Attitudes and Health Behavior in Diverse Populations: Drunk Driving, Alcohol Use, Binge Eating, Marijuana Use, and Cigarette Use

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Five different health behaviors (cigarette use, alcohol use, binge eating, illicit drug use, and drunk driving) were studied prospectively in 5 different groups of subjects. Associations between attitudes toward these behaviors and the behaviors themselves were investigated over at least 2 waves of measurement. Findings revealed that attitudes predicted behavior nonspuriously in 2 instances: alcohol use and marijuana use. Attitudes did not predict drunk driving, binge eating, or smoking behaviors. Past behavior predicted attitude in the domains of binge eating and smoking, but not in the domains of alcohol use, drunk driving, or marijuana use. The results are discussed in terms of several alternative approaches that have implications for interventions that attempt to influence health behavior through attitude change.

Key Words: attitudes, health, behavior, longitudinal, expectancy, drugs

Programs designed to promote changes in health behavior frequently include components that attempt to change attitudes concerning the targeted behavior. Sometimes the focus on attitude change is an explicit component, in which an individual's evaluations of the behavior are targeted. In other cases, as in many educational media campaigns (e.g., Flay, 1987), several key or "salient" beliefs are the focus of the strategy, which more implicitly attempts attitude change by first trying to change beliefs (cf. Ajzen & Fishbein, 1980). Programs that provide information about the harmful consequences of smoking, the dangers of drunk driving, or the necessity of a balanced diet often represent, implicitly or explicitly, an attempt to change behavior through attitude change. These programs may focus on harmful outcomes of a negative health behavior, attempting to make personal evaluations (attitude) of the behavior more negative, or on beneficial outcomes of a positive health behavior, attempting to make evaluations of the healthy behavior more positive. Because of the widespread use and potential of attitude concepts in health-behavior research and interventions, it is important to document the predictive impact of this construct and to integrate theories of health behavior with empirical findings.

The rationale for attitudinal approaches in health-behavior interventions has been strengthened by findings in basic research documenting the association between attitudes and behavior (Bentler & Speckart, 1981; Fazio & Williams, 1986; Fishbein & Ajzen, 1975; Speckart & Bentler, 1982). However, comprehensive evaluations of the predictive impact of attitudes on health behavior have been rare, and the case for attitude as a strong natural precursor to behavior may not be as strong as some of the basic research would suggest. Our goal was to investigate the predictive precedence of attitude and health behavior over time, so that the usefulness of the attitude construct in health can be more thoroughly examined. First, it is important to summarize briefly the predominant definitions of attitude and some of the early research on this construct.

Attitude Definitions and Behavioral Prediction

In the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), attitude is thought to represent a general evaluation of an object, and affect is considered the most essential aspect of attitude (also see Thurstone, 1931). In another dominant view, attitude is considered to be multidimensional, composed of correlated but somewhat independent affective, cognitive, and conative components (Rosenberg & Hovland, 1960). The affect-based definition of attitude, in which an overall evaluation of an object or a behavior is emphasized, is probably the more common one in present research in social psychology and health, and this is the definition we use in this article. A focus on this definition of attitude does not imply that cognitive factors are not important in health behavior, but instead suggests that cognitive variables are better construed as separate but related constructs (e.g., Ajzen & Fishbein, 1980; Stacy, Widaman, & Marlatt, 1990).

Attitudinal research has frequently focused on the strength or nature of attitude–behavior relations, attempting to shed light on the predictive validity of attitude concepts. Although early research often found poor correlations between attitude and behavior (e.g., Corey, 1937; LaPiere, 1934; for review, see Wicker, 1971), Fishbein and Ajzen (1975; Ajzen & Fishbein, 1980) suggested that relations between attitudes and behavior would be stronger when measurements of these variables correspond highly in certain properties. Specifically, Ajzen and
Fishbein’s (1977) review of the literature identified strong attitude–behavior associations across a number of studies in which at least the target (object) and action (e.g., drinking) elements of measurement corresponded highly.

Fishbein and Ajzen’s (1975) approach is consistent with the position that attitudes have predictive priority over behavior (e.g., Bentler & Speckart, 1981). Other positions relevant to health behavior include the view that behavior causes attitude (Bem, 1978), attitudes and behavior influence each other reciprocally (Kelman, 1974), and the influence of attitude on behavior depends strongly on moderator variables, such as individual differences, in the accessibility of attitudes or beliefs from memory (Fazio & Williams, 1986; Stacy, Dent, et al., 1990) or in personality characteristics (e.g., Snyder, 1974). Although these latter perspectives have made contributions to the study of moderators of attitude–behavior relations, most health-behavior campaigns focus on attitude and behavior change rather than on attitude–moderator change. Thus, at least in health-behavior research, it is important to determine the precedence of attitudes and behavior as direct-effect predictors of one another. Surprisingly, questions about the predictive priority of attitudes and behavior have been addressed rarely in health-behavior research.

### Attitudes and Specific Health Behaviors

#### Smoking

The influence of attitudes on smoking onset and cessation is important because attitude-change strategies are frequently used in large mass media programs (Farquhar, 1991; Flay, 1987) and school-based interventions (e.g., Bruvold, 1990). Although little is known at present about the critical elements of successful interventions in this area (Flay, 1987; Snow, Gilchrist, & Schinke, 1985), theoretically sound attitude-change strategies are in principle quite amenable to mass media efforts and school-based interventions. Because most adult smokers begin to smoke in adolescence (Flay, d’Avernas, Best, Kersell, & Ryan, 1983; Leventhal & Cleary, 1980), this age group seems particularly important for research and intervention. Charlton and Blair (1989; but see Jarvis, Goddard, & McNeil, 1990) reported evidence that attitudes among initial nonsmokers predicted adolescent smoking behavior prospectively, but they did not investigate the predictive precedence of attitude and behavior over time. In other instances, attitudes that do not correspond in level of specificity to this behavioral target and action (smoking) have been studied in smoking research, including attitudes toward self or toward health (e.g., Brunswick & Messeri, 1984). Consistent with Ajzen and Fishbein’s (1977) predictions and findings, a lack of correspondence in the target or action element of attitudes and behavior has led to low attitude–behavior relationships. Despite the widespread use of attitude concepts in both interventions and theories of adolescent smoking, no studies have investigated the predictive precedence of attitudes toward smoking and smoking behavior in this population.

#### Alcohol Use and Drunk Driving

Existing evidence about attitude–behavior relations in alcohol-use research can be considered mixed. Kahle and Berman (1979) found that attitudes showed predictive predominance over behavior in a cross-lagged panel correlational investigation of alcohol consumption over a 2-month period (also see Schlegel, Manske, & d’Avernas, 1985), but this type of statistical analysis has been criticized on several grounds (Rogosa, 1980). In a structural equation analysis, Bentler and Speckart (1979; also see Stacy, Widaman, & Marlatt, 1990) found evidence that attitude toward alcohol use predicted drinking behavior 2 weeks later, although they did not perform an examination of predictive precedence. In a 3-year prospective study, Johnson (1988) found no evidence that attitudes about drinking and drinking behavior predicted one another over time, in either of the possible directions. No studies have investigated the predictive precedence of attitudes and behavior regarding alcohol-related problem behaviors, such as driving under the influence of alcohol (DUI). However, the call for attitude change regarding alcohol use frequently accompanies discussions of the social costs of this and other problems associated with alcohol use.

#### Illicit Drug Use

As with tobacco and alcohol use, many intervention efforts attempt some form of direct or indirect attitude change in the prevention and treatment of drug abuse (e.g., Pentz et al., 1989). Although attitudes appear to be predictive of certain types of illicit drug use (e.g., Akers, Krohn, Lanza-Kaduce, & Radospevich, 1979), few studies have examined whether this prediction is as strong as the prediction of attitudes by drug use. If the prediction of attitudes by drug use is much stronger than the prediction of drug use by attitudes, then it may be the case that behavior must change before attitude changes. A predictive predominance of behavior over attitude would have implications for the focus of interventions.

The only existing evidence concerning the predictive precedence of attitudes and illicit drug use was reported by Johnson (1988) and by Schlegel et al. (1985). Johnson found that attitude and marijuana use did not predict one another over time, and that only the stability (autoregressive) effects of the same construct on itself over time were significant. Schlegel et al. reported only preliminary information about predictive precedence, as evaluated in a cross-lagged correlational design of marijuana attitudes and behavior.

#### Binge Eating

During the past two decades, binge eating has appeared to increase in frequency among young women (Polivy & Herman, 1985). Although the behavior of binge eating may be part of the larger eating disorder of bulimia, people who binge eat may vary continuously in their extent of disordered eating behavior and concomitant symptoms. Research investigating this behavior is important because of a number of negative health consequences of the behavior (e.g., Hawkins & Clement, 1980), whether or not a clear, clinically relevant case of...
bulimia is evident. Even when binge eating is not apparently severe, the typical diet associated with binge eating is high in fat and is likely to cause health consequences if the diet continues for an extended period of time.

A number of studies have found that cognitive factors more consistently trigger binge-eating behaviors than do physiological variables, such as caloric intake (e.g., Polivy, Herman, Olmstead, & Jazwinski, 1984; Spencer & Fremouw, 1979), and that certain types of attitudes are associated with this behavior. However, the only types of attitudes that have been investigated are attitudes about one's body (for review, see Ben-Tovim & Walker, 1991). Attitudes toward the target behavior (e.g., Fishbein & Ajzen, 1975) have not been investigated as a predictor of binge eating, so the degree to which binge eating is under attitudinal control is unknown at present. Thus, although attitudinal approaches to primary prevention of binge eating among adolescents and young adults may be theoretically feasible, the absence of empirical evidence showing a relation between attitudes and behavior in this domain dampens the potential enthusiasm for such an approach.

Summary

Little is known about the precise relations between attitude and the health behaviors we address in this article. When attitudes have been studied, attitude and behavior usually have not been measured prospectively over time in a way that would reveal predictive precedence of one variable over the other (e.g., Bentler & Speckart, 1981). We measured binge eating, alcohol use, drunk driving, cigarette smoking, and illicit drug use behaviors and attitudes in five different groups sampled from populations in which these problem health behaviors are relevant. Although there are many other variables relevant to the study of attitude–behavior relations (e.g., Fazio & Williams, 1986; Madden, Ellen, & Ajzen, 1992; Stacy, Widaman, & Marlatt, 1990), the only relevant variables available across each of the present studies were measures of attitude and behavior. As stated earlier, the investigation of the predictive relations between attitude and health behavior is important in its own right, especially when a range of different health behaviors are investigated prospectively. Furthermore, many health-promotion interventions using attitude-change strategies have assumed implicitly that attitudes have direct effects on behavior, consistent with the predictive models we evaluated.

General Method

In each study reported below, we measured attitude and behavior prospectively and used covariance structure analysis (e.g., Bentler, 1989; Bentler & Speckart, 1981; Bollen, 1989) to investigate the predictive precedence of the two primary variables. We report results based on maximum likelihood estimation. This form of estimation has been found to be relatively robust to departures in multivariate normality (e.g., Huba & Harlow, 1987), but we also evaluated each of the covariance structure models using at least one other method of estimation. We evaluated the statistical significance of paths using chi-square difference tests and critical ratios; the overall goodness of fit of the models was evaluated primarily through use of the nonnor-

study 1: binge eating

Method

Subjects. Respondents were 260 undergraduate female college students who participated in the study for extra credit in introductory psychology classes. Although 241 subjects completed all three waves of measurement and provided complete data, only the subjects who participated at all waves and who indicated they binge ate at some time in the past year (N = 144) were included in data analysis. We sampled only women because this problem health behavior generally is much more frequent in women than in men.

Procedure. The survey was given at three different times, separated by 2-week intervals. Respondents completed questionnaires at predesignated times in a classroom, group-testing situation. Questionnaire identification numbers were used to allow for matching of questionnaires across waves; these numbers were self-generated by the subjects according to a previously pilot-tested protocol that ensures a high level of matches (95% or more) over a short period. The anonymity of the questionnaire was emphasized both by the administrator and in written statements in the questionnaire. Previous research has shown that if anonymity is guaranteed fully, valid responses to socially proscribed behaviors are likely even among young adolescents providing self-reports of drug use (Murray & Perry, 1987). Strong assurances of anonymity appear to be as effective as are bogus pipeline procedures in studies of consummatory behavior (Murray & Perry, 1987).

Measures of behavior. The behavioral measures at each measurement asked respondents to report on their binge eating in the past 2 weeks. Before answering the binge-eating questions, respondents were asked to read a common definition of binge eating: "Binge eating is the rapid consumption of a large amount of food in a discrete period of time, usually less than two hours." For this behavior, 18 activities were
assessed that characterize the behavior, consistent with criteria from the
*Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.;
*DSM-III-R*; American Psychiatric Association, 1987) and frequently
used definitions (Katzman & Wolchik, 1984; Polivy et al., 1984). These
items were consistent with most criteria of binge eating based on these
sources, but *DSM-III-R* criteria that refer more specifically to bulimia
were omitted (e.g., dieting and purging). Thus, in our study, binge
eating was used as a more general construct than bulimia per se. Most
items were scored from 1 to 7, with frequency items anchored by not at
all (1) and every day (7). The binge items assessed the number of days
respondents: binge ate, ate large amounts of food while feeling
compelled to do so, were out of control in their binge eating, hid binge
eating from others, could not stop eating voluntarily, ate an extreme
amount of a single type of food, consumed more than 1,200 calories
per binge, ate much more than needed beyond satisfying hunger, ate
much more than typical for body size, ate high-caloric and easily
ingestible food, felt depressed after binge eating, kept eating until they
thought they would explode, ate to the point of feeling sick, ate a large
amount of food when not hungry, felt food controlled their life, and ate
much more rapidly than most people ever eat. An additional item
asked respondents how much food they ate very rapidly when they
binge ate, coded from 1 (none) to 7 (a very large amount). A self-rating
item (see Stacy, Widaman, Hays, & DiMatteo, 1985) assessed how
respondents rated themselves regarding their binge eating, from 1
(non-binge eater) to 8 (very heavy binge eater).

To organize the binge items into factors, we composed three
indicators of binge eating by randomly assigning each of the aforemen-
tioned binge items to one of the indicators, resulting in three indicators
composed of simple sums of 6 items each. We conducted a preliminary
study to evaluate the construct validity of these measures. In that
study, the binge-eating measures were found to show adequate levels
of item convergence and discrimination when thorough multitrait-
multimethod procedures were used (Stacy & Saetormoe, 1987). For
example, binge-eating indicators did not load on other behavioral
factors (dieting and alcohol use), all binge-eating loadings were
substantial (above .81), and none of the potential assessment method
factors appeared to bias the results.

**Measures of attitude.** Attitude at each time of measurement was
assessed with three indicators that each were simple sums of two items.
The items composing this scale were introduced with the statement
"Your binge eating in the next four weeks is": followed by six 7-point
bipolar adjective items ranging from extremely good to extremely bad,
extremely beneficial to extremely harmful, extremely rewarding to extremely
punishing, extremely pleasant to extremely unpleasant, extremely enjoyable
to extremely unenjoyable, and extremely favorable to extremely unfavor-
able. These measures are based on the recommendations of Ajzen and
Fishbein (1980).

**Cross-lagged structural models.** All of the models we tested used the
same measurement model, in which the scale of measurement was
determined by fixing T1 factor variances at 1.0 and imposing equality
constraints on loadings of identical indicators of the same construct
measured at the three different times. In addition, the measurement
model specified covariances among unique scores of identical indica-
tors measured across the three times. These procedures are consistent
with those of Joreskog (1979).

**Results**

The initial, structurally saturated model specified all four
possible predictive paths from T1 attitude and binge factors to
T2 attitude and binge factors. An analogous set of four paths
was estimated among T2 and T3 attitude and binge factors and
among T1 and T3 attitude and binge factors. Covariances

between same-wave factors at T1 and same-wave residual
factor covariances at T2 and T3 also were freely estimated. We
used the chi-square value for this initial model (\( \chi^2 \) \( [110, N = 144] = 144.98, p = .01 \)) in model comparisons with more-
restricted models. Thus, the paths in the initial model were
tested for statistical significance by deleting paths one at a time
from the initial model and evaluating the decrease in fit from
the initial model in single-degree-of-freedom chi-square differ-
ence tests (cf. Bentler & Speckart, 1981). Using this proce-
dure, all nonsignificant (\( p < .05 \)) paths, factor covariances,
and factor residual covariances were deleted from the initial
model, deriving the final model. This final model (\( \chi^2 \) \( [118, N = 144] = 154.97, p = .01 \)) fit the data well regarding practi-
cal indices of fit (NNFI = .99; NFI = .96). An alternative
estimator appropriate for relatively small samples, using ellip-
tical distribution theory (Shapiro & Browne, 1987), yielded
identical results regarding significance tests of alternative
paths.

No single path, factor covariance, or factor residual covari-
ce could be added to this final model to increase its fit
significantly, nor could any single estimate in the final model be
omitted without resulting in a significant decrease in model fit.
In a more global test, the final model was not significantly
different in fit from the initial model (\( \chi^2 \) \( [8, N = 144] = 9.98, p > .05 \)). The only significant cross-lagged path in the final
model was from T1 behavior to T2 attitude. In addition,
covariances between T1 attitude and behavior factors and
between T3 attitude and behavior factor residuals were nonsig-
nificant. The final model is shown in Figure 1, which presents
the standardized structural parameter estimates and residual
variances. Standardized factor loadings in the measurement
model all were statistically significant (all \( p < .001 \)) and were
of adequate size, ranging from .71 to .96 for attitude and from
.96 to .98 for binge-eating. These moderate to large loadings
indicated that these indicators were measured with good
internal consistency; they were well above the minimum
loading sizes recommended prior to interpretation in factor
analysis (e.g., Gorsuch, 1983).

**Study 2: College Alcohol Use**

**Method**

**Subjects.** Respondents were 356 male and female undergraduate
college students enrolled at a small West Coast university. Of the total,
334 respondents provided complete data and completed both waves of
measurement. A subsample of respondents who indicated that they
had drunk at least some alcohol in the previous year was selected for
analysis (\( N = 270 \)). The students received extra credit in an introduc-
tory-level psychology course for their participation in the study. These
data were part of a larger study on alcohol use (Stacy, Widaman, &
Marlatt, 1990). In the previous study, we did not examine a model in
which behavior could predict attitude over time. Because the present
cross-lagged structural model, which is parallel to the other models
analyzed in this article, was not analyzed in the previous study, it is
appropriate to report these analyses here.

**Procedure.** The procedure was identical to the one reported in
Study 1, except that we assessed each subject at two different times,
separated by a 4-week interval. Anonymity of responses was again
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Figure 1. Final structural equation model and standardized maximum likelihood estimates for binge eating. (Large circles designate latent constructs. Small circles depict residual variances of factors. Path coefficients are depicted with single-headed arrows. Correlations between factors or factor residuals are depicted with double-headed arrows. Significance levels are based on critical ratios on unstandardized maximum likelihood estimates [*p < .05; **p < .01; ***p < .001].)

Figure 2. Standardized factor loadings ranged from .28*** to .80*** for binge eating at Time 1, .59*** to .36 for binge eating at Time 2, and .30 for binge eating at Time 3. For attitudes, the loadings ranged from .60*** to .76*** for attitudes at Time 1, .21* to .61 for attitudes at Time 2, and .42 for attitudes at Time 3.

Measures. Measures of attitude were identical to those outlined in Study 1, but were worded in terms of alcohol use. That is, subjects responded to identical semantic differential attitude items but reported attitudes in terms of "your drinking alcohol in the next four weeks." Alcohol-use measures were constructed to assess the general extent (i.e., both quantity and frequency) of alcohol use during the past 4 weeks. The first indicator of alcohol use was the sum of two 7-point scales, closely modeled after scales used by Bentler and Speckart (1979, 1981). Both scales assessed frequency of use; one had endpoints of every day and not at all, and the second scale had endpoints of extremely frequently and never. The second indicator used an 8-point rating scale on which each respondent was instructed to classify himself or herself into 1 of 8 drinker categories (very heavy drinker, heavy drinker, fairly heavy drinker, moderate drinker, fairly light drinker, light drinker, very light drinker, and nondrinker). The third indicator was a quantity-frequency, or QF, index in which quantity and frequency of typical use (number of drinks consumed in previous month, based on typical quantity consumed on days the subject drank) was summed with greatest use (greatest number of drinks the subject consumed multiplied by the number of days the subject drank this greatest amount). A thorough multitrait-multimethod assessment of similar alcohol indicators has demonstrated their convergent and discriminant validity (Stacy et al., 1985). In addition, Stacy et al. found evidence that method effects, such as general self-report biases, were not strong influences on this type of data.

Cross-lagged structural models. The model construction and evaluation in this study were identical to that outlined in Study 1, except that this model involved a two-wave design.

Results

The initial, structurally saturated model specified all four possible predictive paths from T1 attitude and alcohol factors to T2 attitude and alcohol factors. Covariances between same-wave factors at T1 and same-wave residual factor covariances at T2 also were freely estimated. We used the chi-square value for this initial model ($\chi^2 [46, N = 270] = 73.40, p < .01$) in model comparisons with more-restricted models, using the same model testing and parameter trimming procedures as reported in Study 1. Only one path, from T1 behavior to T2 attitude, was nonsignificant using this procedure, and this path was eliminated to derive the final model. The final model ($\chi^2 [47, N = 270] = 74.98, p < .01$) fit the data well according to practical indices of fit (NNFI = .98; NFI = .97). Elliptical theory and arbitrary distribution theory estimation (Bentler, 1989) led to the same final model. The final model did not differ significantly from the initial model. The standardized structural parameter estimates for the final model are provided in Figure 2. Standardized factor loadings ranged from .28*** to .80*** for binge eating at Time 1, .59*** to .36 for binge eating at Time 2, and .30 for binge eating at Time 3. For attitudes, the loadings ranged from .60*** to .76*** for attitudes at Time 1, .21* to .61 for attitudes at Time 2, and .42 for attitudes at Time 3.
Study 3: Alcohol Use and Drunk Driving Among DUI Offenders

Method

Subjects. Respondents were 175 men who had been convicted of driving under the influence (DUI) of alcohol and who were participating in an educational program mandated by the state of California. Because all of the subjects drank alcohol and had engaged in DUI in the past, no subjects were removed from the analysis. Of this sample, 164 respondents completed both waves of measurement. Respondents were paid $5.00 to complete the questionnaire, which was completely voluntary and anonymous.

Procedure. The procedure was identical to the one described in Study 2. Subjects again were assessed at two different times, separated by a 4-week interval. No subjects completed the program before the final assessment. Respondents completed questionnaires on a voluntary basis after regular driver-education program meetings, in a classroom setting. Anonymity of responses was again thoroughly emphasized, but respondents were further assured that their participation in the study had nothing to do with the education program and that no one, including the program staff, had any way to discover their responses.

Measures of alcohol use behavior and attitude. Three indicators were developed for each latent variable. Measures of attitude toward alcohol use were identical to those outlined in Study 2, except that one of the three attitude indicators contained only one item because only five attitude items were used in the questionnaire. Alcohol-use measures included the three indicators used in Study 2, using the same frequency, rating, and QF methods of measurement; similar alcohol-use indicators were validated by Stacy et al. (1985).

Measures of DUI behavior and DUI attitude. Attitude toward driving under the influence of alcohol was assessed with a single bipolar item that asked respondents to answer the following question on a scale coded from 1 (extremely unfavorable) to 7 (extremely favorable): "Your attitude toward or feeling about your driving after drinking in the next month is?" This item is in the form of one of the alternative methods of measuring attitude suggested by Ajzen and Fishbein (1980). DUI behavior was measured by three items. One item asked respondents how often they drove after drinking alcohol in the past month, coded from 1 (not at all) to 7 (every day). A second item asked respondents how often they drank at least three drinks right before driving in the past month, coded on the same 7-point scale. The third item asked respondents to rate what kind of drinker they were when they drove after drinking in the last month, coded from 1 (nondrinker) to 8 (very heavy drinker).

Cross-validated structural models. Two different domains of attitude—behavior relations (DUI and alcohol use per se) were examined in two different series of models. For the alcohol-use domain, the models we tested used the same model construction and evaluation procedures as in Studies 1 and 2. For the DUI domain, the behavior factor at T1 and T2 represented three indicators, as with the aforementioned alcohol factor, but the attitude factors at both times were composed of a single indicator, consistent with a standard path-analytic specification (e.g., Bentler, 1989). The model-evaluation procedure for the DUI domain was the same as the procedure used in the alcohol-use domain and in Studies 1 and 2.

Results

Alcohol Use. The chi-square values for the initial, saturated structural model ($\chi^2$ [46, $N = 164$] = 53.44, $p = .21$) were employed in model comparisons with more-restricted models, using the same model-testing and parameter-trimming procedures as reported in the previous studies. The two cross-lagged paths and the covariance between the factor residuals at T2 were found to be nonsignificant. These three estimates were omitted to derive the final model. The final model ($\chi^2$ [49, $N = 164$] = 57.68, $p = .19$) fit the data very well using practical indices of fit (NNFI = .99; NFI = .97). The final model did not differ significantly from the initial model in terms of model fit, and the significance of paths did not change when we evaluated the models with alternative (elliptical and arbitrary distribution) estimators. Standardized structural parameter estimates for the final model are reported in Figure 3. Standardized factor loadings ranged from .81 to .97 for attitude and from .89 to .96 for alcohol use (all $ps < .001$).

Driving under the influence of alcohol. The initial model was structurally saturated, as in the initial model for alcohol use. The chi-square value for this initial model ($\chi^2$ [15, $N = 164$] = 50.00, $p < .001$) was to be used in model comparisons with more-restricted models, but more-restricted models could not be estimated, because of linear dependencies in estimation. Even when a model is mathematically identified, such dependencies can be a product of "empirical underidentification" (resulting from various peculiarities in the data; Rindskopf, 1984). However, the structurally saturated model did not contain any dependencies or estimation problems, and the statistical significance of parameter estimates therefore could be evaluated on the basis of z-tests from this model (instead of model-trimming procedures). Neither of the cross-lagged paths, from attitude to behavior or from behavior to attitude, was significant at $p < .05$ according to these tests. Standardized structural parameter estimates from this model are provided in Figure 4. Standardized factor loadings on DUI behavior ranged from .70 to .95 and each was
statistically significant (all ps < .001); because it was a single indicator, DUI attitude had no factor loadings. This model fit the data somewhat less well than did the preceding final models (NNFI = .92; NFI = .94). Use of the alternative estimators did not change the pattern of significance of structural paths.

Study 4: Adolescent Smoking

Method

Subjects. Respondents were 199 male and female 11th-grade Canadian high-school students who indicated they had smoked at least once in their lives. These students constituted a subsample of a larger sample of students involved in a longitudinal study of adolescent smoking described by Flay et al. (1985).

Procedure. We assessed each subject at two different times, separated by approximately 12 months. Respondents completed questionnaires in regular high school classrooms. Confidentiality, but not anonymity, of responses was emphasized. A number of studies have indicated that self-reports of cigarette use among adolescents are reasonably valid as long as certain safeguards are present during questionnaire administration (e.g., Bauman & Dent, 1982; Evans, Hansen, & Mittelmark, 1977; Murray & Perry, 1987; Peache et al., 1984). For example, Murray and Perry recommended that pipeline methods (cf. Jones & Sigall, 1971), which involve obtaining biological specimens, should be used to increase the validity of self-reports in adolescents when anonymity cannot be guaranteed. Thus, we used a pipeline procedure in which carbon monoxide (CO) measures were taken from each student to increase the validity of self-reports of cigarette use. Stacy, Flay, et al. (1990) found that this procedure yielded an adequate level of convergent validity between self-reported cigarette use and CO measurement in adolescents from the same population of subjects as sampled in this study.

Results

We used the initial, structurally saturated model ($\chi^2 [46, N = 199] = 132.42, p < .001$) in model comparisons with more-
restricted models, using the procedures reported in the previous studies. One cross-lagged path, from T1 attitude to T2 smoking, was found to be nonsignificant; this path was omitted to derive the final model. The final model \( \chi^2 [47, N = 199] = 132.50, p < .001 \) fit the data well according to practical indices of fit (NNFI = .96; NFI = .95). The final model did not differ significantly from the initial model in terms of model fit. Standardized structural parameter estimates for the final model are reported in Figure 5. Standardized factor loadings ranged from .84 to .91 for attitude and from .90 to .97 for smoking (all ps < .001). Model evaluations using alternative (elliptical and arbitrary distribution) estimators showed the same pattern of significance of structural paths.

Study 5: Illicit Drug Use

Method

Subjects. Respondents were 706 male and female young adults who were participants in a larger study on drug abuse etiology and consequences. The predominantly White, middle-class sample had an average age of 17.9 years at the first time of measurement used in this study, which was the third wave of assessment in the larger study (Newcomb & Bentler, 1988). The subjects were recruited for participation in the larger study from representative junior high schools from Los Angeles County.

Procedure. We assessed each subject at two different times, separated by approximately five years. Respondents completed a self-administered questionnaire at both times of measurement. Although the data were not anonymous, the complete confidentiality of responses was emphasized to respondents, who were informed that their responses were protected by a federal certificate of confidentiality.

Measures of attitude and behavior. The two measures of attitude asked respondents to indicate what they thought about smoking marijuana or taking PCP, on scales from 1 (terrible idea) to 5 (great idea). These measures were found to show an adequate degree of reliability in previous research as shown in high loadings on their respective factors (Bentler & Speckart, 1979). The measures of illicit drug-use behavior assessed the frequency of use of a variety of different drugs over the past 6 months on scales from 1 (never) to 7 (more than once a day). Although we assessed use of a variety of different drugs, we restricted the primary analyses to marijuana use because of results from some preliminary analyses described below.

Cross-lagged structural models. The model-evaluation procedures were the same as those used in the previous studies. However, the construction of the primary model was different because of some results from a preliminary analysis. As outlined above, attitude measures were available only for marijuana and PCP use. In the preliminary analysis, we attempted to model attitude-behavior relations between a general factor of drug-use attitudes, representing the

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**Figure 5.** Final structural equation model and standardized maximum likelihood estimates for adolescent smoking. (Large circles designate latent constructs. Small circles depict residual variances of factors. Path coefficients are depicted with single-headed arrows. Correlations between factors or factor residuals are depicted with double-headed arrows. Significance levels are based on critical ratios on unstandardized maximum likelihood estimates \[ \ast p < .05; \ast\ast p < .01; \ast\ast\ast p < .001 \].)
common variance of marijuana and PCP attitudes, and more general
drug-use behavior (a variety of different drugs). However, on the PCP
measures only a few respondents indicated values above the minimum.
In addition, the preliminary model did not yield any significant paths
between the general factors, although it did support the significance of
some paths between the marijuana indicators of these factors. Because
only marijuana indicators had significant effects, and because the
measurement of PCP was problematic, we only report the analysis of a
model that was restricted to the associations between marijuana
behavior and attitude indicators over time. In this primary model,
attitude toward marijuana use is represented by a single indicator,
rather than as a factor, and marijuana behavior also is represented by
a single indicator. Otherwise, the model was constructed similarly to the
models in the previous studies. To maintain compatibility with the
other studies, only subjects who had smoked marijuana at least once at
the initial time of measurement were used in the analysis (N = 357).

Results

The primary path model just described for marijuana use
estimated paths from T1 attitude and behavior indicators to T2
attitude and behavior indicators, as well as a covariance
between the T1 indicators and a covariance between the T2
residuals of the predicted indicators. Because this initial model
was completely saturated (i.e., no additional parameter esti-
mates could be made in the model), it fit the data perfectly ($\chi^2$
$[0, N = 357] = 0$). This model was used in model comparisons
with more-restricted models, using the procedures reported in
the previous studies. One cross-lagged path, from T1 mari-
juana use to T2 attitude toward marijuana, was found to be
nonsignificant; this path was omitted to derive the final model.

The final model ($\chi^2 [1, N = 357] = .66, p = .42$) fit the data
well according to practical indices of fit (NNFI = 1.00;
NFI = 1.00). The final model did not differ significantly from
the initial model in terms of model fit. Standardized structural
parameter estimates for the final model are reported in Figure
6. Because the model used only single indicators rather than
factors, there were no factor loadings. Model evaluations using
alternative (elliptical and arbitrary distribution) estimators
showed the same pattern of significance of structural paths. In
several supplementary analyses, adjustments of the assumed
amount of error variance in the single-indicator constructs did
not change these results.

Discussion

Many intervention programs include attitude change as an
important element of health–behavior change. In addition,
previous research, as well as most of the present studies, has
shown significant cross-sectional correlations between atti-
tudes and behavior, suggesting that attitudes may be important
precursors of health-related behavior. However, the most
general conclusion from the present longitudinal results is
that, when stabilities and cross-sectional correlations were
taken into account, attitude was neither a consistent nor strong
predictor of the health behaviors we assessed. Although
attitude did not have general or strong effects, it did predict
certain specific health behaviors in two of the six models we
analyzed, suggesting that attitude still may be of some impor-
tance.

Figure 6. Final structural equation model and standardized maximum likelihood estimates for marijuana
use. (Rectangles represent measured-variable, or single-indicator, constructs. Small circles depict residual
variances of constructs. Path coefficients are depicted with single-headed arrows. Correlations between
constructs or construct residuals are depicted with double-headed arrows. Significance levels are based on
critical ratios on unstandardized maximum likelihood estimates [*p < .05; **p < .01; ***p < .001].)
The failure of attitude to be consistently predictive among subjects who have a minimal degree of behavioral experience does not imply that affective or cognitive approaches are not important in health behavior. On the contrary, the lack of direct effects of attitude in most of our analyses suggests that other approaches involving affective or cognitive constructs should be considered as viable alternatives to the direct-effect attitude model we investigated. We now outline several of the possible reasons why attitude may not be a consistent, direct-effect predictor of health behavior.

First, it is possible that attitude toward health behavior is useful empirically, theoretically, and practically only in the context of a more general theory than that implied by our investigation of direct-effect paths from attitude to behavior. More general theories, such as reasoned action (Fishbein & Ajzen, 1975), planned behavior (Ajzen & Madden, 1986; Madden et al., 1992), attitude accessibility (Fazio & Williams, 1986), or social–cognitive approaches to attitude (e.g., Wyer & Srull, 1989) contain more complex predictions than the simple, direct-effect paths we were able to investigate. Future research on attitudes toward health behavior may find attitude more generally explanatory in the context of one of these formal theories. If so, health–behavior interventions may be improved by an acknowledgment of the complexity of attitude effects on behavior as well as by the explicit use of propositions from these theories in programs of change. Although some health–behavior interventions use empirically supported, theoretically driven programs of attitude–behavior change, many others do not go beyond a simple direct-effect model of attitude effects.

There are other available interpretations. Our study used one of the most typical definitions of attitude, which was represented as a single bipolar affective predisposition toward performing a behavior. In this approach, a person cannot hold strong positive and negative attitudes simultaneously without responding to the attitude measure in the middle range of the single attitude continuum. This approach assumes that positive and negative affect toward a behavior converge or balance out in a type of summary of affective tendencies, which then influences behavior (or a mediator of behavior, e.g., intention; Fishbein & Ajzen, 1975). One example of such an approach regarding health behavior has been outlined by Akers (1992), in which the stronger affective tendencies win out in the overall attitudinal predisposition toward a behavior. Obviously, people can answer attitude questions in this way, because the bipolar construction of attitude scales is likely to force some consideration of both positive and negative affect when answering the questions. However, this does not imply necessarily that attitude is a unitary entity that is represented in this way in the mind. In some perspectives, affect is not a unitary summary of positive and negative qualities of a behavior or object, but is instead two separate dimensions of positive and negative affect. These perspectives are in agreement with findings showing that affect often appears as two dimensions of positive and negative (e.g., Diener & Emmons, 1984; Gotlib & Meyer, 1986; Watson, 1988) and with evidence that each of these dimensions has different neurophysiological substrates (Baker, Morse, & Sherman, 1987; Wise, 1988).

The two-dimensional view of affect can be translated into a two-dimensional view of affective predispositions in health behavior. In some health-behavior research, a two-dimensional view has been used to construct separate positive and negative value × expectancy scales representing both belief and affective elements of behavioral tendencies (Stacy, Dent, et al., 1990; Stacy, Widaman, & Marlatt, 1990). Although these constructs have been referred to as expectancies, they could be considered to be quasi-attitudinal constructs because they include affective components. However, instead of merely predicting attitude, in accord with traditional attitude perspectives (e.g., Fishbein & Ajzen, 1975), positive expectancies had a unique and superior predictive effect on behavioral intentions (Stacy, Widaman, & Marlatt, 1990). In addition, positive and negative expectancies equally and strongly predicted attitude, yet positive and negative expectancies were only modestly intercorrelated. Other recent studies, using more traditional assessments of outcome expectancies, also have found that general factors of expectancies about positive and negative outcomes were correlated only weakly, or nonsignificantly (Leigh & Stacy, 1993; Stacy, MacKinnon, & Pentz, 1993), providing further evidence that these constructs are not simply cognitive elements of opposite poles of attitude.

Empirical support of the two-dimensional views of affect and expectancies suggests that traditional attitude constructs may need to be complemented, if not replaced, by alternative affective and cognitive constructs in some areas of health-behavior research. It is possible that attitudes are merely judgments that people sometimes make but that do not represent the underlying source of judgments or behavior. This source may be somewhat less unitary or abstract than attitude and may be better represented by sets of anticipated outcomes or expectancies. If so, then attitude, as traditionally defined and measured in the present studies, would not be expected to be a strong predictor of behavior. Even though this perspective is only one of several different ways to interpret the lack of strong, general effects of attitude on health behavior, the previous success of expectancies as long-term predictors of some health behaviors (Stacy, Newcomb, & Bentler, 1991) suggests further that the expectancy framework may be a viable complement (or alternative) to traditional attitude frameworks.

Although alternatives to attitude may be needed to more adequately reflect affective and cognitive influences on health behavior, attitude was predictive of health behavior in two of the models we analyzed (college alcohol use and community marijuana use). Past behavior was a nonspurious predictor of attitude in two other models (college alcohol use and community binge eating). A third interpretation of the pattern of results is that the nature of the specific behaviors, the population sampled, or the time interval used in these models may have contributed to the obtained differences. In other words, attitudes may be more generally important than we found, but something correlated with the particular analyzed model moderated the predictive effects of attitude on health behavior. Although it is unclear what specific aspects of the populations or the health behaviors could have acted as moderators of attitude–behavior relations in the present studies, we offer some speculations about potential moderators. It is possible...
that alcohol and marijuana use in mostly nonproblematic populations (college and community populations) are under greater volitional control; for most people sampled from these populations, these behaviors probably are not particularly addictive or compulsive. On the other hand, the literature on binge eating and smoking suggests that these behaviors are often quite compulsive or addictive in quality, even among otherwise nonproblematic populations (e.g., college or high school students). Alcohol use in groups of drunk-driving offenders is by definition more problematic, and is likely to be more compulsive or addictive than alcohol use among college students. This framework would suggest that, among more problematic samples or behaviors, previous behavior (as an indicator of habit) would be a very strong predictor of future behavior, overriding any potential effects of attitudes. In fact, in the present models, past behavior was a stronger predictor of future behavior in the four instances in which attitude was not predictive, compared with the two instances in which attitude was predictive of health behavior. It also is possible that when behavior is particularly stable over time, it has a greater potential to influence attitudes, as found in our binge eating and smoking models. This effect could occur through stable and repeated self-perceptions (Bem, 1978) or other processes (Stacy et al., 1991).

Another feature of the models we analyzed that may moderate the predictive effects of attitude is the time interval used to evaluate attitude–behavior relations. In several theories, such as self-perception, cognitive dissonance, and attitude accessibility, the influence of attitudes and behavior on one another may be quite temporary and may not be captured by the moderate to extremely long time intervals assessed in our studies. However, there was no apparent correlation between stability of attitude–behavior relations in our studies and time interval. In fact, one of the only models to show a significant prediction of health behavior by attitudes was in the longest study, in which marijuana attitudes predicted marijuana use over a 9-year interval. Nevertheless, it is possible that much shorter time intervals (e.g., days instead of weeks, months, or years) would show a quite different pattern of findings. Although findings from very short interval studies would be of great theoretical interest, their applied importance is not readily apparent. Most attitude-change interventions in health behavior seek to make long-term changes in behavior.

Further research may delineate more specifically what features of the population and specific behavior are responsible for differences in attitude–behavior relations in health. The potential moderators mentioned earlier should be considered for use in future research on attitudes in health behavior. The investigation of such moderators may reveal that attitudes have a relevant degree of predictive utility under certain sets of specific conditions. If so, then developers of prevention programs may be better able to determine the conditions under which an attitude-change program may be most successful. On the other hand, future research may confirm the alternative view that attitudes are too limited in their predictive effects to be useful in health–behavior interventions. Such findings would provide further motivation for the use of alternative affective and cognitive constructs.


