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A Rose by Any Other Name? Objective Knowledge, Perceived Knowledge, and Adolescent Male Condom Use

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ABSTRACT. *Objective.* To investigate the role of objective and perceived knowledge about condoms in adolescent males' condom use at first intercourse.

Methods. A longitudinal analysis was conducted of data from a nationally representative sample of 404 virgin male adolescents who were aged 15 to 17 years at wave 1 and reported becoming sexually experienced at the second wave of data collection. Objective knowledge was measured as a 5-item knowledge test about condoms. Perceived knowledge was measured as a 5-item scale regarding participants' confidence about their answers on the objective knowledge test. Condom use was assessed by self-report.

Results. Objective and perceived knowledge were moderately correlated with each other. Male adolescents with low objective but high perceived knowledge were identified as being at particular risk for not using a condom in that they were nearly 3 times less likely to report using a condom at first intercourse (odds ratio: 0.35) than those with other levels of objective and perceived knowledge.

Conclusions. Previous evidence suggests that knowledge about sex does not accurately predict sexual behavior. This lack of predictive accuracy may be because studies have focused only on objective knowledge. Our results suggest that both objective and perceived knowledge serve as antecedents to male condom use at first intercourse. However, those with higher perceived knowledge, particularly in the context of low objective knowledge, may be at greater risk for not using condoms. Addressing not only objective but also perceived knowledge may increase the effectiveness of interventions that are designed to increase rates of condom use among male adolescents. *Pediatrics* 2005;115:667–672; adolescents, sexual behavior, objective knowledge, perceived knowledge, condom use.

ABBREVIATION. STI, sexually transmitted infection.

"That which we call a rose, by any other name would smell as sweet."

William Shakespeare, *Romeo and Juliet*, Act II, Scene II

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A broad understanding of adolescent sexual behavior is crucial: sexual experience and risky sexual behavior are prevalent among adolescents.¹ Such behavior increases the probability of morbidities including sexually transmitted infections (STIs) and unintended pregnancy, which may result in severe and long-lasting consequences for individual adolescents. Such outcomes are disproportionately borne by adolescents and are costly to greater society as well.^{2,3}

Traditionally, efforts to reduce the morbidities associated with sexual risk behavior have been targeted at female adolescents. However, an interest in the important role that male adolescents (Romeo included) play in STI and pregnancy prevention has emerged. In particular, understanding male condom use has become salient, as condoms are the only reversible form of contraception and STI protection that requires direct male participation. Although rates of condom use have increased during the past decade, currently one third of sexually experienced male individuals reported not using a condom at last intercourse.¹ Reducing the number of adolescents who have intercourse without using a condom is a national priority and is included in the Healthy People 2010 goals.⁴ Recent work suggests that condom use at first intercourse is particularly crucial, as it may predispose adolescents to future condom use.⁵ Therefore, an understanding of why Romeo does or does not use a condom the first time he engages in sexual intercourse may ultimately allow for the design of interventions that increase condom use not only at first sex but also with subsequent sexual experiences.

Health behavior theories have provided important insights into the understanding of antecedents to adolescent sexual behavior, including condom use, and have served as a framework for effective interventions aimed at reducing risk behaviors, promoting protective ones, and ultimately diminishing serious morbidities. Theories including the Health Belief Model,⁶ the Theory of Reasoned Action,⁷ and Social Cognitive Theory⁸ have been applied empirically to adolescent sexual behavior and have successfully predicted a variety of outcomes.^{9–20} A recurrent theme in health behavior theory is the role of perception as an antecedent of behavior. Is a rose always a rose, regardless of how one perceives it? This question has been addressed by W.I. Thomas as "the definition of the situation,"²¹ in which one's perceptions (the definition) of a situation shape subsequent

behavior. Thomas suggested that, often, subjective experiences or assessments more fully explain human behavior than do objective ones. This notion is supported by contemporary behavioral theory: the Health Belief Model, the Theory of Reasoned Action, and Social Cognitive Theory all include constructs that emphasize subjective assessments over objective ones.

Although the definition of the situation has been applied successfully to many individual antecedents of adolescent sexual behavior, its contribution to our understanding of the role of knowledge has yet to be explored fully. To date, the relationship between objective knowledge about sex (that might be measured by a test) and sexual behavior has been inconsistent at best.^{9,14–17,19,20,22} Some research suggests that knowledge is protective, whereas other work finds knowledge to be a risk or simply not a significant predictor of sexual behavior. It is possible, however, that the lack of consistent findings regarding knowledge as a significant antecedent to adolescent sexual behavior has occurred because an important aspect of knowledge has been overlooked: perception. The crucial element may not be just what Romeo actually knows but also what he thinks he knows or how confident he is about what he knows.

This notion is supported by research in cognitive psychology, which suggests that discrepancy between objective and perceived knowledge is common, and perceived knowledge often contributes significantly to learning.^{23–26} The experience of an “illusion of knowing”²⁵ has been described as one in which an individual overestimates his or her knowledge or has high perceived knowledge in the context of low objective knowledge. In this situation, the illusion of knowing acts as an obstacle to the acquisition of new information. Thus, one might anticipate that individuals with low objective but high perceived knowledge would be more likely to report high-risk sexual behavior, such as not using a condom at first intercourse. The reverse situation has also been described. When individuals have high objective but low perceived knowledge, they are less likely to trust what they know and apply it appropriately.²⁴ Given this, such individuals might also be less likely to report condom use. Taken together, these theories predict that Romeos with discordant objective and perceived knowledge would be less likely to report condom use at first intercourse.

Despite this, few studies have directly addressed perceived knowledge about sex as an antecedent to adolescent sexual behavior. One study found a weakly negative correlation between perceived knowledge about AIDS and sexual intercourse, suggesting that higher perceived knowledge was protective.²⁷ In a second study, perceived amount learned about sex seemed to predict weakly a small amount of regular contraceptive behavior.¹⁵ A third study suggested that perception of knowledge about condoms was not related to actual condom knowledge.²⁸ This study, however, did not examine the relationship between knowledge and behavioral outcomes.

Therefore, we undertook a line of investigation²⁹ that directly examined the relationship between per-

ceived knowledge and behavior. The analysis found significant correlations between perceived knowledge about sex and sexual risk behavior. In this study, sexually experienced adolescents with low perceived knowledge about sex were more likely also to report several high-risk sexual behaviors, including not communicating with partners about STIs and pregnancy, having a history of pregnancy or pregnancy involvement, not using contraception or condoms consistently, and having greater numbers of male and female sexual partners. However, the data allowed for only an indirect determination of level of perceived knowledge and did not provide a measurement of objective knowledge. Thus, any important interplay between objective and perceived knowledge could not be examined. Finally, the cross-sectional nature of the data did not allow for establishment of causation.

A Medline search identified no longitudinal studies that have assessed both objective and perceived knowledge about sex and their relationship to each other and their ability to predict sexual risk behavior among adolescents. Building on previous work, in this article we analyzed longitudinal data from a nationally representative sample of male adolescents to examine both the relationship between perceived and objective knowledge about condoms and the roles of perceived and objective knowledge as antecedents to Romeo’s condom use at first intercourse. We hypothesized (1) that perceived knowledge about condoms would not be strongly correlated with objective knowledge and (2) that individuals with discordant levels of perceived and objective knowledge would be less likely to report using condoms at first intercourse than their peers with concordant perceived and objective knowledge.

METHODS

Add Health

The present analysis used the first 2 waves of data from the National Longitudinal Study of Adolescent Health (Add Health), which has been previously described in detail.³⁰ Add Health is a longitudinal study of 7th- to 12th-grade students in the United States, concentrating on both social contextual factors and health-related behaviors. All high schools in the United States that had an 11th grade and a minimum of 30 enrollees in the school were included in the primary sampling frame ($n = 26\,666$). Schools then were stratified by region, community size, school size and type, ethnic distribution, and grade span. A systematic random sample of 80 high schools was selected from these strata. For each of the selected high schools, the primary feeder school that included 7th grade was recruited. High schools that spanned grades 7 to 12 were used as their own feeder school. The final sample comprised 134 schools.

Of the 119 233 eligible students, 90 118 respondents completed an in-school survey during the 1994–1995 academic year. From the list of in-school survey participants and from school rosters, a random sample ($n = 27\,000$) stratified by grade and gender was invited to participate in in-home interviews. The first wave (wave 1) of the in-home interviews was conducted from April to December 1995. The 90-minute computer-assisted interview was completed by 20 745 (78.9%) students and included a wide range of questions on health; risk behaviors; protective factors; family dynamics; and adolescents’ attitudes, knowledge, and expectations. Sensitive components of the interview were delivered through earphones with responses entered directly into a laptop computer. A second wave of interviews was conducted with the wave 1 in-home sample ~1 year later (wave 2), between April and August 1996. The response rate at Wave 2 was 88.2% (14 738). Students in

the 12th grade at wave 1 were not interviewed at wave 2. Wave 3 data were not available at the time of this analysis.

All study protocols received Institutional Review Board approval. Extensive arrangements, including signed contractual agreements by investigators with access to the data, were taken to protect confidentiality and to preclude deductive disclosure of students' identities. All participants and their parents provided written, informed consent. The present analysis received approval from the University of Minnesota Institutional Review Board.

Analytic Sample

The present sample was restricted to male adolescents who participated in both wave 1 and wave 2 in-home interviews. Male adolescents who were aged 15 to 17 and reported that they had never had sexual intercourse at wave 1 but did report sexual intercourse at wave 2 (male adolescents who were virgins at wave 1 and had their sexual debut by the wave 2 interview) were included in the final analytic sample. Inclusion criteria were chosen to avoid the confounding effect of previous sexual experience (with or without a condom) on objective and perceived knowledge about condoms and on condom use.

Measures

Dependent Variable

Condom use was assessed at wave 2, measured by self-report of use of a condom at first intercourse. Participants who reported having used birth control at first intercourse were asked, "What method of birth control did you or your partner use the first time you had sexual intercourse?" and could choose up to 3 methods from a list of contraceptive options ("condoms, withdrawal, rhythm, birth control pills, vaginal sponge, foam, jelly, creme, suppositories, diaphragm with or without jelly, intrauterine device, Norplant, ring, Depo Provera, contraceptive film, or some other method"). Participants who chose "condoms" for any of up to 3 methods were considered to have used a condom at first intercourse.

Independent Variables

The key independent variables were objective and perceived knowledge about condoms. Objective knowledge about condoms was assessed at wave 1 with a 5-item knowledge test (Table 1). Students could respond, "true," "false," or "don't know." The number of correct answers was summed; this total constituted the objective knowledge score (range: 0–5). Those who answered at least 4 of 5 questions correctly were considered to have "high" objective knowledge; those who answered 3 or fewer questions correctly were considered to have "low" objective knowledge. Perceived knowledge was also assessed at wave 1 with a 5-item measure. After each objective knowledge question, students were asked, "How confident are you that your answer is correct?" Students responded using a 4-point Likert scale ranging from "very" to "not at all." These responses were combined by taking the mean across the 5 knowledge questions to create a perceived knowledge scale (range: 0–3; Cronbach $\alpha = .72$). Those who

scored in the top quartile were considered to have "high" perceived knowledge; the remaining participants were considered to have "low" perceived knowledge.

Several variables that may have affected both independent and dependent variables were included as potential confounders. Age was reported in years. Grade point average was calculated by taking the mean of the most recent grades in English/language arts, mathematics, history/social studies, and science. Ethnicity was based on adolescent self-report. The present analyses used white, black, Hispanic/Latino, and other ethnicity. Family structure was determined through household rosters and was dichotomized to 2-parent biological families and all other family types. Contraceptive self-efficacy, which has been identified as a protective antecedent to condom use, was assessed with a 3-item scale. Students were asked, "If you wanted to use birth control, how sure are you that you could stop yourself and use birth control once you were highly aroused or turned on?" "How sure are you that you could plan ahead to have some form of birth control available?" "How sure are you that you could resist sexual intercourse if your partner did not want to use some form of birth control?" Students responded to each question using a 5-point Likert scale ("very sure/moderately sure/neither sure nor unsure/moderately unsure/very unsure"). The contraceptive self-efficacy score ranged from 0 to 5 (Cronbach $\alpha = .66$).

Analysis

For examining the role of discordance between objective and perceived knowledge in predicting condom use, students were organized into 1 of 4 categories on the basis of their dichotomized levels of objective and perceived knowledge (low objective/low perceived, low objective/high perceived, high objective/low perceived, and high objective/high perceived). Two groups (low objective/low perceived and high objective/high perceived) were considered to have concordant knowledge. The remaining 2 groups (low objective/high perceived and high objective/low perceived) were considered to have discordant knowledge. A series of $2 \times 2 \chi^2$ tests compared differences in condom use at first intercourse among the 4 groups. Finally, multivariate logistic regression was used to compare the outcome of condom use among the 4 groups of students. Data were analyzed using SAS version 8.2.³¹ Sampling weights were applied for all analyses. In determining difference, $P = .05$ was used to differentiate true effect from chance occurrence.

RESULTS

The final analytic sample consisted of 404 male adolescents who were aged 15 to 17 years. Descriptive characteristics are described in Table 2. Just <40% of the sample reported using a condom the first time they had intercourse. Despite a low rate of condom use, the male adolescents reported fairly high objective knowledge, answering, on average, 3.4 of 5 questions correctly. The respondents also had fairly high levels of perceived knowledge. Table 3

TABLE 1. Questions to Assess Objective Knowledge About Condoms

	Correct Answer*
1. When using a condom, the man should pull out of the woman right after he has ejaculated (come).	True
2. Natural skin (lamb skin) condoms provide better protection against the AIDS virus than latex condoms.	False
3. When putting on a condom, it is important to have it fit tightly, leaving no space at the tip.	False
4. Vaseline can be used with condoms, and they will work just as well.	False
5. As long as the condom fits over the tip of the penis, it doesn't matter how far down it is unrolled.	False

* Respondents could answer "true," "false," or "don't know."

TABLE 2. Demographic and Descriptive Characteristics of the Participants

	Mean	SD
Age, mean y	16.0	0.56
Grade point average, mean	2.6	0.74
Ethnicity, %		
Black/African American	14.49	
Latino	14.79	
White	67.1	
Other	3.62	
Lives with 2 biological parents, %	47.04	
Used condom at first intercourse, %	39.33	
Objective knowledge score, mean	3.42	1.27
Perceived knowledge score, mean	2.15	0.68
Self-efficacy score, mean	4.0	0.99

Sample size is unweighted ($n = 404$). All values are reported with sampling weights applied. All participants were male.

TABLE 3. Objective and Perceived Knowledge Results

Question	% Answering Correctly	How Confident Are You That Your Answer Is Correct? %			
		Very	Moderately	Slightly	Not at All
1	81.7	43.9	35.3	14.2	6.6
2	70.5	45.2	27.9	15.8	11.1
3	53.0	57.1	28.4	9.9	4.6
4	57.3	41.4	24.6	21.7	12.3
5	80.9	47.2	33.4	12.3	7.1

Sample size is unweighted ($n = 404$). All values are reported with sampling weights applied.

shows the percentage of students who answered each question correctly and the distribution of confidence about answers. The respondents were most likely to know the answer to the question about whether a man should pull out right away after he has ejaculated and about whether the condom needs to be unrolled all the way. It is interesting that students were most confident about the question that the fewest of them answered correctly, whether it is important to have the tip of the condom fit tightly when putting it on, leaving no space at the tip. The correlation between the 5-item objective and knowledge variable was moderate ($r = 0.43$).

For examining the role of concordance and discordance between objective and perceived knowledge, participants were placed into 1 of 4 categories on the basis of dichotomization of objective and perceived knowledge scores to high or low (Table 4). Those who were dichotomized to "high" objective knowledge scored a 4 or greater. Those who were dichotomized to "high" perceived knowledge (the top quartile) scored a 2.8 or greater. A series of six 2×2 χ^2 tests among the 4 groups revealed that those with low objective but high perceived knowledge were significantly less likely to use a condom at first intercourse compared with each of the 3 other groups, which did not differ from each other in their report of condom use (Table 4). Multivariate logistic regression analysis confirmed that compared with the low objective/low perceived knowledge group, those with low objective but high perceived knowledge were significantly less likely to report using a condom at first intercourse (Table 5). The other 2 groups were no different in their condom use from the referent low objective/low perceived knowledge group.

TABLE 4. Bivariate Relationships Among Knowledge Categories and Condom Use at First Intercourse

Category	%	% Using Condom at First Intercourse
Low objective/low perceived	38.0	37.4
Low objective/high perceived	8.6	17.8
High objective/low perceived	38.6	44.8
High objective/high perceived	14.8	42.0

Sample size is unweighted ($n = 404$). All analyses were performed using sampling weights. $\chi^2 = 9.07$, $df = 3$, $P = .03$. Serial χ^2 analysis revealed that condom use among the low objective/high perceived group was significantly lower than that of each other group, whereas rates among the 3 remaining groups did not significantly differ.

TABLE 5. Multivariate Relationships Among Knowledge Categories and Condom Use at First Intercourse

Variable	OR (95% CI)	χ^2	P
Low objective/high perceived knowledge group*	0.35 (0.14–0.9)	4.75	.03
Latino ethnicity†	0.35 (0.173–0.714)	8.36	.004

All analyses were performed using sampling weights. Only significant predictors of condom use are shown. Age, black and other ethnicity, grade point average, family structure, contraceptive self-efficacy, and high objective knowledge with low or high perceived knowledge did not significantly predict condom use at first intercourse. OR indicates odds ratio; CI, confidence interval.

* Low objective/high perceived knowledge compared with low objective/low perceived group.

† Latino compared with white.

DISCUSSION

The findings of this study seem to support the inclusion of perception as another behavioral antecedent to adolescent sexual behavior. It is possible that the inconsistent ability of objective knowledge to act as a predictor of adolescent sexual behavior has occurred because an additional aspect of knowledge had not been addressed. Perceived knowledge, in concert with objective knowledge, seems to play a significant role in condom use at first intercourse among male adolescents.

Our results showed that objective and perceived knowledge were moderately correlated with one another. This finding suggests that objective and perceived knowledge are often but not automatically concordant. Although those with high objective knowledge tended also to have higher perceived knowledge, this was not always the case. Similarly, those with low objective knowledge did not always have low perceived knowledge. Thus, future investigations regarding the relationship between knowledge and behavior should not use objective or perceived knowledge as a proxy for one another: both constructs should be assessed.

Our second research hypothesis addressed the role of concordance or discordance between objective and perceived knowledge. Given that the 2 were only moderately correlated, we wanted to examine how discrepant levels of knowledge might affect behavior. The findings support the theory that an illusion of knowing can act as a barrier to low-risk behavior. When discrepant knowledge occurs in a direction such that individuals overestimate their actual knowledge (have high perceived knowledge in the context of low objective knowledge), the acquisition of new information may be less likely. Thus, individuals with high perceived but low objective knowledge about condoms may be less receptive to learning about condoms or may forgo opportunities to improve their objective knowledge base (and to correct inaccuracies in their objective knowledge). As such, one might anticipate that individuals with low objective but high perceived knowledge would be less likely to report condom use. In fact, those with low objective but high perceived knowledge were nearly 3 times less likely to report condom use at first intercourse. The other discordant group, however,

did not differ in condom use behavior from the 2 concordant groups. These results identify a group of male adolescents who may be at particular risk for not using condoms. When identified, male adolescents with low objective but high perceived knowledge may require additional intervention to promote condom use at first and subsequent sexual intercourse.

The results of this study must be interpreted in light of its limitations. Add Health is a school-based sample that does not allow us to generalize our findings to adolescents who are home schooled or not in school at all. The data were based on self-report; thus, we were not able to assess the reliability of students' answers. However, rates of condom use were comparable to other national surveys of youth. We were not able to control for the gender of the intercourse partner, which also may have affected condom use. The question about having sexual intercourse specifies "when a male inserts his penis into a female's vagina." However, some of the respondents may have endorsed having had intercourse even if it was with a male partner. Their condom use and the influence of knowledge on that use may have been different. We were not able to assess for history of sexual abuse, which also may have affected sexual behavior. Finally, by dichotomizing and categorizing our students, we may have tapped into some other, unmeasured personality trait, such as being a risk taker or being generally underconfident, that may explain condom use at first intercourse. It may not be discordance of knowledge that directly predicts condom use. Rather, such discordance may act as a marker for male adolescents who are more or less likely to use a condom.

It should also be noted that knowledge (objective or perceived) cannot stand as the panacea to adolescent condom use. Knowledge is but 1 antecedent of health behavior: skills, self-efficacy, environment, and a host of other factors interplay to shape behavioral outcomes. To ignore an adolescent's access to condoms, ability to negotiate use, or skill in appropriate use of a condom would be as myopic as ignoring knowledge states. Ideally, all relevant antecedents should be considered and addressed.

Despite its limitations, this study also has several strengths. To our knowledge, it is the first study that has examined directly the roles of both objective and perceived knowledge on adolescent sexual behavior. It is longitudinal, which allowed us to measure knowledge states before the behavioral outcome. Finally, whereas traditional efforts to understand and reduce the morbidities associated with sexual risk behavior have been focused on female adolescents, this study provides insight into some of the important antecedents to male condom use.

Our findings suggest that health care providers who work with male adolescents should assess both objective and perceived knowledge. This could be done through the use of Likert scales or one-on-one with a health care provider, not unlike screening assessments for depression, alcohol addiction, or other conditions. Additional research into the most valid and reliable means of assessing objective and

perceived knowledge is needed. Once assessed, level of objective knowledge must be interpreted in the context of perceived knowledge when predicting the likelihood of Romeo's using a condom at first intercourse. It should not be assumed that those with high objective knowledge automatically have high confidence about their knowledge or that those with low objective knowledge by default have low perceived knowledge. The male adolescents who are most at risk seem to be those with high perceived but low objective knowledge. By considering both facets of knowledge, providers may be able to predict further which male adolescents are at risk and thus tailor health intervention strategies to those who need it most. Such strategies, particularly those that are designed to narrow the gap between perceived and objective knowledge for a male adolescent with the "illusion of knowing," will require not only skill in the "art" of health care but also outcomes-based research.

Our findings also have implications for programs that seek to promote condom use among male adolescents. Programs that focus solely on the acquisition of objective knowledge do not significantly change sexual behavior.^{32,33} Our results suggest that programs that target perceived knowledge, in addition to objective knowledge, may produce more successful outcomes. Direct attention to adolescents' perception of their own knowledge, both before and after programmatic intervention, may promote outcomes that were not attainable by programs that focus exclusively on knowledge acquisition.

Thus, it seems that a rose is not always a rose, as Juliet might have us believe. Both objective reality and perception of that reality must be considered. Therefore, knowing what Romeo actually knows and what he thinks he knows is relevant. By addressing both aspects of knowledge, we may be able to predict and ultimately design interventions that promote Romeo's condom use when he and Juliet consummate their relationship.

"In real life, unlike in Shakespeare, the sweetness of the rose depends on the name it bears. Things are not only what they are. They are, in very important respects, what they seem to be." Hubert H. Humphrey, Jr.

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MINNESOTA ISSUES A HOSPITAL REPORT CARD OF MEDICAL ERRORS

"In a path-breaking move that other states may follow, Minnesota issued a report card intended to both provide patients with information about medical errors at individual hospitals in the state and spur those hospitals to prevent such mistakes in the future.

"The report . . . identified 21 preventable deaths, 13 operations on the wrong body part, and 31 cases of foreign objects left in patients after surgery among errors reported by the state's 139 hospitals. Though the numbers are relatively small, hospital officials and health-quality experts believe that collecting and disclosing the data will give patients information to guide health-care decisions and prompt hospitals to adopt strategies to improve safety."

Davies P. *Wall Street Journal*. January 20, 2005

Noted by JFL, MD

A Rose by Any Other Name? Objective Knowledge, Perceived Knowledge, and Adolescent Male Condom Use

Ellen M. Rock, Marjorie Ireland, Michael D. Resnick and Clea A. McNeely

Pediatrics 2005;115:667-672

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