	Public Costs Averted
Contraceptive services	Unintended pregnancies are prevented, leading to: Fewer unplanned births and abortions; Fewer births with short interpregnancy intervals (IPIs); and Fewer preterm or LBW births.	Maternity and birth-related care to 60 months for all unwanted births and some mistimed births (mostly Medicaid). Care for miscarriages (including ectopic pregnancies) and abortions (mostly Medicaid).
Chlamydia and gonorrhea testing	Infections are identified and treated, leading to: Fewer cases of pelvic inflammatory disease (PID), epididymitis, and other sequelae (pelvic pain, ectopic pregnancy, infertility); Fewer infections and their sequelae transmitted to partners; and Fewer cases of STI-attributable HIV.	Treatment for PID and other sequelae (mostly Medicaid).
HIV testing	Clients are informed of their HIV status, thereby reducing HIV infections and sequelae in partners.	Treatment for HIV and AIDS (Medicaid, Ryan White, and others).
Pap and HPV testing	Cases of HPV and sequelae are identified, including abnormal cervical cells, precancerous lesions, and cervical cancer, thereby reducing cases that progress to cervical cancer and death.	Treatment for cervical cancer (mostly Medicaid and Medicare).
HPV vaccination	Fewer clients become infected with HPV, so fewer individuals experience its sequelae: abnormal cervical cells, precancerous lesions, cervical cancer and death, and other HPV-attributable cancers (vulvar, vaginal, anal/rectal, and oropharyngeal cancers).	Treatment for more severe sequelae of HPV infection, including cancers (mostly Medicaid and Medicare).

for STIs and cervical cancer and HPV vaccination. We assumed that all women in our comparison group who were expected to continue to use prescription methods (13%), such as oral contraceptives or long-acting reversible methods, would also obtain these related screening and vaccination services in a timely manner. We assumed, too, that 16% of the remaining 87% of women in our comparison group who, in the absence of publicly funded services, were expected to use nonprescription methods or no method, would make a visit to obtain preventive services, including these screening and vaccination services. We based this proportion on the observed behavior of similar women in the NSFG. Accordingly, we calculated the benefits and cost savings for STI and cervical cancer screening and for HPV vaccination for only the 73% of female clients who, in the absence of publicly funded services, would likely forgo both the use of prescription methods and preventive gynecological visits for these screening and vaccination services. For male clients in the absence of publicly funded services, we assumed that 100% would forgo care.

   Data Sources.   We used various sources of data for this analysis. Our calculations of numbers of women served were based primarily on the Guttmacher Institute's 2010 Census of Publicly Funded Clinics Providing Contraceptive Services,[3] which counted the number of women served at all US health centers that provide publicly supported family planning services, and we estimated the number of women receiving Medicaid-funded contraceptive services from private physicians. In addition, we used data from the Family Planning Annual Report (FPAR)[25] produced by the federal Office of Population Affairs, which gives additional details about specific services provided to women and men served at Title X–supported facilities. Our analyses sometimes generalized the data for these facilities to all publicly supported facilities. In some cases, we used data from the Planned Parenthood Federation of America as a proxy for the larger universe of these clients,[26] which is reasonable given that Planned Parenthood's network of 800 centers provides services to 36% of all publicly supported family planning center clients.[3] Estimates of the incidence of medical conditions were drawn from either actual data for the client universe (such as the 2010 FPAR report)[25] or the medical and epidemiological literature. Additional estimates of clients' characteristics were based on the NSFG and the American Community Survey (ACS). Appendix Table A1 summarizes the key parameters related to this analysis.

Discounting and Inflation. Data on the cost of treatment for specific diseases and conditions were adjusted for inflation to 2010 dollars, using the Consumer Price Index (All Urban Consumers) for Medical Care.[27] Separately, for the cost of treatment that would occur years in the future, we applied a 3% annual discount, in accordance with the recommendations of the US Public Health Service Panel on Cost-Effectiveness in Health and Medicine.

Rounding. The incidence of most events usually was rounded to the nearest 10 or 100, although numbers less than 100 were left unrounded. The numbers of dollars saved were usually rounded to the nearest 1,000.

Pregnancy Spacing and Preterm/LBW Births

A substantial body of research indicates that short interpregnancy intervals (IPIs)—often defined as less than 18 months between a birth and a subsequent pregnancy—are positively associated with babies being born prematurely, at LBW, or small for their gestational age.[16,17,28,29] Unintended pregnancy is strongly predictive of short IPIs, whereas contraceptive use is protective against them.[30-32]

To estimate the impact of the US family planning effort on women's ability to avoid short IPIs and poor infant health outcomes, we started with state-level numbers of the unplanned births averted by women's use of publicly supported family planning.[3] Next we analyzed data from the 2006-2010 NSFG and found that of all unplanned births to US women with incomes below 250% of the federal poverty level, 26% were conceived less than 18 months after an earlier birth.[33] We applied this 26% rate to the number of unplanned births averted in 2010 to arrive at state-level estimates of the number of short IPI births averted through publicly supported family planning services.

Using vital statistics data from the Centers for Disease Control and Prevention (CDC) for 2008, we tabulated the proportion of total births in each state that were preterm, LBW, or both.[34] We then applied these rates to the numbers of unplanned births averted in 2010 to arrive at state-level estimates of the number of preterm or LBW births averted through publicly supported family planning services.

Frost and colleagues' 2010 estimates of the costs and cost savings from publicly supported family planning services already included the costs of contraceptive services.[3] Moreover, the public-sector cost savings from

averted unplanned births that they had calculated were based on the average cost of Medicaid-funded maternity and infant care, including care for preterm and LBW births. Therefore, we factored no additional costs or savings into this analysis.

Chlamydia and Gonorrhea Testing

Screening for STIs, including chlamydia and gonorrhea, is an integral component of reproductive health services that is offered at 97% of publicly funded sites that provide family planning.[35] The costs of STIs in the United States—for both health consequences and economic burden—have been well documented,[13,36] although the impact that STI testing and treatment during publicly funded family planning visits have had on reducing those consequences has not been calculated. Chlamydia and gonorrhea are two of the most common STIs in the United States, with an estimated 2.9 million new chlamydia infections and 820,000 new gonorrhea infections each year.[37] Untreated, such infections can lead to a host of adverse health outcomes, including PID, infertility, ectopic pregnancy, and chronic pelvic pain in women and epididymitis in men.[38,39]

We estimated the direct medical benefits from testing for chlamydia and gonorrhea during family planning visits by first figuring the proportion of public clients who received positive test results for each STI during family planning visits. We applied these proportions to the numbers of women and men who would be expected to forgo family planning visits and related STI testing in the absence of publicly funded services (73% of current female clients and 100% of current male clients).

To estimate the proportion of female clients positive for each STI, we began with the reported number of female clients tested for chlamydia at a Title X–funded health center in 2010, by age (<20, 20-24, ≥25) and state, and the total number of gonorrhea tests performed on female clients that year by state (counting tests, even if the same woman received more than 1 test during the year).[25] We calculated the number of female clients tested for gonorrhea in each state as 96% of the number of tests conducted on the basis of the national ratio of female clients receiving chlamydia tests to total gonorrhea tests performed on female clients. We multiplied the number of women who received each test by age- and state-specific chlamydia positivity rates and state-specific gonorrhea

positivity rates reported for women attending family planning clinics[40] through the CDC's infertility prevention project to estimate the number and percentage of female Title X clients with a positive chlamydia or gonorrhea result in 2010.

These percentages were then applied to state-level data on the number of all female contraceptive clients served at publicly funded health centers in 2010 (both Title X and non–Title X) and to national-level data on the number of female Medicaid recipients who received contraceptive services from private physicians that year.[3]

For men, we followed similar steps, beginning with the reported state-level numbers of male clients tested for chlamydia during a family planning visit at a Title X–funded health center in 2010 and the numbers of gonorrhea tests performed on male clients. We multiplied the number of men receiving each test by state-specific positivity rates for chlamydia and gonorrhea reported for men aged 16 to 24 entering the national job-training program[41] to estimate the number of male Title X clients with a positive chlamydia or gonorrhea result in 2010. We determined the numbers of male clients tested in non–Title X health centers by assuming that the same ratio of males tested to female clients found at Title X centers would apply in non–Title X centers and that the same proportion of positive test results would apply in both types of centers. We did not estimate any male clients served or tested for STIs by private doctors, because we had no data on the numbers of male Medicaid recipients making family planning visits to private doctors.

We assumed that 96.5% of both female and male clients testing positive for chlamydia or gonorrhea would receive treatment.[42] Following published formulas for estimating costs averted by STI prevention programs developed by Chesson, Owusu-Edusei, and others,[43-46] we assumed that the likelihood that treated women would develop PID would be reduced from 15% to 0% of symptomatic positive cases and from 15% to 7.5% of asymptomatic positive cases. We also assumed that the likelihood that men would develop epididymitis would be reduced from 2% to 0% in all cases. Recent evidence indicates that treatment is less effective for women with asymptomatic chlamydia or gonorrhea, as their infections may already have progressed to PID before treatment.[47] We assumed that 31% of women testing positive for chlamydia or gonorrhea would be symptomatic.[39] Following Chesson and colleagues, we adjusted our estimates of the impact of chlamydia treatment to account

for possible coinfection with gonorrhea (multiplying by 0.925 for both men and women). We also adjusted our estimates of the impact of gonorrhea treatment to account for possible coinfection with chlamydia (multiplying by 0.79 for women and 0.90 for men) and for possible reinfection within 1 year (multiplying by 0.70). We used updated estimates of the lifetime direct medical cost per case of untreated PID ($3,202) and epididymitis ($313).[46,48]

In addition to the direct medical benefits of testing, we also estimated the benefits from the reduced transmission of chlamydia and gonorrhea in the population, using published formulas that assume that each infection treated (in both women and men) will result in 0.5 fewer cases in the population.[44] For this, we relied on published estimates of the average cost per STI case. The cost per case of chlamydia ($197) was calculated by averaging the cost per case for women ($364) and for men ($30)[46] and was applied to the estimated number of prevented infections. The average lifetime cost per case of gonorrhea was calculated at $217, again by averaging the cost per case for women ($354) and for men ($79).[46]

Finally, we estimated the number of HIV infections prevented by treating individuals infected with chlamydia or gonorrhea before they contracted an STI-attributable HIV infection. We used published formulas assuming that the average numbers of new HIV cases attributable to a new case of chlamydia and gonorrhea are 0.0011 and 0.0007, respectively, and that the treatment of these infections would reduce by one-fourth (multiplying by 0.25) the time frame in which an STI-attributable HIV transmission is possible; and we adjusted for any overlap in the sex-partners of those clients being treated (multiplying by 0.75).[44]

To calculate the percentage of averted costs that would have been paid from public sources (primarily Medicaid) for both chlamydia and gonorrhea treatment, we first distributed the averted costs according to the percentage of Title X clients in 2 income groups (<100% or 100% to 249% of the federal poverty level). We then used data from the 2008-2010 ACS to determine the percentage of women aged 15 to 44 enrolled in Medicaid or other public programs (eg, Medicare or Indian Health Service) for each of those 2 income groups[49] and applied those percentages to the averted costs. Nationally, an estimated one-third of the averted costs for chlamydia and gonorrhea sequelae were public.

HIV Testing

HIV testing is often provided during family planning visits and is offered at 92% of health centers that provide publicly supported family planning services.[35] It is a preventive care service for partners of individuals who learn they are HIV positive, because it leads to less risky behavior after a positive test result and reduced infectivity (via earlier entry into treatment for people living with HIV),[13] both of which significantly decrease transmission.

We started with state-level data specific to Title X–supported family planning centers[25] on the numbers of HIV tests performed on each female and male contraceptive client, and on the numbers of positive HIV tests for all those tested. Because the number of positive HIV tests each year was small, we combined data from 2010, 2011, and 2012[50,51] to calculate positivity ratios. Then we adjusted these state-level rates by sex, using data on HIV testing in health care settings from the CDC. The positivity rate for males between 2008 and 2010 (the most recent 3 years available) was 3.33 times that for females.[52,53]

Next, we applied the HIV testing rates and positivity rates to state-level estimates of female clients at publicly funded health centers in 2010 (both Title X and non–Title X) and to national-level estimates of female Medicaid recipients who received contraceptive services from private physicians that year.[3] We also applied them to state-level estimates of male health center clients, assuming that the same ratio of male to female clients found at Title X centers would apply in non–Title X centers; we did not estimate any male clients served by private doctors. We then adjusted these numbers to apply only to those women and men who would be expected to forgo contraceptive and related STI services in the absence of publicly funded care (73% of current female clients in each provider setting and 100% of male clients). We further adjusted the number of positive test results by multiplying the totals for each state by 0.63 to account for individuals who already knew they were HIV positive or did not return for their test results; the adjustment was based on an estimate from Holtgrave.[20]

To estimate the impact of the positive test results, we applied a rate of 7.8 transmissions averted per year per 100 persons newly aware of their serostatus, based on an estimate from Hall and colleagues accounting for the reduction of risky behavior and of infectivity after receiving treatment.[19] The preventive effects of learning about one's serostatus do

not last for merely 1 year, however. In their study of a publicly funded HIV testing program, Hutchinson and colleagues assumed that in the absence of that testing program, patients would receive an HIV test from another source an average of 3 years later.[22] We applied that assumption to our own estimates for testing received through publicly funded family planning by multiplying the annual number of HIV infections averted by 3.

To estimate the public-sector cost savings from averted HIV infections, we started with an estimate of the total lifetime medical costs associated with HIV. Farnham and colleagues reported a cost of $330,000 in 2011 dollars, discounted by 3% annually to the year of infection.[18] We applied that figure to the state-level numbers of HIV cases averted to arrive at the total cost to society. Finally, we applied to those state-level savings Holtgrave and colleagues' estimation that 75% of HIV treatment costs nationally are paid for with public dollars.[21]

Cervical Cancer Testing and Prevention

Although the incidence and mortality of cervical cancer have declined in recent years, more than 12,000 women were diagnosed with the disease in 2009, and about 4,000 died from the disease that year.[54] The direct annual health care costs for screening, treating, and managing abnormalities related to cervical cancer and cervical dysplasia in the United States are estimated to be as high as $4.6 billion.[55] Because family planning providers play an important role in identifying and reducing the risk of cervical cancer, in this analysis, we examined 2 related forms of care: Pap and HPV testing, and HPV vaccination.

Pap and HPV Testing.   For decades, Pap tests have been used to identify abnormal cervical cells, facilitating early and effective treatment. Now it is common practice to "co-test" with an HPV test to detect for viral strains associated with cervical cancer. Our analysis determined the direct medical benefits and cost savings that accrue from cervical cancer testing of publicly supported clients. The conceptual premise for these benefits is that testing enables the early identification of HPV-attributable abnormal cells, precancer, and cervical cancer and thus the early (and less costly) treatment and prevention of more serious diagnoses and death.

To calculate these benefits, we began by determining the number of publicly supported clients receiving a Pap test. We used the proportion of unduplicated clients who received a Pap test at a Title X–supported health center in 2010[25] as a proxy for all public clients. We determined the ratio of women tested to all women served at the state level and then applied, by state, that ratio to the total number of public clients served at Title X and non-Title X health centers, who would be expected to forgo services in the absence of publicly funded care (73% of current clients). We also applied the national-level ratio to the number of female Medicaid recipients receiving family planning services from private providers.[3] Thirty-one percent of all clients were tested for cervical cancer and its precursors.

The next step was to calculate the number of cervical cancer cases and deaths averted by testing. We used data from Mandelblatt and colleagues[56] on the number of cases and deaths that would occur without testing and under various testing scenarios, including Pap testing only and both Pap and HPV testing, in which women are tested every 3 years from ages 20 to 65 and receive a maximum of 16 tests. By comparing the testing scenarios with the no-testing scenario, we were able to determine the number of cases averted in each scenario. These scenarios were chosen because of their similarity to the testing recommendations that were current at the time of this analysis.

We thus were able to produce ratios of cancer cases averted (148 cases per 100,000 women for Pap testing only and 165 for Pap and HPV testing) and deaths averted (87 per 100,000 women for Pap testing only and 94 for Pap and HPV testing) for 1 year of testing. We applied these ratios to the proportions of all publicly funded clients who would have received the Pap-only testing regimen and the co-testing regimen (59% and 41%, respectively, based on information from the 2010 Survey of Clinics Providing Contraceptive Services[35,57]) to get the number of cancer cases and deaths averted. To calculate the cost savings from these tests, we multiplied the number of cancer cases averted by the per-case cost to treat cervical cancer. Costs were calculated from Chesson and colleagues[58] ($38,800) and discounted at 3% per year to account for the average number of years between testing[59] and cervical cancer diagnosis (23),[60] which resulted in a final discounted 2010 per-case cost of $19,692.

Finally, we determined the proportion of these total cost savings attributed to the public sector by estimating the proportion of women

diagnosed with cervical cancer who were covered by public insurance, stratified by age at cancer incidence. Specifically, we used the 2008-2010 ACS to identify state-level proportions of women with Medicaid, Medicare, or Indian Health Services coverage by age group.[61] We multiplied that proportion for each age group by the national-level proportion of total cancer diagnoses for women in that age group[60] and then summed the results for each age group to yield state-level and national-level totals. Nationally, an estimated 28.9% of cervical cancer costs were public costs. Finally, for each state, we applied the result to total cost savings to arrive at public-sector cost savings.

HPV Vaccination. Vaccination against HPV has become an essential component of reproductive health care. Because HPV is responsible for almost all cases of oncogenic dysplasia of the cervix, the 2 vaccines currently on the market could significantly reduce the incidence of cervical cancer, as well as other HPV-attributable cancers of the vulva,[62] vagina, anus/rectum, and oropharynx.[63]

For this analysis, we estimated the direct medical benefits and cost savings that accrue from HPV vaccinations administered to women at publicly funded family planning visits. We began by determining the number of HPV vaccine injections administered during family planning visits at publicly funded centers. We used data from the Planned Parenthood Federation of America's annual report[26] to estimate the ratio of vaccine injections administered to all clients (0.014), and used that as a proxy for the ratio of all female clients receiving publicly supported care who would have forgone care in the absence of publicly funded services (73% of current clients). (Earlier research indicates that similar proportions of Planned Parenthood clinics, health departments, and federally qualified health centers provide the HPV vaccine.[57])

A complete vaccination sequence entails 3 injections. We converted the number of injections to the number of individuals vaccinated based on National Immunization Survey data on the proportion of women vaccinated by the number of vaccine doses received: Of clients vaccinated at a public facility, 46% received at least 3 doses, 32% received 1, and 22% received 2.[64]

Virtually all HPV vaccines distributed in the United States are quadrivalent, meaning that they are designed to prevent 4 types of HPV, including types 16 and 18, which cause 70% of cervical cancers. Because the quadrivalent vaccine has a 99% efficacy in preventing cervical precancers in women not previously exposed to HPV, we applied that

efficacy rate to women who received 3 doses.[65,66] We discounted the efficacy rate by a conservative 10% per dose missed, for an estimated 2-dose efficacy of 89%, and a 1-dose efficacy of 80%. These estimates are in line with the literature, which indicates that 2 doses might be nearly as effective as 3 and that receiving 1 or more doses is 82% effective.[67-69]

These estimated efficacy rates were based on the assumption that vaccinations are given to 12-year-old girls who have not yet become sexually active. In reality, however, some girls are vaccinated after they have become sexually active and thus already might have been exposed to HPV. Therefore, we adjusted the efficacy rates by first multiplying the percentage of vaccines administered to women of each year of age up to 26 (the oldest age for which the vaccine is recommended) by an age-specific vaccine efficacy adjustment factor published by Chesson and colleagues.[70,71] We then summed these products to get 1 adjustment proportion.

Next we obtained an estimate of the proportion of women who would have contracted HPV and experienced selected medical sequelae—abnormal Pap tests, precancerous lesions, and cervical cancer—over their lifetime had they not been vaccinated. To do so, we calculated the difference between published estimates of the number of cases that would occur in nonvaccinated women minus the number of cases in vaccinated women. For abnormal Pap tests, precancerous lesions, and cervical cancer, these differences were 50,000, 10,000, and 500 cases per 100,000 women vaccinated, respectively.[72] We applied these rates to the population of vaccinated women. Using the rate of 200 deaths per 100,000 women vaccinated, we also calculated the number of women who would have died from cervical cancer within 5 years of receiving a cancer diagnosis.[72]

We then calculated the number of other cancer cases averted by vaccination using published data[46] on the annual incidence of HPV-attributable vulvar, vaginal, anal/rectal, and oropharyngeal cancer in the United States. To get the absolute number of noncervical cancer cases averted among women receiving public services, we calculated the ratio of annual incidence of each HPV-attributable cancer to the annual incidence of cervical cancer. For vulvar cancer, this ratio was 1,560 vulvar cancer cases to 11,370 cervical cancer cases. For vaginal, anal/rectal, and oropharyngeal cancers, the ratios were 460, 2,770, and 1,450 cases to 11,370 cervical cancer cases. We then multiplied each ratio by the

absolute number of cervical cancer cases averted in women receiving public services.

The per-case costs of treating cervical dysplasia and precancerous lesions were estimated based on a study of administrative and laboratory records that are related to HPV health care costs from 2002 and that account for false positives.[73] We adjusted the costs to 2010 dollars and then discounted them 3% annually to account for the average number of years between vaccination and diagnosis of dysplasia and precancer (12 and 7, respectively). Data on median age at vaccination came from a large national network of family planning centers, and the median age at each diagnosis was calculated based on the diagnosis rate by age for each diagnosis.[74] The resulting costs were $690 per case of dysplasia and $1,863 per case of precancer.

To calculate the cost to treat cervical cancer, we started with the same 2010 estimate of $38,800[58] used in the Pap and HPV testing analysis. We discounted the cost 3% per year to account for the average number of years between vaccination and cervical cancer diagnosis (28),[60] which resulted in a figure of $16,732. Similar calculations were made to determine the cost of treating cases of other HPV-attributable cancers, discounting the time between the average age at vaccination and the median age at diagnosis for each cancer type ($6,404 per case of vulvar cancer, discounted by 44 years; $7,366 per case of vaginal cancer, discounted by 44 years; $11,263 per case of anal/rectal cancer, discounted by 40 years; and $12,889 per case of oropharyngeal cancer, discounted by 41 years).

Finally, we calculated the proportion of these averted costs that would have been public costs. For dysplasia and precancerous lesions, we assumed that the proportion borne by public funding was equal to the proportion of women who have public insurance. For cervical cancer, we used the proportion of women diagnosed with cervical cancer who were covered by public insurance, stratified by age at cancer incidence. We used a similar approach to determine the public cost of treating other HPV-attributable cancers. These estimates were calculated at the state level and then totaled to produce national estimates of 28.0% for precancerous lesions, 28.9% for cervical cancer (which is the same proportion used in the Pap and HPV testing analysis), 60.6% for vulvar cancer, 60.4% for vaginal cancer, 46.1% for anal/rectal cancer, and 48.5% for oropharyngeal cancer.

Extended Cost Savings From Averting Unplanned Births

As indicated earlier, publicly funded contraceptive services helped US women prevent an estimated 2.2 million unintended pregnancies in 2010, 1.1 million of which would have resulted in an unplanned birth.[3] The detailed methodology for estimating unintended pregnancies averted has been described elsewhere,[24] so we offer only a brief summary here. Alternative estimates of unintended pregnancies averted are given in the following sensitivity analyses. Our estimates are based on a comparison of the actual mix of contraceptive methods used by current clients of publicly funded providers with a hypothetical mix of methods that we expect these women would use in the absence of such services.

The hypothetical method-mix scenario was based on the contraceptive behavior of sexually active women who were not trying to get pregnant but who did not visit a publicly funded family planning provider in the prior 12 months or who visited a private doctor and paid for that visit themselves. These women were of similar age and income as women using publicly funded services (ie, were at risk for unintended pregnancy and either younger than 20 or aged 20 to 44 and under 250% of poverty), were eligible for publicly funded care and in need of contraceptive services to prevent an unintended pregnancy, but did not receive any publicly funded contraceptive care in the previous year (though they may have received such care at an earlier date).

For each group, we estimated the number of unintended pregnancies that would be expected over a 1-year period by combining the distribution of methods used and the failure rates of each method (using subgroup-specific data when available, broken down by age, marital status, racial and poverty status). (Our method failure rates were further adjusted to compensate for the difference between typical first-year failure rates and actual rates of failure among contraceptive users who may have used their method for longer or shorter durations. The basis for this adjustment is a comparison of the number of pregnancies expected among all current contraceptive users and the actual number of pregnancies for US contraceptive users in 2008.)

Out of 1,000 actual users of publicly funded contraceptive services 62 would have had an unintended pregnancy; in our hypothetical scenario, 350 per 1,000 would have had an unintended pregnancy. Subtracting the

former from the latter resulted in the number of unintended pregnancies (288) that are prevented per 1,000 users of publicly funded family planning care. We then applied this ratio to the numbers of contraceptive clients served by publicly funded centers in 2010 and to the data on numbers of Medicaid recipients receiving contraceptive services from private doctors to arrive at 2.2 million unintended pregnancies averted. These were classified according to births, abortions, and miscarriages based on the 2008 distribution (for adult women and teens separately) of unintended pregnancies by outcome.

The public cost savings of preventing unplanned births for 2010 were originally estimated by Frost and colleagues[3] for all unplanned births to women eligible for Medicaid-covered maternity care and included costs for prenatal care, delivery, postpartum care, and 12 months of infant care. We built on those findings by adjusting the number of unplanned births included in the cost analysis and by including the direct medical costs paid by Medicaid for care of children for months 13 to 60.

First, we reviewed the assumption that all averted births would result in public savings. Other researchers have instead assumed that at least some births would be delayed, not averted altogether, and because such births would eventually end up as costs or public costs, they should not count as current savings.[10,11,75] We felt that such an adjustment was important to incorporate into this analysis, especially because we are considering public cost savings that extend beyond 1 year. To make this adjustment accurately, however, it is necessary to differentiate 4 types of averted unplanned births: unwanted births, mistimed births that would have contributed to "extra" births (ie, those resulting in women having a higher completed parity than they would have had otherwise), mistimed "nonextra" births that would have been privately funded if they had been delayed until the woman wanted the birth, and mistimed "nonextra" births that would have continued to be publicly funded even if they had been delayed until the woman wanted the birth.

Next we describe our methodology for categorizing into the 4 groups the unplanned averted births among publicly funded family planning clients. Then we explain our estimations of the public cost savings for unplanned averted births that fall into the first 3 categories. Averted births that fall into the fourth category do not represent public savings, as their costs would still be covered by public funds.

Unwanted Births. Of the unplanned births to women most likely to be using publicly funded family planning services (ie, all teens, plus adult women under 250% of poverty), 37% are unwanted and 63% are mistimed.[33]

"Extra" Births. Using the 2006-2010 NSFG, we compared the mean parity for women aged 30 and older with at least 1 mistimed birth with that for same-aged women with no mistimed births.[33] Because this comparison assumes that both groups of women have the same overall desired parity and that some groups of women may be more likely than others to have a mistimed birth and to desire more children, we compared the overall parity for women with and without mistimed births within each racial and ethnic group and estimated separately for each group the differences in overall parity between women with and without mistimed births.

We then recalculated the average difference, weighting the results according to the racial and ethnic distribution of women served at Title X–funded health centers.[25] The difference in overall parity between women with and without mistimed births using this methodology and adjusting for race and ethnicity was 0.80 births. By comparing this excess parity with the total average number of births to women with mistimed births (2.89), we estimated that 28% of mistimed births could be considered "extra."

Mistimed Births Not Paid for With Public Funds. Using the 2006-2010 NSFG, we estimated the actual number of years in which all mistimed births had occurred too soon.[33] We made separate estimates for teen births and adult births and also weighted the results by race and ethnicity using the distribution of women served at Title X centers.[25] On average, women reported that the mistimed births they had had as a teen had occurred 4.7 years too soon and those they had had as an adult had occurred 2.4 years too soon.

To estimate how many women with an averted mistimed birth would have been eligible for Medicaid maternity care had that birth been delayed (4.7 years for teens and 2.4 years for adults), we looked at the percentage of births paid for by Medicaid according to the woman's age at birth (in 2-year increments) and to whether the birth was planned or unplanned. For teens, we looked at payment for first births, because 92% of mistimed births to teens are first births,[33] and for adults, we looked at payment for all births.

Specifically, we compared the percentage of *unplanned* first births for 2 age groups of teens (<18 and 18-19) paid for by Medicaid with the percentage of *planned* first births paid for by Medicaid for women who were 4.7 years older than those aged <18 and 18-19 and then calculated the percentage change between these 2 proportions. Partial years were interpolated between age groups, assuming the change over the interval was constant. The average for all teens, adjusting for the age distribution of teens served at Title X centers, was 33%.

We used a similar process for 8 two-year age groups of adults between ages 20 and 35, comparing the percentage of unplanned births that were paid for by Medicaid with the percentage of planned births that were paid for by Medicaid for women 2.4 years older. The age-adjusted average decline in use of Medicaid for all adult women was 44%.

By applying these adjustments to the 1.1 million unplanned averted births in 2010, we estimated that 37% (409,000) were unwanted births, all of which could have incurred public savings; 17% (193,000) were "extra" births, all of which could have incurred public savings; and 46% were "nonextra" mistimed births (on average, such births occurred to women 2.9 years too early). Of the "nonextra" mistimed births, 4 in 10 (19% of all unplanned births, or 209,000) would not have been publicly funded if they had occurred at the desired time, and all of them could have incurred public savings. The other 6 in 10 (27% of all unplanned births, or 285,000) would still have needed to be covered by public funding even if they had occurred at the desired time; therefore, none of these would have incurred public savings.

Overall, we considered 811,000 unplanned averted births as potentially contributing to public cost savings. Of these, an estimated 94% (762,000) would have been to women currently eligible for Medicaid maternity care (a proportion that varies by state).[24]

The public cost per birth for the first 12 months of maternity and infant care varied by state and was previously estimated to be $12,770 nationally, unweighted.[3] To estimate the public cost of medical care for children aged 13 to 60 months, we analyzed state-level data from the Medicaid Statistical Information System (MSIS)[76] and found that the annual amount paid by Medicaid per eligible child was about $2,300 nationally. We then applied 3 adjustments to the state-level public cost per child and summed the results across 4 years. First, we reduced the number of eligible children each year to account for changes in family income; this was based on an analysis of the ACS that estimated

the proportionate drop in Medicaid coverage among children by single years of age.[61] Using the proportion of infants covered by Medicaid as the base, 94% were covered at age 1, 91% at age 2, 88% at age 3, and 85% at age 4. Second, we discounted costs 3% annually. Finally, we made an adjustment to account for multiple births by drawing on US vital statistics data: Some 3.95 million children were born in 2011 through 3.88 million deliveries, for a ratio of 1.018 children per birth.[77] With these adjustments, we estimated the final unweighted national cost per birth for 4 years of public medical care to be $7,950. After multiplying the state-level costs per birth by the number of births averted and summing across states, we arrived at our estimates of the total medical cost savings from unplanned births averted.

Extended Cost Savings From Averting Unplanned Pregnancies Ending in Miscarriage and Abortion

Publicly funded contraceptive services also helped women avoid 360,000 miscarriages and 760,000 abortions in 2010.[3] The cost savings estimated by Frost and colleagues did not account for these averted outcomes; we made those estimates here.

For miscarriages, we first applied the estimate from Frost and colleagues of the proportion of births averted by publicly funded contraceptive services that would have been born to women currently eligible for Medicaid maternity care (94% overall, varying by state).[24] Next, because state-level estimates for the public cost per miscarriage were not available, we derived our own estimates. We did so by dividing a national estimate of the public cost of miscarriage (including ectopic pregnancies) from Monea and Thomas[10] ($1,252, after adjusting for inflation) by Frost and colleagues' estimated national average of the public cost per birth for the first 12 months of maternity and infant care ($12,770)[24] and then applying the result (9.8%) to Frost and colleagues' state-level per birth cost estimates to arrive at state-level estimates for the public cost per miscarriage. We assumed that state-level costs for miscarriage effectively varied in the same way as state-level costs did for births. We then multiplied those state-level costs per miscarriage by the number of Medicaid-funded miscarriages averted and summed across states.

The estimates for abortions were complicated because Medicaid coverage of abortion is barred by federal law (except in the rare cases of

rape, incest, or endangerment of the woman's life), but as of 2010, 17 states had policies requiring them to use state funds to pay for abortions for women enrolled in Medicaid.[23] To estimate the proportion of averted abortions in each state that would have been paid for with public funds, we divided the state-level number of publicly funded abortions in 2010 from Sonfield and Gold (181,000 nationally)[23] by the total state-level number of abortions to state residents in 2008 (1.2 million nationally),[78] which was the most recent available year. The result—the proportion of abortions that were publicly funded—was 15% nationally but varied from 0% in many states to more than 40% in several. For the several states for which data were not available, we used the average proportion among states with similar abortion-funding policies. These are conservative estimates because they include abortions for all women in the state, rather than only those for the lower-income women who used publicly supported family planning, but state-level breakdowns of abortion incidence by income were not available.

We calculated state-level estimates for the public cost per abortion from Sonfield and Gold[23] by dividing each state's public expenditures for abortion in 2010 by its reported number of publicly funded abortions that year ($376 nationally). For those several states for which data were not available, we used the average cost per abortion in states with similar abortion-funding policies. We then multiplied together the state-level estimates (number of averted abortions, proportion paid for with public funds, and public cost per abortion) and summed them across states.

Net Savings

All estimates of the gross cost savings attributable to the benefits described in each of the preceding sections were then summed together and compared with the estimated public cost to provide publicly funded contraceptive care in 2010 (previously estimated at $2.2 billion).[3]

Results

In 2010, nearly 9 million women received contraceptive services from publicly supported providers in the United States,[3] which represents more than one-third of the 25 million US women who receive contraceptive services each year.[59] Without access to subsidized family planning

visits, these women would have experienced a host of additional adverse health outcomes with far-reaching consequences for themselves and their families. In addition, these outcomes would have cost the government far more than it paid to provide the women with family planning and related preventive services. Approximately 75% of the measured health benefits and cost savings reported here are attributable to the services that women received from publicly funded health centers, and more than half are attributable to Title X–funded centers.

Tables 2 and 3 present national-level estimates for all averted outcomes and cost savings according to provider type. Our summary here focuses on estimates for the overall publicly funded family planning effort. (State-level estimates for many of these indicators are presented in supplementary Tables 1, 2, 3, and 4, available online at http://onlinelibrary.wiley.com/doi/10.1111/1468-0009.12080/abstract).

Benefits From Contraceptive Use

Women who rely on publicly supported providers for their family planning care use a more effective mix of contraceptive methods than they would if they did not have these subsidized services. In addition, publicly funded family planning services allow women to better plan the timing and spacing of the births they do want, which leads to better health outcomes for themselves and their infants. Of the estimated 1.1 million unplanned births avoided by women receiving publicly funded contraceptive care in 2010, an estimated 287,500 would have been closely spaced, and 164,190 would have been premature, LBW, or both (Table 2).

Benefits From STI Testing

During family planning visits at publicly funded providers, women and men receive a range of other related preventive care services. Nearly half (49%) of female clients, some 4.4 million in 2010, received a chlamydia test; 49% were tested for gonorrhea; and 19% received an HIV test. STI testing also was common among the much smaller group of men who made family planning visits at publicly funded providers. Without access to publicly funded contraceptive services in 2010, an estimated 3.2 million women (73%) would have forgone chlamydia or gonorrhea testing, which would have resulted in tens of thousands of undetected and untreated STIs.

Table 2. Health Benefits From Contraceptive and Related Noncontraceptive Services Received During Family Planning Visits at Publicly Funded Providers, According to Provider Type, National Summary, 2010

Adverse Health Outcomes Averted	Publicly Funded Health Centers		Private Doctors Serving Medicaid Recipients	All Publicly Supported Providers
	All	Title X–Funded		
From contraception:				
Unintended pregnancies	1,677,200	1,181,500	552,700	2,229,900
Unplanned births	831,700	585,900	274,100	1,105,800
Abortions	572,200	403,100	188,600	760,800
Unplanned births after short interpregnancy intervals (<18 months IPI)	216,240	152,310	71,260	287,500
Unplanned preterm/low birth weight (LBW) births	122,820	87,110	41,370	164,190

Continued

Table 2. *Continued*

Adverse Health Outcomes Averted	Publicly Funded Health Centers		Private Doctors Serving Medicaid Recipients	All Publicly Supported Providers
	All	Title X–Funded		
From STI testing:				
Chlamydia infections	76,680	53,450	22,420	99,100
Gonorrhea infections	12,440	8,810	3,790	16,240
HIV infections	350	250	65	410
PID cases	9,910	6,920	3,260	13,170
Ectopic pregnancies	850	590	280	1,130
Infertility cases	1,660	1,160	550	2,210
From Pap and HPV testing:				
Cervical cancer cases	2,710	1,900	890	3,600
Cervical cancer deaths	1,570	1,100	520	2,090
From HPV vaccination:				
Abnormal cervical cell cases	5,640	3,970	1,860	7,500
Precancer cases	1,130	790	370	1,500
Cervical cancer cases	61	43	20	81
Cervical cancer deaths	15	11	5	20
Other HPV-attributable cancer cases	33	24	11	44

Table 3. Cost Savings From Contraceptive and Related Noncontraceptive Services Received During Family Planning Visits at Publicly Funded Providers, According to Provider Type, National Summary, 2010

Cost Savings (in 000s of dollars)	Publicly Funded Health Centers		Private Doctors Serving Medicaid Recipients	All Publicly Supported Providers
	All	Title X–Funded		
Maternity and birth-related costs to 60 months	11,072,327	7,805,411	4,162,828	15,235,155
Miscarriage and ectopic pregnancy costs	296,630	209,195	112,755	409,385
Abortion costs	33,272	23,228	10,630	43,902
Chlamydia and gonorrhea testing	24,886	17,418	7,663	32,550
HIV testing	76,994	54,968	13,539	90,533
Pap and HPV testing	15,416	10,807	5,080	20,496
HPV vaccination	1,621	1,142	534	2,156
Total gross savings	11,521,147	8,122,170	4,313,030	15,834,177
Family planning costs	1,640,731	1,140,753	594,005	2,234,736
Total net savings	9,880,416	6,981,417	3,719,025	13,599,441

The identification and treatment of these infections prevented future infections among the partners of clients and resulted in direct health benefits for the clients tested. By reducing their transmission to partners, an estimated 99,100 chlamydia infections, 16,240 gonorrhea infections, and 410 HIV infections were prevented. And among the clients who tested positive for chlamydia or gonorrhea and were treated, an estimated 13,170 cases of PID were avoided, which would have resulted in 1,130 ectopic pregnancies and 2,210 women becoming infertile (Table 2).

Benefits From Cervical Cancer Testing and Prevention

In 2010, an estimated 59,000 young women received at least 1 dose of the HPV vaccine during family planning visits at publicly funded providers. By vaccinating women before they contracted HPV, publicly funded providers helped them avoid an estimated 7,500 cases of abnormal cervical cells, 1,500 cases of precancer, and 81 cases of cervical cancer. An estimated 20 women avoided dying of cervical cancer, and 44 women avoided contracting other HPV-attributable cancers, such as anal or vulvar cancer (Table 2).

Most women who receive family planning services from publicly funded providers are not, however, vaccinated against HPV, and vaccination does not protect against all high-risk (ie, oncogenic) strains of HPV. Periodic testing therefore remains the standard of care to detect potential cervical cancer. In 2010, an estimated 3.2 million women received cervical cancer testing during a publicly funded family planning visit. In the absence of publicly funded family planning services, an estimated 2.3 million women would have forgone or postponed cervical cancer testing that year. Through this testing, an estimated 3,600 potential cervical cancer cases were identified and treated before the cancer developed, and 2,090 cervical cancer deaths were averted (Table 2).

Cost Savings

For each of the adverse health outcomes averted, we estimated both the total direct medical costs of sequelae attributable to those outcomes and how much of those costs would have been paid for by public funds, primarily Medicaid and Medicare. Only public costs and savings are presented here. As described earlier, and following the methodology of prior studies, our estimates include only the public cost savings for

services provided to clients who, in the absence of publicly supported care, would have used a less effective mix of contraceptive methods or would have delayed obtaining other preventive care services. We did not estimate the gross benefits or savings that would have accrued if the clients had stopped using *all* contraceptive methods or had never received any of the other preventive care services.

   The biggest share of averted public costs was attributed to contraceptive services, which help prevent unplanned pregnancies and their associated costs (Table 2). Without such services, an estimated additional $15.2 billion would have been spent in 2010 on Medicaid-covered maternity and infant care and on publicly funded medical care for children aged 13 to 60 months. An estimated additional $409 million would have been spent on Medicaid-covered care for miscarriages (including ectopic pregnancies), and $44 million for abortion care (almost all of which would have been spent in the 17 states that use their own funds to pay for abortions for Medicaid enrollees).

   In 2010, an estimated $123 million in cost savings was attributable to STI and HIV testing during family planning visits: Specifically, without chlamydia and gonorrhea testing, an estimated additional $33 million would have been spent on treating PID or epididymitis in women and men with untreated chlamydia or gonorrhea infections or on treating clients with STI-attributable HIV infections, and without HIV testing, an estimated additional $91 million would have been spent on HIV care for clients' partners who contracted the virus because the clients did not know their serostatus. Finally, an estimated $23 million in cost savings was attributable to HPV sequelae being identified and treated earlier because of testing for cervical cancer ($20.5 million) or prevented because of vaccines ($2.2 million).

   Together, publicly supported services averted an estimated total of $15.8 billion in gross public costs in 2010. Subtracting the total public cost to provide family planning and related sexual and reproductive health services that year—$2.2 billion—results in an estimated total net savings of $13.6 billion. Of the total net savings, an estimated $9.9 billion was attributable to publicly funded health centers—$7 billion to Title X–funded centers alone—and $3.7 billion was attributable to the Medicaid-funded family planning services provided by private physicians. Overall, by providing clients with the services they want and need to avoid unintended pregnancies and to protect their health against reproductive cancers and STIs, these services saved taxpayers an estimated $7.09 for every public dollar spent.

Sensitivity Analyses

All these findings rely on a wide array of parameters drawn primarily from earlier published research. Although we attempted to choose the best parameters available, in many cases we could have chosen other data and assumptions as part of a given estimate. As reported earlier, we often chose those indicators that produced conservative estimates, so to test these choices further, we performed a series of sensitivity analyses.

Cost Savings. Our estimates of net cost savings from publicly funded family planning and related services depend primarily on 4 factors: (1) the rate of unintended pregnancies averted per 1,000 contraceptive clients; (2) the adjustment for mistimed births that would not be cost saving; (3) the cost per Medicaid-funded birth (including maternity care and care through 60 months of age); and (4) the cost per family planning client. We tested changes in all 4 of these parameters. (Although the savings from STI testing and cervical cancer prevention services do not have a major impact on net cost savings, we did test changes to the key parameters used in our estimates of those benefits.)

First, we performed threshold tests to determine how high or low these variables would have to be for the net savings to equal zero. We found that for these services not to produce any net savings, the number of unintended pregnancies averted would have to drop from 288 per 1,000 contraceptive clients[3] to 31 per 1,000. Alternatively, the total cost per Medicaid-funded birth would have to drop from a weighted national average of $19,902 to $2,137, or the cost per family planning client would have to increase from a weighted national average of $251 to $1,776. None of these scenarios is remotely feasible.

We tested several other extreme scenarios. Even using the highest cost per family planning client ($512 in Alaska) and the lowest cost per birth ($5,848 for delivery and months 1 to 12 in New Hampshire, plus $3,260 for months 13 to 60 in Idaho)—a scenario that ignores the fact that all health care costs vary substantially by state—the results would still be an estimated savings of $1.66 for every dollar spent. Similarly, even if we assumed that all mistimed births would not be cost saving and therefore limited the savings to unwanted births, publicly funded family planning and related services would still save an estimated $3.71 for every dollar spent.

Finally, we tested the impact on cost savings from the use of alternative scenarios for the rate of unintended pregnancies averted

per 1,000 contraceptive clients. Researchers (Foster and colleagues) assessing California's Family PACT program have produced several of the most robust cost-benefit studies related to family planning care, drawing on a wealth of individual-level data that are not available nationally.[9,11,12,79] In our test, we used both their base scenario estimate of the rate of unintended pregnancies averted (287 per 1,000 clients, estimated using the method mix of clients before their first Family PACT visit) and their conservative alternative scenario for this rate (80 unintended pregnancies averted per 1,000 clients, estimated using the method mix reported by clients in an exit interview asking what contraceptive method they would use without this program). Since their base scenario rate is almost identical to our rate, 288, our cost savings are almost identical as well. Their alternative scenario rate is roughly one-quarter of both their and our base scenario rate and returns proportionately lower cost savings, but would still result in an estimated $2.16 saved per dollar spent. Finally, we tested the scenario used both by Foster and colleagues[11,79] and by Guttmacher in past studies,[5,6,7] which assumed that all women would use no contraceptive method in the absence of publicly funded services. In this scenario, the number of unintended pregnancies averted per 1,000 clients rose to 828, and the estimated cost savings increased to nearly $20 saved for every dollar spent.

   STI Testing.   For the chlamydia and gonorrhea testing analysis, we tested the impact of changes to 2 parameters that were known to vary widely. The reported incidence of both chlamydia and gonorrhea among populations tested by federally funded clinics varies widely from state to state; we tested the impact of using either the highest state incidence (10.2% in South Carolina for chlamydia and 2.8% in Wisconsin for gonorrhea) or the lowest state incidence (3.43% for chlamydia in Vermont and 0.04% for gonorrhea in Wyoming).[40,41] A recent review highlighted the difficulty of estimating how many untreated STI cases would ultimately progress to PID.[47] We tested a 50% variance around the average proportions used for both chlamydia and gonorrhea. Overall, the impact was greater when we varied the incidence of each STI based on the states' high and low incidence levels. The number of cases of chlamydia and the savings fell by 40% with the lowest state incidence and rose by 75% with the highest state incidence. The number of cases of gonorrhea and the cost savings fell by 96% using the lowest state incidence and rose by 182% using the highest state incidence.

For the HIV testing analysis, we tested 2 parameters that relied on assumptions from the literature, rather than on actual data. First, we tested the assumption from Hutchinson and colleagues that individuals would be tested, on average, 3 years later in the absence of publicly funded services.[22] Changing that parameter to 2 years would reduce the number of HIV infections averted by this testing and the resulting cost savings by one-third; increasing it to 4 years would increase both results by one-third. Second, we tested the assumption from Holtgrave and colleagues that 75% of HIV treatment costs are paid for with public dollars (which is a rough, national estimate rather than the state-specific estimates used in other parts of this analysis).[21] We replaced that parameter with the proportion of chlamydia and gonorrhea costs paid for with public dollars (data that vary by state but that exclude many avenues of public funding, such as the federal Ryan White program), which averages 33% nationally, and found that cost savings from HIV testing would total $43 million, slightly under half the base scenario.

Cervical Cancer Prevention. For the HPV vaccine analysis, we changed 2 parameters based on available data. We used the low and high ends of the confidence intervals around the vaccine efficacy adjustment factors by age (a measure of the extent to which women of different ages were exposed to HPV before being vaccinated) published by Chesson and colleagues.[71] We also changed the efficacy of 1 and 2 doses of the vaccine. For the low end, the effectiveness of 1 dose was replaced by the low end of the confidence interval of at least 1 dose from Markowitz and colleagues,[67] and the efficacy of 2 doses was the median of 1 and 3 doses. For the high end, 1 and 2 doses were considered as protective as 3 doses, as concluded by Kreimer and colleagues.[68] For the Pap and HPV testing analysis, we changed 1 parameter: the distribution of cervical cancer screening between those who received only a Pap test and those who received a Pap plus an HPV test, in which the low end was based on the proportion receiving each kind of test among Title X clients only and the high end was based on non–Title X clients only.[57] Of these 3 parameters, the only change that resulted in a substantial change in cases averted was the first, the effectiveness adjustment factor. In the low scenario, the number of cases of abnormal cells fell from 7,500 to 3,210, and the number of cases of cervical cancer fell from 81 to 35. In the high scenario, the number of cases increased to 12,160 and 130, respectively. This suggests that exposure to HPV before vaccination can have a noticeable effect on the impact of the vaccine.

Limitations

We tried to use the best available parameters from the literature to model the broader impact of publicly funded family planning services. Nonetheless, many of our assumptions, as well as our data, were deficient in one or more ways. For example, we often relied on data on services provided in Title X health center settings (which cover 53% of all women served by publicly funded providers) and then assumed that such services were delivered similarly in non–Title X settings. Although this assumption is not perfect, we felt that it was reasonable. We looked at both published[59] and unpublished[33] national data on service use by provider type and found that for our target population of women relying on publicly funded care, rates of testing were similar across settings (women served at Title X and non–Title X centers, and Medicaid clients served at private practices) for Pap, HIV, and other STI testing.

In addition, much of our analysis here began with the number of unintended pregnancies prevented by publicly funded services in 2010 estimated by Frost and colleagues.[3] The methodology used in that analysis is subject to potential bias due to unmeasured differences between the comparison group and women currently using publicly funded services, which could mean that the actual contraceptive behavior of women in the absence of publicly funded services would be more or less protective compared with our hypothetical scenario. For example, some of the small subgroup of women who have private insurance, but do not use it for contraceptive services, might do so if their access to public services were eliminated. To address this limitation, we conducted sensitivity analyses, presenting the results using alternative method-mix scenarios.

Although several steps in our analyses may have introduced some errors in our final results, they are the best available assumptions based on the literature, and when in doubt, we erred conservatively. For example, because we lacked actual data on the numbers of all publicly funded family planning clients who tested positive for chlamydia or gonorrhea, or who received treatment for their infection, we used data from other, similar provider settings for this information. We also relied on data from the literature, which are typically derived from cumulative small-scale or targeted studies, to estimate the national percentage of untreated infections that would have resulted in adverse outcomes, as well as the cost of those outcomes. Our HPV vaccine analysis used Planned Parenthood data as a proxy for the proportion of all public clients who received a vaccination, but this is likely not a perfect proxy. Finally, the literature

on the efficacy of receiving an incomplete HPV vaccination series is relatively new but is advancing rapidly. Our assumptions conservatively accounted for the newest literature.

In addition, our analysis did not account for all the health benefits for each service assessed. The HIV testing analysis did not include the health benefits (or any related costs or cost savings) accrued from the early detection of HIV for the HIV-positive individual herself; those benefits would derive from connecting HIV-positive individuals to earlier care and treatment. Nor did this analysis include the benefits from preventing vertical HIV transmission, from mother to infant.

The HPV vaccination analysis did not capture any impact that vaccines may have on noncancerous strains of HPV, although they do protect against some strains that lead to treatable medical conditions, such as genital warts. This analysis also did not account for herd immunity, although some additional benefits are likely. In addition, cervical cancer screening may lead to some unnecessary treatment of cases that would have resolved on their own. But our analysis was based on screening only every 3 years, so it is likely that this would not occur very often. In fact, some agencies even suggest a longer period between screening for some women,[80] so should the recommendations change, the cost-benefit ratio could be higher.

Similarly, our analysis of preterm and LBW births did not attempt to address the fact that by helping women avert such births, publicly supported contraceptive services avert particularly expensive births, which should reduce the average cost of a Medicaid-funded birth. Detailed state-level data on maternity and infant costs would be necessary to assess this impact on average costs and on the overall cost savings that would result.

Finally, we acknowledge that several factors might influence our findings if we updated our analysis for HPV vaccination. For example, once more older women have been vaccinated for HPV, the average age of individuals newly vaccinated will drop, effectively increasing both the efficacy of the vaccine (due to a reduction in prior exposure to HPV) and the resulting cost savings. In addition, advancements in cancer treatment mean that life expectancy may be increasing and death rates decreasing. In future years, the number of deaths averted through Pap testing, HPV testing, and HPV vaccination may decline—which would, of course, be a welcome finding.

Discussion

Helping women and couples prevent unintended pregnancy and thereby take control of their lives and futures is the primary purpose of the US family planning effort. Research has long demonstrated those successes in the form of millions of unintended pregnancies averted. Yet family planning providers, clients, and advocates have always known that the federal and state dollars spent on this effort have a long list of additional health benefits. This analysis, for the first time, provides estimates of a number of these additional benefits. These results are especially timely, as they document the impact of preventive services such as chlamydia and cervical cancer screening that are promoted under the Affordable Care Act (ACA) and are provided routinely during family planning visits.

Nationwide, the estimated 2.2 million unintended pregnancies averted each year include an estimated 287,500 that would have been closely spaced (<18 months IPI) and 164,190 that would have been preterm or LBW. The STI testing provided as part of publicly funded family planning visits prevents an estimated 99,100 cases of chlamydia, 16,240 cases of gonorrhea, 410 cases of HIV, and 13,170 cases of PID that would have led to 1,130 ectopic pregnancies and 2,210 cases of infertility in a single year. Pap tests, HPV tests, and HPV vaccinations provided at these visits prevent an estimated 3,680 cases of cervical cancer and 2,110 cervical cancer deaths annually; HPV vaccination prevents an estimated additional 9,000 cases of abnormal sequelae and precancerous lesions. The services provided at Title X–supported health centers are estimated to account for more than half of all these benefits.

The other main purpose of this analysis was to extend and refine estimates of the public savings accrued through the US family planning effort by including savings over a longer time frame and for more of the services provided and by excluding savings for some mistimed births. Earlier Guttmacher Institute estimates of cost savings from publicly funded family planning care were limited to the immediate costs associated with helping women avoid unplanned births, that is, the cost of maternity care and 12 months of infant care. Most recently, Frost and colleagues[3] found that the gross public savings from these limited benefits were estimated to be $12.7 billion in 2010, or $5.68 for every dollar spent providing contraceptive care. Here we expanded that

window to account for the medical care associated with averted births over 60 months of the child's life. At the same time, we excluded any cost savings from those mistimed births that do not contribute to higher completed parity and that would still be publicly funded, even if delayed until the woman desired the birth. Together, these changes resulted in an additional $2.5 billion in estimated public savings, for an estimated total of $15.2 billion in gross public savings due to averting unplanned births. We also factored in an estimated $453 million in public savings from averting the miscarriages and abortions that would have followed unintended pregnancies. Next, we added in public cost savings accrued from the health benefits derived from chlamydia, gonorrhea, and HIV testing; Pap and HPV testing; and HPV vaccination. Those estimated cost savings were comparatively small, roughly $146 million in 2010. Finally, we subtracted out the estimated $2.2 billion in public costs to provide family planning and related sexual and reproductive health services. All told, we estimate that the national public investment in family planning and related services saved $13.6 billion in 2010, which amounts to $7.09 saved per public dollar spent. Our sensitivity analysis found that although this ratio of cost savings could vary considerably under different scenarios, even the most extreme and unlikely scenarios would still produce substantial cost savings.

Neither the health benefits nor the cost savings estimated in this analysis represent the complete impact of the US family planning effort. For example, our estimates of the cost savings from preventing unintended pregnancies exclude the additional lifetime costs of preterm and LBW births, and they do not account for any unintended pregnancies averted by the contraceptive services provided to male clients. In addition, no benefits have been measured from counseling and education regarding the importance of preconception care and early access to prenatal care, or how to avoid STIs through the use of condoms and safe-sex practices. Nor did our analysis encompass additional common services, such as breast exams and screenings for high blood pressure and intimate partner violence. Similarly, this analysis did not include any estimates for the noncontraceptive health benefits and risks of contraceptive method use, or any related costs or cost savings.

Finally, our analysis did not extend beyond medical benefits. It did not estimate any of the numerous social and economic benefits to women and families that come from the ability to time and space their childbearing, such as greater opportunities to complete an education and participate

fully in the workforce.[81] It did not measure any nonmedical public costs associated with unintended pregnancy, such as food stamps or welfare payments. And it did not include any estimates of indirect cost savings— for example, the cost to society of lost productivity in the workplace or lost tax revenue to government coffers.

These estimates are based only on services provided by publicly funded family planning providers in 2010, well before the implementation of most elements of the ACA. But the importance of providing essential preventive services and of being able to quantify their impact remains relevant, and these results can still be used to demonstrate that impact overall, as well as to illustrate variation among states. As more individuals gain insurance coverage under the ACA, particularly under the law's expansion of Medicaid, the numbers served by publicly funded health centers and by private doctors under Medicaid can be expected to increase as well. And a growing proportion of the costs averted by preventive services can be expected to be paid for by Medicaid and other public dollars. Future work will be needed to monitor the impact of those changes.

In sum, our estimates provide new evidence of the national-level and state-level value of public programs that support family planning and related preventive services. These programs and providers not only help women and couples avoid unintended pregnancy but also make valuable contributions to reducing the incidence and impact of cervical cancer, STIs, infertility, and preterm and LBW births. And by supporting these vital preventive care services, the government also ends up saving many billions of public dollars.

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Supplementary Material

Additional supporting information may be found in the online version of this article at http://onlinelibrary.wiley.com/doi/10.1111/1468-0009.12080/abstract.

Appendix Table 1
Appendix Table 2
Appendix Table 3
Appendix Table 4

Appendix

Table A1. Summary of Medical Cost Estimates and Additional Selected Parameter Values

Parameter	National-Level Value		State-Level	Source
	Females	Males		
Direct medical costs (in 2010 $US), discounted to year of service				
Pregnancy and birth				
Average public cost per birth for:				
prenatal care, delivery, infant care to month 12	12,770	—	√	24
care of the child, months 13–60	7,950	—	√	76
Average public cost per miscarriage	1,252	—	√	[a]11, 24
Average public cost per abortion	376	—	√	[a]23
Sexually transmitted infections				
Average cost per case:				
PID	3,202	—		46
epididymitis	—	313		46
chlamydia	364	30		46
gonorrhea	354	79		46
HIV	330,000	330,000		18
Cancers				
Average cost per case averted from testing:				
cervical cancer	19,692	—		[a]46, 58

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	**Males**		
Average cost per case averted by vaccines:				
cervical dysplasia	690	—		[a]73
precancer	1,863	—		[a]73
cervical cancer	16,732	—		[a]46, 58
vulvar cancer	6,404	—		[a]46, 58
vaginal cancer	7,366	—		[a]46, 58
anal/rectal cancer	11,263	—		[a]46, 58
oropharyngeal cancer	12,889	—		[a]46, 58
Medical costs paid for with public funds				
Proportion of costs that are public:				
births and miscarriages	0.94	—	√	[a]24
abortions	0.15	—	√	[a]23, 78
chlamydia and gonorrhea	0.33	0.33	√	61
HIV	0.75	0.75		21
precancer	0.28	—	√	61
cervical cancer	0.29	—	√	61
vulvar cancer	0.61	—	√	61
vaginal cancer	0.60	—	√	61

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	Males		
anal/rectal cancer	0.46	—	✓	61
oropharyngeal cancer	0.49	—	✓	61
Other parameters				
Unintended pregnancy and contraceptive use				
Proportion of unplanned births to women <250% federal poverty level conceived <18 months postpartum	0.26	—		33
Proportion of births that are LBW or preterm	0.15	—	✓	34
Chlamydia, gonorrhea and their sequelae				
Proportion of clients tested for:				
chlamydia	0.50	0.58	✓	25
gonorrhea	0.49	0.58	✓	25
Proportion of tested clients who are positive:				
chlamydia	0.06	0.05	✓	[a]40
gonorrhea	0.01	0.01	✓	[a]41
Proportion of positive clients who are treated:				
chlamydia and gonorrhea	0.97	0.97		42

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	Males		
Proportion of treated clients who were symptomatic:				
chlamydia and gonorrhea	0.31	0.31		82
Adjustment to account for women who would be tested without public funding	0.73	—		33
Absolute reduction in probability of sequelae due to treatment:				
chlamydia and gonorrhea, symptomatic cases	0.15	0.02		46
chlamydia and gonorrhea, asymptomatic cases	0.08	0.02		46
Adjustment to chlamydia costs averted to account for gonorrhea coinfection	0.93	0.93		44
Adjustment to gonorrhea costs averted to account for chlamydia coinfection	0.79	0.90		44

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	Males		
Adjustment to account for reinfection:				
chlamydia and gonorrhea	0.70	0.70		44
Number of cases of STI averted in population per STI case treated	0.50	0.50		44
Probability of a new case of HIV attributable to chlamydia	0.0011	0.0011		44
Probability of a new case of HIV attributable to gonorrhea	0.0007	0.0007		44
Adjustment for time frame for STI-attributable HIV infections	0.25	0.25		44
Adjustment for partner overlap (heterosexuals)	0.75	0.75		44
Proportion of women with PID who:				
experience pelvic pain	0.19	—		48
experience ectopic pregnancy	0.09	—		48
become infertile	0.17	—		48

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	Males		
HIV				
Ratio of HIV tests performed per family planning clients served	0.22	0.51	√	[a]25, 50, 51
Proportion of tested clients who are positive:				
HIV (overall)	0.0014	0.0014	√	[a]25, 50, 51
HIV (sex-specific)	0.0010	0.0035	√	[a]52, 53
Adjustment to account for women who would be tested without public funding	0.73	—		33
Adjustment to account for HIV infections previously known	0.63	0.63		20
HIV transmissions averted per 100 persons newly aware of their infection	7.80	7.80		19
Years of transmissions averted from testing	3.00	3.00		22

Continued

Table A1. *Continued*

Parameter	National-Level Value			Source
	Females	Males	State-Level	
Pap and HPV testing				
Proportion of female clients tested	0.36	—	✓	[a]25, 33
Adjustment to account for women who would be tested without public funding	0.73	—		33
Number of cervical cancer cases averted per 100,000 women tested:				
Pap-only testing regimen	148	—		[a]56
Pap plus HPV testing regimen	165	—		[a]56
Number of cervical cancer deaths averted per 100,000 women tested:				
Pap-only testing regimen	87	—		[a]56
Pap plus HPV testing regimen	94	—		[a]56
Proportion of women tested using Pap-only testing regimen	0.59	—		[a]57

Continued

Table A1. *Continued*

Parameter	National-Level Value			State-Level	Source
	Females	Males			
HPV vaccines					
Ratio of HPV injections provided to female clients served	0.014	—			[a]3, 26
Adjustment to account for women who would be tested without public funding	0.73	—			33
Proportion of female clients vaccinated receiving:					
3 doses	0.46	—			64
2 doses	0.22	—			64
1 dose	0.32	—			64
Effectiveness of regimen:					
3-dose regimen	0.99	—			66
2-dose regimen	0.89	—			[a]66-68
1-dose regimen	0.80	—			[a]66-68
Adjustment factor to account for exposure to HPV prior to vaccination	0.38	—			[a]71

Continued

Table A1. *Continued*

Parameter	National-Level Value		State-Level	Source
	Females	Males		
Cases averted per 100,000 women vaccinated:				
abnormal cervical cell cases	50,000	—		72
precancer cases	10,000	—		72
cervical cancer cases	500	—		72
cervical cancer deaths	200	—		72
Ratio of other HPV-attributable cancers averted per cervical				
cancer case averted:				
vulvar cancers	0.14	—		46
vaginal cancers	0.04	—		46
anal/rectal cancers	0.24	—		46
oropharyngeal cancers	0.13	—		46

[a]National- and/or state-level values are calculated from figures in the reference(s) listed.