

Are Condoms Effective in Reducing the Risk of Sexually Transmitted Disease?

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See also page 1135.

A panel of more than two dozen experts reviewed the scientific evidence on condom effectiveness for sexually transmitted disease (STD) prevention, and a final report was released July 20, 2001, by the Department of Health and Human Services.¹ This panel was cosponsored and convened for a two-day workshop by four government agencies (Agency for International Development, Food and Drug Administration, Centers for Disease Control and Prevention [CDC], and the National Institutes of Health [NIH]).

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The report concluded that consistent use of condoms gave the best risk reduction for HIV (~85%) in both males and females and approximately a 25–75% risk reduction for gonorrhea in males. There were adequate data to say that condoms do not reduce the risk of human papillomaviruses (HPV) infection in females, although some studies suggested that the latex male condom might reduce the risk of HPV-associated diseases, including warts in men and cervical neoplasia in women. For gonorrhea in females and for chlamydia, trichomonas, genital herpes, chancroid, and syphilis in both males and females, studies were inadequate to reach conclusions about whether or not consistent use of condoms reduced the risk of STD transmission and, if so, to what degree.

Since the report's release in late July, there has been a firestorm of commentary in the press from both the left

and the right. Contrary to what the press reported, this 28-member panel was a diverse group of researchers, clinicians, educators, and governmental officials. They were chosen by the staff of the National Institute of Allergy and Infectious Diseases for their content expertise and their ability to read, interpret, and summarize the scientific literature. The members of the panel were appointed during the Clinton administration. No study that was of clinical significance was intentionally omitted, and every member of the panel had the opportunity to submit articles that he or she thought would be of benefit to the group and our charge, which was to answer the question, "Does the consistent use of condoms reduce the transmission of STDs or not?" The report was based on articles published in peer-reviewed journals as of June 2000.

Every panel member signed the report. There was general agreement on what the studies demonstrated, although there were some differing points of view, such as: (1) With respect to the status of the research, is the glass half full or is it half empty? (2) What is more important — "biologic plausibility" that condoms be expected to work for one act of sex with perfect use and no slippage or breakage, or the potential risk in the clinical setting where multiple acts of sex can occur over time and where slippage, breakage, and incorrect use occur even with consistent use, not to mention inconsistent use? Is there a significant difference in the amount of risk reduction provided for one act of sex with an infected partner compared with that provided for multiple sex acts? (3) How confident should we be that future research with better-designed studies will show that condoms are effective across the full range of non-HIV STDs in reducing the risk of STD transmission, especially STDs that are highly infectious and/or spread by skin contact?

Some answers to the above questions were found in articles included in the NIH Bibliography, but were unfortunately either buried in the middle of the report or were not

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included in the final report. Although many factors determine condom effectiveness, the most important are (1) the infectivity (or ease of transmission) of the STD; (2) the consistency of condom use; (3) the exposure that may occur even with consistent use due to breakage, slippage, and incorrect use; (4) the number of acts of vaginal intercourse with an infected partner; (5) the sex of the individual; and (6) whether or not the STD can be transmitted by skin contact occurring outside the area covered by a condom.

The significance of differences in infectivity between individual STDs was discussed in the report, but its importance was unfortunately lost in the final summary and conclusions. On page 12, the report states that failure to use a condom or slippage and breakage is more important for diseases like gonorrhea, which is easily transmitted, than HIV, which is much less easily transmitted. For example, the risk of acquiring HIV from one act of sex with an infected partner without the use of a condom is approximately 1:1000. (This is simply an estimate of the mean infectivity; the actual infectivity probably varies from 1:250 with a high viral load to 1:10 000 with a low viral load.)²³ In comparison, the risk of acquiring gonorrhea from one act of sex in a male is approximately 1:5, and the female's risk is $\geq 1:2$.⁴⁵ One would expect greater risk reduction with condoms from an STD with a risk of 1:1000 (HIV) versus 1:2 (gonorrhea in females) per act of sex without a condom.

One important study⁶ that was reviewed but not included in the report showed that even with consistent (100%) condom use by college men (mean 5 y condom experience), one in 10 condom uses resulted in potential exposure to disease due to incorrect use, slippage, or breakage.

Another article⁷ included in the NIH Bibliography, but not included in the final report because it was a commentary rather than a study, is an article by a respected group of researchers. In this article, the authors make the following statement: "Product labeling and counseling of people at risk have to make a clear distinction between absolute protection ('prevents infection') and partial protection ('reduces the risk of infection'). Another important counseling point is that single-episode efficacy and cumulative efficacy diverge widely as the number of exposures to an infected person increases. A method that is more than 99% effective for a single coital act can give an 18% cumulative failure rate with 100 exposures over time ($1 - 0.998^{100} = 0.18$)."

Even with HIV, condoms do not "prevent" infection, but rather offer significant risk reduction. Applying the same formula to the risk of a female acquiring gonorrhea from an infected male partner ($\geq 50\%$ risk from a single act of sex) and using the 10% risk of exposure due to incorrect use, slippage, or breakage, a female's probability of being infected when using a condom for one act of sex is 5% versus a 50% probability of infection with no condom use. After five acts of sex with an infected male, 97% of females would be expected to be infected with no condom use versus 23% of females who always used a condom, but had a 10% risk of exposure per act. After 10 acts of sex with an infected partner, 40% would likely be infected

even if they always used a condom; after 20 acts of sex, the risk increases to 64%. In comparison, the risk of acquiring gonorrhea from an infected female partner in a male using condoms consistently with a 10% risk of failure per use would be 10%, 18%, and 33% after five, 10, and 20 exposures, respectively. This phenomenon may explain why our studies showed risk reduction for gonorrhea in males but not females. Inconsistent use dramatically increases the probability of becoming infected.

A significant study done in 1999⁸ was part of the NIH Bibliography, but was not included in our report because it measured the impact of condoms on a group of six STDs rather than individual STDs. This study took place in four Atlanta teen clinics with a grant from the CDC and was supervised by CDC personnel. It studied condom effectiveness in girls aged 14–19 attending these clinics for a group of six STDs as a whole (chlamydia, gonorrhea, trichomonas, syphilis, hepatitis B, herpes simplex type II). At the start of the study, 40% of the girls were infected with one or more of the six STDs (87% of the infected girls were asymptomatic). At the end of the six-month study, 23% were reinfected. The risk of acquiring at least one STD was not significantly different for the 12.6% of study participants who used condoms consistently compared with those who used condoms inconsistently or not at all. As most of the girls had steady boyfriends, this study illustrates what happens over time with numerous acts of sex with an infected partner even when a condom is used. Another alarming fact that is not unusual in adolescent studies is the small percentage of teens that use condoms consistently. Even in studies of HIV serodiscordant partners, approximately only 50% "always" used condoms.

With significant risk reduction afforded by consistent condom use for HIV, the question is not whether a condom should be used when someone has sex outside of a long-term monogamous relationship with an uninfected partner, but rather what is the risk of STD infection other than HIV, even with consistent condom use? Some fear that informing the public of how little we know about condom effectiveness would lead to nonuse of condoms. Although it is improbable that any scientific evidence supports this hypothesis, the question remains. Is it ethical for healthcare professionals, including physicians and pharmacists, to hide the truth from the public? As in every other area of health care, we must give accurate data as we attempt to steer our patients toward the healthiest and safest choices. Ultimately, each individual must decide how much risk he or she is willing to take. But such a decision can be made responsibly only if individuals are accurately informed about the degree of risk they face (or may face) if they choose to be sexually active. Yes, an individual is at greater risk with no or inconsistent condom use, but appreciable risk remains, even with consistent condom use. This remaining risk may lead to a significant chance of infection given multiple acts of sex with an infected partner, especially for females exposed to highly infectious STDs such as HPV, chlamydia, gonorrhea, chancroid, and probably syphilis.

Some may argue that, for most STDs other than HIV, we simply do not have adequate scientific studies to state that condoms are not effective. That is true in one sense, but based on what we know about the unforgiving nature of condom use for prevention of highly infectious STDs, we should not expect future studies to approach the risk reduction that is achieved for HIV risk reduction. Such highly infectious STDs would include chlamydia, gonorrhea, chancroid, HPV, and probably syphilis. At present, many individuals probably feel that if they use a condom at least most of the time, they are at minimal risk for acquiring any STD. Accurate information about the potential of condom failure for STD prevention will, hopefully, allow the public to make well-informed decisions about whether to participate in sexual activity, and if they choose to be sexually active, should encourage them to receive appropriate screening for STDs since they are at risk of infection even with consistent condom use.

Condom package labeling, as well as counseling of sexually active couples outside of a mutually faithful long-term monogamous relationship with an uninfected partner, needs to accurately reflect the data reported in the recently released NIH Condom Effectiveness Report. This report is now the standard. As professionals, we must not base today's counseling practices on our prejudices of what we hope future research may show, but rather on the scientific data available today.

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