Journal of Studies on Alcohol. 60.1 (Jan. 1999): p90.

The Modeling of Alcohol Consumption: A Meta-Analytic Review

R. Lorraine Collins and Brian M. Quigley

ABSTRACT. Objective: Modeling, or the imitation of another's behavior, has been proposed to influence alcohol consumption. The literature dealing with effects of modeling on alcohol consumption was reviewed using meta-analytic procedures in order to determine the strength of the modeling effect and the variables that moderate the effect. Method: Thirteen studies were examined in which participant's alcohol consumption in the presence of a high consumption model was compared to a low consumption model condition or a no-model condition. Analyses were conducted for the four dependent measures utilized in the literature: amount consumed, blood alcohol concentration, number of sips taken and volume per sip. Mean effect sizes (d) were calculated for each dependent measure and moderator variables were examined. Results: Modeling had a significant effect on all four dependent measures, with the strongest effects being on amount consumed and blood alcohol concentration. In addition, analyses identified numerous variables that moderate the effect of modeling on alcohol consumption, including the drinking history of the participant, the drinking task used and the nature of the interaction between model and participant. Conclusions: Results indicated that modeling has a strong effect on alcohol consumption; however, several variables do mediate this effect. (J. Stud. Alcohol 60: 90-98, 1999)

IN 1975, Caudill and Marlatt published a study designed to determine whether social modeling had any influence on drinking behavior. Building on Bandura's (1969) social learning theory and research indicating that modeling influenced the acquisition and performance of a variety of social behaviors, Caudill and Marlatt created an analog research paradigm in which male, heavy social drinkers were exposed to male research confederates who modeled "heavy drinking," "light drinking" or a no-model Control condition during a wine-tasting task. The results indicated that participants exposed to a heavy-drinking model consumed significantly more wine than participants in the other two conditions. There was also a significant modeling effect for two other alcohol-related dependent variables, sip rate (total sips) and blood alcohol concentration. Thus began a new approach to examining social influences on alcohol intake. In subsequent research, Caudill and Marlatt's design was modified to vary aspects such as the characteristics of the confederate models and participants (e.g., gender, social status, ethnicity), and the nature of the interaction between the model and participants (e.g., warm vs cold).

In the only existent review of this research, Collins and Marlatt (1981) concluded that the research to date indicated "the existence of a powerful effect wherein an individual's consumption of alcohol will vary to match that of a drinking partner" (p. 235) and that the modeling effect occurred regardless of the study setting and moderating variables such as gender of the model. Although this review represented the state of the art in 1981, the conclusions were based on a qualitative rather than an empirical examination of a small number of published studies. In addition, Collins and Marlatt's review contained only a rudimentary analysis of the role of moderator variables. These limitations can now be rectified as we conduct a more extensive, empirical review of the published research on the modeling of alcohol consumption.

During the past two decades, researchers have developed meta-analysis as a tool for interpreting the meaning of cumulative research on a specific topic. As outlined by Schmidt (1992), meta-analysis can serve a number of important functions including assistance in identifying moderator variables and illustrating the relationships among variables. Meta-analysis allows one to overcome the limitations of a qualitative review by empirically examining the effects of a variable over a number of research studies. In the current review we used meta-analysis to examine the research on the modeling of alcohol consumption. Our review had two purposes: (1) to update the Collins and Marlatt (1981) review by considering studies published after 1980; and (2) to use an empirical procedure to estimate the strength of the modeling effect and to identify variables that moderate the modeling effect. We focused on the design of the modeling study (exposure to heavy-drinking model, light-drinking model, or no model) as well as moderator variables in three areas: characteristics of the situation (e.g., setting, type of alcohol), characteristics of the participants (e.g., age, drinking history) and characteristics of the model (e.g., gender, nature of interaction). Each of these areas was examined in the context of four commonly measured dependent variables: amount of alcohol consumed, blood alcohol concentration (BAC), sip frequency and sip volume. Of the four dependent variables, "amount consumed" was conceptualized as the main outcome variable, because it is the focus of much of the research on the modeling of alcohol intake and it is the most often used dependent measure in the research studies. This comprehensive examination of the research on the modeling of alcohol consumption should enhance our understanding of social influence processes in drinking.

Method

Search parameters

Database searches of PsycLIT from January 1974 to December 1996 were conducted using the key terms "modeling" and "alcohol or drinking." Of the 163 articles identified, those that dealt with the experimental manipulation of modeled drinking and its effects on alcohol consumption were examined. The reference lists of articles identified in this set were examined in order to obtain any references that were missed in the computerized search. The final set of studies identified consisted of 14 articles in which 16 studies were reported. Dissertation Abstracts was also searched from 1974 to 1996. Four dissertations examining social modeling and alcohol consumption were identified; one had been published in Collins et al. (1985), the remaining three were unpublished.

Inclusion of studies

Studies were included if they met three criteria. First, only articles published in refereed journals, edited books or unpublished dissertations were examined. Unpublished conference papers were not included. Second, the studies had to have manipulated the alcohol consumption of a model (heavy consumption model versus light consumption model or heavy consumption model versus no-model control condition) and measured the participants' subsequent consumption of alcohol. Third, only studies were included in which effect sizes could be calculated from the statistics reported in the article (i.e., means, standard deviations and sample size, or inferential statistics for the comparison between heavy and light model conditions).(1) Of the 14 articles identified, four (Caudill and Lipscomb, 1980; DeRicco and Garlington, 1977; DeRicco and Niemann, 1980; Garlington and DeRicco, 1977) did not provide adequate statistics for the calculation of effect sizes and were dropped from the subsequent analysis. We were able to obtain two of the three unpublished dissertations (Becotte, 1987, and Wilkins, 1980). Thus, 10 articles and two dissertations reporting 13 experiments were quantitatively reviewed (see Table 1).

TABLE 1. Study authors, sample sizes, effect sizes and confidence intervals for amount of alcohol consumed

Study	N	d	95% CI
Collins et al. (1985) Study I	26	−0.28	−1.05–0.49
Wilkins (1980)	24	0.28	−0.52–1.08
Chipperfield and Vogel-Sprott (1988)	26	0.33	−0.42–1.07
Lied and Marlatt (1979)	16	0.44	−0.56–1.43
Lied and Marlatt (1979)	16	0.52	−0.48–1.51
Reid (1978)	10	0.52	−0.74–1.78
Goldberg et al. (1982)	30	0.62	−0.11–1.35
Collins et al. (1994)	132	0.68	0.32–1.03
Cooper et al. (1979)	16	0.68	−0.32–1.69
Lied and Marlatt (1979)	16	0.73	−0.28–1.74
Cooper et al. (1979)	16	0.76	−0.26–1.77
Hendricks et al. (1978)	12	0.91	−0.28–2.10
Collins et al. (1985) Study II	54	1.03	0.46–1.59
Cooper et al. (1979)	16	1.07	0.02–2.12
Chipperfield and Vogel-Sprott (1988)	24	1.10	0.25–1.96
Hendricks et al. (1978)	12	1.13	−0.09–2.35
Wilkins (1980)	24	1.15	0.29–2.02
Collins et al. (1985) Study I	26	1.31	0.46–2.95
Becotte (1987)	16	1.42	0.33–2.52
Cooper et al. (1979)	16	1.43	0.33–2.53
Lied and Marlatt (1979)	16	1.87	0.69–3.04
Becotte (1987)	16	1.99	0.79–3.19
Watson and Sobell (1982)	64	2.14	1.53–2.75
Caudill and Marlatt (1975)	14	2.34	0.98–3.70
Caudill and Marlatt (1975)	14	2.42	1.04–3.80
Hendricks et al. (1978)	12	2.98	1.34–4.68
Reid (1978)	10	3.46	1.50–5.42

Effect size calculated

The effect size calculated was g, which represents the standardized difference between the heavy consumption model condition and the light consumption model (or in some cases the no-model control) condition. Because g tends to overestimate the population effect size with small samples, the effect size was converted to d (Hedges and Olkin, 1985). A positive d indicates that more consumption occurred in the high model consumption condition than in the low model consumption condition. In several of the studies analyzed, multiple effect sizes were retrieved from a single study. These multiple effect sizes were calculated when the comparison of high consumption model to control was crossed with other variables (e.g., gender of participant, setting, participant drinking history). This allowed, for example, an effect size to be estimated for male participants and a separate effect size to be estimated for female participants in the case of participant gender. This procedure results in stronger meta-analytic tests for moderating effects. Although independence of effect sizes is an assumption of meta-analysis (Hedges and Olkin, 1985), if one assumes that participants' responses in one condition did not influence participants' responses in other conditions multiple independent effect sizes can be retrieved from studies.

The homogeneity statistic calculated was Q which has a chi-square distribution of k - 1, where k is the number of effect sizes. A nonsignificant effect indicates homogeneity of effect sizes. All effect sizes and homogeneity statistics were calculated using DSTAT meta-analytical software (Johnson, 1989). Separate analyses were conducted for four separate dependent measures most commonly used in the literature: the amount of alcohol consumed by the participant, the BAC of the participant, the number of sips taken by the participant and the volume of alcohol ingested per sip.

Moderators coded

Based on the literature, a number of variables are predicted to moderate the relationship between model's behavior and participant's consumption. These variables can be divided into three general categories: characteristics of the situation, characteristics of the participants and characteristics of the models.

Design. There was one characteristic of study design that was coded as a moderator variable. The control group varied among studies. Some studies used a low consumption model as a control and some studies used a no-model control group. As this essentially changes the meaning of the effect size, the type of control group was coded as a moderating variable.

Characteristics of the situation. A number of characteristics of the experimental situation were identified. The type of alcohol (beer, wine, distilled spirits, or participant selects type) and the drink task (i.e., taste-rating task or ad lib drinking) were coded. Also coded were the three settings for the study: a laboratory setting, a laboratory designed to look like a natural bar or an actual bar. The amount of time allowed for participants to engage in drinking was coded into time frames of 15 minutes, 30 minutes or over 30 minutes. Whether the model was presented live to the participants or was presented on video also was coded. Two variables that were characteristics of the situation, but involved the participant and model, were coded. The first of these was coaction (see Hendricks et al., 1978). Studies were identified as involving coaction if the participant and model worked together on the drinking task. Other situations were: "audience facilitation" in which the model drank first, but was still present when the participant drank; or "participant alone" in which the participant viewed the model, but the model was not present when the participant consumed alcohol. The other situational characteristic of the study that involved the participants was the gender make-up of the participant-model dyad. The category was coded as participant-model same gender or different gender.

Characteristics of the participants. Five characteristics of the participants were coded from each study. The gender of the participants was coded into three categories: male, female, or a mixed gender sample. The age of the participants also was coded. Because of variability in the reporting of ages it was difficult to establish mutually exclusive categories; therefore, we coded age based on the minimum age of participants allowed in the study. These were coded into 18 years of age or older, 21 years of age or older, or minimum age of participants unable to be determined. The sample also was coded as a college population, a general population sample, or a sample of hospital patients. The drinking history of the participants was coded into light drinkers, heavy drinkers, mixed sample of light or heavy drinkers, or no information given regarding drinking history. The participants' family history of alcohol-related problems was coded family history positive (FH+), family history negative (FH-), or no information.

Characteristics of the models. Three characteristics of the model were coded. First, the gender of the model was coded as either male, female, or both male and female models used. Second, the nature of the participant-model interaction (see Caudill and Marlatt, 1975) was coded into four categories: model behaves warmly, model behaves coldly, no information regarding model behavior, or model and participant told not to interact. The third characteristic of the model coded was the social status of the model (see Collins et al., 1985). The coding categories used were status similar to participant, status lower than participant, status greater than participant, or not enough information available.

One of the authors and a research assistant performed the coding of the articles. Initial rater agreement was 89%. In the case of discrepancies, articles were re-examined and discussed, and following this process agreement was 100%.

Results

Amount of alcohol consumed

Overall effect size. Twenty-seven effect sizes were calculated out of the available articles (Table 1). Overall, the mean unweighted effect size was $d = 1.22$. The mean effect size weighted by sample size was $d = 0.97$, which Cohen (1988) defines as a large effect size. The confidence interval did not include zero, indicating a significant effect across studies (95% CI = 0.81-1.14). This indicates that participants in the high consumption model condition consumed more alcohol than those in the control condition. The studies were not homogeneous ([chi square] = 63.43, 26 df, p [is less than] .05), suggesting other variables moderate the effect of modeling on alcohol consumption.

Moderator analyses. Six moderating variables resulted in significant heterogeneity between groups as indicated by the significant [Q.sub.B] (Table 2). The [Q.sub.B] statistic identifies heterogeneity between groups much as an omnibus F indicates a difference between groups in ANOVA. The control group (light consumption model versus no model) used in the study showed significant between groups heterogeneity. Stronger effects were found when the comparison group was a no-model control group. As the 95% confidence intervals for these two groups did not overlap this difference is significant. Heterogeneity between groups also was evident for setting. Natural bar settings had the strongest effect, followed by laboratory setting, and then laboratory bar. However, all the confidence intervals overlapped. In addition, the coding for setting was perfectly correlated (r = 1.00) with coding for time of consumption task, which also was identified as a moderator. Because of this correlation it is difficult to determine if the moderating effect is due to setting or time of task. Participant drinking history also was a moderator. Unlike the other three groups, the 95% confidence interval associated with the effect size for light drinkers included zero, indicating a nonsignificant effect of modeled behavior on drinking in this group. Finally, nature of the interaction between participant and model was a moderator.(2) When the model was cold (i.e., unfriendly) the 95% confidence interval included zero, indicating a nonsignificant effect. Significant effects were found for the three other groups including the group in which participants and models were told not to interact. This finding suggests that, although lack of interaction does not inhibit modeling effects on drinking, unfriendly behavior can have an inhibiting effect on modeled drinking.

TABLE 2. Moderators of modeling effect on amount consumed

Variable and categories	[Q.sub.B]	k
Comparison	6.84([dagger])	
Light consumption model		22
No model		5
Setting	9.10(*)	
Laboratory		19
Laboratory bar		6
Natural bar		2
Task	7.60([dagger])	
Taste test		19
Ad lib drinking		8
Time of task	7.85(*)	
15 minutes		19
30 minutes		4
Over 30 minutes		4
Participant drinking history	9.44(*)	
Light drinkers		3
Heavy drinkers		13
Mixed light and heavy		9
Unknown history		2
Nature of interaction	17.63([double	

	dagger])	
Warm model		6
Cold model		2
Participant and model not to interact		14
Unknown		5

Variable and categories	d	95% CI
Comparison		
Light consumption model	0.88	0.70-1.05
No model	1.46	1.06-1.85
Setting		
Laboratory	1.19	0.97-1.42
Laboratory bar	0.70	0.66-0.94
Natural bar	1.38	0.32-2.44
Task		
Taste test	1.20	0.97-1.42
Ad lib drinking	0.74	0.50-0.97
Time of task		
15 minutes	1.19	0.97-1.42
30 minutes	0.71	0.44-0.97
Over 30 minutes	0.85	0.34-1.36
Participant drinking history		
Light drinkers	0.39	-0.14-0.92
Heavy drinkers	1.20	0.95-1.44
Mixed light and heavy	0.85	0.60-1.10
Unknown history	1.38	0.32-2.44
Nature of interaction		
Warm model	0.85	0.60-1.10
Cold model	-0.06	-0.71-0.60
Participant and model not to interact	1.34	1.07-1.61
Unknown	0.85	0.43-1.27

Variable and categories	[Q.sub.W]
Comparison	
Light consumption model	47.23([dagger])
No model	9.36
Setting	
Laboratory	36.69([dagger])
Laboratory bar	11.53
Natural bar	6.11
Task	
Taste test	36.69([dagger])
Ad lib drinking	19.14
Time of task	
15 minutes	36.69([dagger])
30 minutes	9.40
Over 30 minutes	9.50(*)
Participant drinking history	
Light drinkers	0.01
Heavy drinkers	33.23)[dagger])
Mixed light and heavy	14.50
Unknown history	6.11(*)

Nature of interaction	
Warm model	11.59
Cold model	1.12
Participant and model not to interact	31.31([dagger])
Unknown	1.77

(*) p < .05;

([dagger]) p < .01;

([double dagger]) p < .1301.

Blood alcohol concentration (BAC)

Overall effect size. The available statistics allowed the calculation of 12 effect sizes for the effect of modeling on BAC (Table 3). The overall unweighted effect size for BAC was d = 0.81. The weighted mean effect size was d = 0.70 (95% CI = 0.53-0.88), indicating that the individuals in the high consumption model condition were more intoxicated than those in the control condition. The studies were homogeneous as indicated by the nonsignificant chi square ([chi-square] = 19.24, 11 df, p = .057); however, the statistic neared significance, suggesting it may still be worthwhile to examine moderator effects.

TABLE 3. Study authors, sample sizes, effect sizes and confidence intervals for BAC

Study	n	d	95% CI
Wilkins (1980)	48	0.27	-0.30-0.84
Hendricks et al. (1978)	12	0.40	-0.74-1.55
Collins et al. (1985) Study II	54	0.43	-0.11-0.97
Chipperfield and Vogel-Sprott (1988)	26	0.51	-0.25-1.26
Lied and Marlatt (1979)	64	0.53	0.03-1.02
Collins et al. (1994)	132	0.63	0.28-0.98
Collins et al. (1985) Study I	52	0.63	0.07-1.19
Hendricks et al. (1978)	12	0.81	-0.37-1.98
Caudill and Marlatt (1975)	32	0.91	0.18-1.63
Chipperfield and Vogel-Sprott (1988)	24	0.93	0.09-1.78
Watson and Sobell (1982)	64	1.65	1.09-2.22
Hendricks et al. (1978)	12	2.02	0.63-3.40

Moderator analyses. Although the studies in the analysis were homogeneous, four moderators were detected (Table 4). The minimum age of participants was indicated as a moderator with a stronger effect found for studies in which the minimum age of participants was 18 years of age than for those in which the minimum age was 21 years. However, the confidence intervals did overlap. The setting for the study and the type of task were also nonhomogeneous. A larger effect size was indicated in the laboratory than in a laboratory bar, and a larger effect size was indicated for the taste test task than for ad lib drinking. However, as setting and task in this analysis were perfectly correlated, it is unclear which variable is producing the results. In addition, the comparison condition was identified as a moderator. Again, a stronger effect was indicated when a no-model control group was used than when a light consumption model was used; however, there was only one effect size in the no-model control category.

TABLE 4. Moderators of the effect of modeling on BAC

Variable and categories	[Q.sub.B]	k
Comparison	11.88([double dagger])	
Light consumption model		11
No model		1
Setting	4.92(*)	
Laboratory		8
Laboratory bar		4
Task	4.92(*)	
Taste test		8
Ad lib drinking		4
Minimum age of participants	7.83([dagger])	
18 years		6
21 years		6

Variable and categories	d	95% CI	[Q.sub.W]
Comparison			
Light consumption model	0.60	0.42-0.79	7.36
No model	1.65	1.09-2.22	0.00
Setting			
Laboratory	0.93	0.66-1.19	12.93
Laboratory bar	0.53	0.29-0.76	1.39
Task			
Taste test	0.93	0.66-1.19	12.93
Ad lib drinking	0.53	0.29-0.76	1.39
Minimum age of participants			
18 years	1.12	0.77-1.47	9.51
21 years	0.56	0.35-0.76	2.35

(*) $p < .05$;

([dagger]) $p < .01$;

([double dagger]) $p < .001$.

Number of sips

Overall effect size. Thirteen effect sizes were retrieved from the literature (Table 5). The unweighted mean effect size for the dependent measure of number of sips participants took from the glass was d = 0.70. The weighted effect size was d = 0.34, with a 95% confidence interval that did not include zero (95% CI = 0.14-0.54). The effect sizes were heterogeneous ([chi-square] = 24.76, 12 df, p [is less than] .05), suggesting the presence of moderating variables.

TABLE 5. Study authors, sample sizes, effect sizes and confidence intervals for number of sips taken

Study	N	d	95% CI
Collins et al. (1985) Study II	54	0.00	-0.53-0.53
Lied and Marlatt (1979)	64	0.00	-0.49-0.49
Watson and Sobell (1982)	64	0.00	-0.49-0.49
Goldberg et al. (1982)	30	0.08	-0.63-0.80
Wilkins (1980)	48	0.31	-0.26-0.88
Cooper et al. (1979)	16	0.60	-0.40-1.60
Cooper et al. (1979)	16	0.60	-0.40-1.60
Caudill and Marlatt (1975)	32	0.71	-0.00-1.42
Hendricks et al. (1978)	12	0.74	-0.43-1.91
Hendricks et al. (1978)	12	0.91	-0.28-2.10
Cooper et al. (1979)	16	1.13	0.07-2.18
Hendricks et al. (1978)	12	1.38	0.11-2.62
Cooper et al. (1979)	16	2.66	1.31-2.18

Moderator analyses. Three moderators were identified (Table 6). There were differences based on the type of alcohol consumed. A larger effect size was associated with wine than with beer. The largest effect based on gender was for female participants. In other words, the difference in the number of sips taken between the high consumption model condition and light consumption model condition was greater for female than for male or for mixed-gender participant samples. In addition, the gender of the dyad was a moderator. When participants were of a different gender than the model the difference in the number of sips taken between the high consumption model condition and the control condition was significantly greater than when the model and participant were of the same gender.

TABLE 6. Moderators of modeling effect on number of sips

Variable and categories	[Q.sub.B]	k
Type of alcohol	7.18(*)	
Beer		3
Wine		9
Distilled spirits		1
Gender of dyad	11.18([double dagger])	
Same gender		11
Different gender		2
Participant gender	7.73(*)	
Male subjects		10
Female subjects		2
Both gender subjects		1

Variable and categories	d	95% CI	QW

Type of alcohol			
Beer	0.02	−0.31–0.34	0.04
Wine	0.61	0.32–0.90	17.54(*)
Distilled spirits	0.31	−0.26–0.88	0.00
Gender of dyad			
Same gender	0.25	0.04–0.46	10.50
Different gender	1.71	0.88–2.54	3.08
Participant gender			
Male subjects	0.33	0.10–0.56	11.22
Female subjects	1.33	0.53–2.14	5.80
Both gender subjects	0.00	−0.49–0.49	0.00

(*) p < .05;

([dagger]) p < .01;

([double dagger]) p < .001.

Volume of alcohol per sip

Overall effect size. Twelve effect sizes were retrieved from the literature for the dependent measure of the amount of alcohol consumed per sip (Table 7). The unweighted effect size estimate was d = 0.38. The mean effect size weighted by sample size was d = 0.36 (95% CI = 0.16-0.57), indicating that those viewing the high consumption model consumed more per sip than those in the control group. The effect sizes were heterogeneous ([chi square] = 20.340, 11 df, p [is less than] .05).

TABLE 7. Study authors, sample sizes, effect sizes and confidence intervals for volume per sip

Study	N	d	95% CI
Cooper et al. (1979)	16	−0.58	−1.59–0.42
Cooper et al. (1979)	16	−0.19	−1.17–0.79
Cooper et al. (1979)	16	−0.12	−1.10–0.86
Collins et al. (1985) Study I	52	0.00	−0.54–0.54
Watson and Sobell (1982)	64	0.00	−0.49–0.49
Hendricks et al. (1978)	12	0.18	−0.95–1.32
Collins et al. (1985) Study II	54	0.55	0.01–1.09
Cooper et al. (1979)	16	0.59	−0.41–1.59
Lied and Marlatt (1979)	64	0.80	0.29–1.31
Hendricks et al. (1978)	12	0.83	−0.35–2.01
Caudill and Marlatt (1975)	32	1.18	0.43–1.93
Hendricks et al. (1978)	12	1.31	0.06–2.55

Moderator analyses. Five variables were identified as moderators of the modeling effect on the volume consumed per sip (Table 8). When the minimum age of participants in the study was 21 years there was a significant effect of modeling; however, when the minimum age of participants was 18 years there was not a significant effect. Participants consumed significantly more alcohol per sip when the comparison was high consumption model versus light consumption model than when the comparison was versus a no-model control condition. In fact, the effect size derived for the latter condition was not significant. Regarding the drinking history of the participant, only two groups were available for the analysis: heavy drinker, and a mixture of heavy and light drinkers. The volume of alcohol consumed per sip by heavy drinkers was not affected by the presence of the heavy-drinking model. However, when participants consisted of heavy and light drinkers, more alcohol was consumed per sip in the high consumption model condition than in the control condition. A significant effect also was found when the gender of the dyad was the same, but a nonsignificant effect was found when the gender of the model and participant was different. In addition, men and a combined sample of men and women drank significantly more per sip in the heavy model condition than in the control group, but this difference was not evident for women.

TABLE 8. Moderators of modeling effect on volume per sip

Variable and categories	[Q.sub.B]	k	d	95% CI	QW
Comparison	8.04([dagger])				
Light consumption model		7	0.59	0.33-0.86	9.50
No model		5	-0.38	-0.39-0.31	2.80
Gender of dyad	4.35(*)				
Same gender		10	0.43	0.22-0.65	15.57
Different gender		2	-0.35	-1.05-0.35	0.43
Minimum age of participants	4.31(*)				
18 years		8	0.12	-0.19-0.43	8.47
21 years		4	0.57	0.28-0.85	7.56
Participant drinking history	5.32(*)				
Heavy drinkers		8	0.22	-0.03-0.46	13.26
Mixed light and heavy		4	0.78	0.37-1.19	1.76
Participant gender	7.17(*)				
Male		9	0.36	0.11-0.60	12.86
Female		2	-0.38	-1.08-0.32	0.31
Both gender subjects		1	0.80	0.29-1.31	0.00

(*) $p < .05$;

([double dagger]) $p < .01$.

File drawer analysis

Due to the small number of studies in the literature and the fact that only published articles were used in this meta-analysis it is possible that the effect sizes calculated represent a sample of studies biased toward significance. The possible bias of published articles to demonstrate significant results has been called the "file-drawer problem" in recognition of all the unpublished studies that did not find significant differences and are languishing in researchers' file drawers across the world (Rosenthal, 1979). In order to control for possible bias it is possible to calculate a Fail Safe N. The Fail Safe N is an estimate of how many effect sizes demonstrating a null effect would have to be added to the analysis in order to reduce the mean effect size to nonsignificance. Fail Safe N's based on the formula presented in Rosenthal (1991) were calculated for each dependent measure examined in the present analysis. For the amount of alcohol consumed, 1,388 effect sizes would need to be added to the analysis in order to reduce the overall effect to nonsignificance. The Fail Safe N for BAC indicated that 213 null effect sizes would be needed to reduce the mean effect to nonsignificance. For the number of sips taken, 85 null effects would be needed to create a nonsignificant mean effect size. Finally, for the volume of alcohol consumed per sip the Fail Safe N was 36. It is usually assumed a Fail Safe N that exceeds $5k + 10$, where k is the number of effect sizes in the actual meta-analysis, indicates a robust effect in the meta-analysis and that the influence of unincluded null effects is not a problem. As the Fail Safe N's found for three of the dependent measures examined (amount consumed, BAC and number of sips) exceed this criterion we are confident that the results of present analysis are robust.

Discussion

The results of the meta-analysis are consistent with the conclusions of Collins and Marlatt (1981) that modeling can produce a strong effect on the consumption of alcohol. Increased consumption when an individual is exposed to a heavy-drinking model is consistent across all the studies and thus can be seen as a definitive effect. The weighted mean effect sizes for both amount of alcohol consumed and BAC were what Cohen (1988) defines as large effects. The weighted mean effects of modeling on number of sips and volume per sip were in the moderate range. The findings regarding amount consumed provide a context for understanding the results for BAC and sip volume, each of which is typically related to alcohol intake. Thus, the effects for BAC are best interpreted as a reflection of the fact that BAC is a physiological indicator of the body' s metabolism of alcohol. With regard to sip volume, there are differences in the topography of heavy versus light drinking, with heavy drinking involving sips of greater volume (Schaefer et al., 1971). The stronger effect for amount consumed and BAC is indicative of the fact that these variables are the best indicators of modeling's effect on drinking.

The modeling paradigm (i.e., design) played a significant role in effects for three of the four dependent variables: amount consumed, BAC and volume per sip. Participants consumed more alcohol in the heavy-drinking condition than in both the no-model control condition and the light-drinking model condition. The effect was larger when the comparison was between the heavy-drinking model and the no-model conditions than when the comparison was between the heavy-drinking model and the light-drinking model conditions. Light-drinking models probably served to reduce natural levels of consumption and thus participants consumed less when exposed to a light-drinking model than when no model was present. These results are consistent with modeling theory (Bandura, 1969) and indicate that presentation of low consumption models may be beneficial in helping drinkers cut down on their intake. However, the effects in which models consumed nothing came from only two studies (Cooper et al., 1979, and Watson and Sobell, 1982) and the results could be due to other differences in the procedures of these studies as well as the type of control group.

Effects related to each of the three sets of moderator variables (situation, participant and model) provide additional information about the social influence processes involved in the modeling of alcohol consumption. Each area will now be discussed in turn.

Moderator effects related to characteristics of the situation

Three of the situational moderator variables (setting, task, time of task) demonstrated heterogeneity between groups, indicating that the effect of modeling on the drinking behavior differed depending on the level of the moderating variable. Most of the moderating variables related to aspects of the methodology, including the nature of the drinking task, the setting, time engaged in the task and the type of alcohol. The drinking task involved either a taste test or ad libitum drinking. Given the significant effects for each task, we can conclude that the tasks are equally appropriate for eliciting the modeling of alcohol consumption. The taste-rating task produced a stronger effect size; however, as the confidence intervals overlapped, both types of tasks may be equally useful in evoking modeled drinking. Two of the situational variables, setting and time engaged in the task, were perfectly correlated. This could mean that either variable might account for the moderating effect. Finally, consistent with studies involving the natural observation of drinking in bars (e.g., Aitken and Jahoda, 1983; Cutler and Storm, 1975; Harford et al., 1983), participants consumed more alcohol when they had more time for drinking.

Type of alcohol (beer versus wine) was a significant moderator of modeling effects for the number of sips taken. This finding likely reflects the social scripting of the way in which different types of alcohol are consumed. Consumption of wine is typically seen as taking more time and involving smaller sips whereas consumption of beer is more likely to involve large sips or gulps (Kidorf et al., 1990). Our results indicate heterogeneity within the effect sizes for wine, possible reflecting varying levels of compliance with the social norm of taking smaller sips (particularly for women). Finally, the gender of the drinking dyad (same versus mixed) was a situational characteristic that had a significant effect on both the number and the volume of sips. First, it is important to note that most

(11 of the 13) of the effect sizes retrieved used dyads of the same gender and only two effect sizes were for mixed-gender dyads. For studies involving same gender dyads, our results suggest good matching of the topography of the drinking partner, for which sip rate and volume serve as excellent indicators. A stronger effect was demonstrated when the participant-model dyad was made up of both genders. However, given that both of these effect sizes were retrieved from a single study (Cooper et al., 1979) and one consisted of a male model/female participant pair and the other consisted of a female model/male participant pair, it is difficult to draw any definite conclusions. The gender makeup of the model-participant dyad is an area in which further research may be useful. Given some research suggesting convergence in the drinking behavior of young men and women (Mercer and Khavari, 1990), it is possible that gender of the dyad will play a less significant role, particularly among the young adults who typically participate in alcohol modeling studies.

Moderator effects related to characteristics of the participants

Of the five participant characteristics coded, three (drinking history, age, gender) resulted in significant moderating effects. The participants' drinking history showed effects for amount consumed and volume per sip. These results are consistent with the fact that most studies used heavy drinking (or moderate to heavy drinking) participants who are both likely to consume more and to take larger sips or gulps as they drink (Schaeffer et al., 1971). Sip volume also was related to the participant characteristic of minimum age. Participants' age moderated the effect of modeling on BAC. It is difficult to interpret the meaning of age for either sip volume or BAC because there is only a slight difference (3 years) in participants' minimum age of 18 and 21 years. The difference in minimum age is not likely to have much impact on drinking behavior since both age categories represent "young adulthood" and drinking patterns are fairly consistent within that group. However, we coded this variable to examine the impact of legal changes in the drinking age (from 18 to 21 years) over the course of the 20 years during which the studies were conducted. These legal changes more than anything else are probably related to the age effects noted.

The case for gender as a moderator of sip volume and sip frequency is more complex. Men tend to take larger sips in heavy- as opposed to light-drinking conditions, while there were no major differences in sip volume for women, regardless of the drinking condition. Women tended to take a greater number of sips in heavy- as opposed to light-drinking conditions than did men. These findings seem to reflect gender stereotypes with regard to the topography of drinking. Generally, men take larger sips (or even gulps) when they drink thereby increasing sip volume, but they may not show significant increases in sip frequency as they increase alcohol intake (Rosenbluth et al., 1978). On the other hand, women generally take smaller sips, but they may increase their sip frequency as they consume larger amounts of alcohol (Rosenbluth et al., 1978).

Moderator effects related to characteristics of the model

Only one of the three model characteristics coded had an effect on an alcohol-related outcome and that was the nature of the interaction (e.g., warm versus cold). The nature of the interaction had an effect on our key dependent variable, amount consumed. In most of the studies we coded, the participant and model either did not interact or the nature of their interaction was unspecified. The high degree of heterogeneity in those studies that did not involve interaction precludes our making any definitive conclusions, although the results seem to indicate that a lack of interaction does not inhibit the modeling of alcohol intake. Where studies explicitly manipulated the nature of the interaction, a "warm" sociable model was more likely to produce a match on alcohol intake, while a "cold" unsociable model usually failed to show a match between the drinking behavior of the model and the participant. When faced with a "cold" model, the participant seemed to experience the lack of rapport and interaction as aversive and either consumed more alcohol as a means of coping with the situation (Collins et al., 1985) or quickly left the situation, thereby consuming less alcohol (Reid, 1978). This intriguing finding may have some clinical implications in terms of helping recovering alcoholics to identify aversive social situations as presenting high risk for relapse.

Conclusions

Although this meta-analytic review provides an empirical basis for understanding the effects of many of the variables associated with the modeling of alcohol intake, these results are essentially correlational. Thus, we must caution that these associations do not provide knowledge of the underlying mechanisms or causal relationships among the variables. We also must state that the four dependent variables we examined were not equal in the number of effect sizes that could be generated, therefore we focused on amount consumed both because it had the largest number of effect sizes and met other conceptual criteria related to the focus of the alcohol-modeling paradigm. The reader should remember, however, that the literature examined is small and may be a biased sample. We attempted to examine as much of the available literature as possible. It should be noted that in the articles in which we were unable to retrieve statistics all reported an effect of modeling, and of the two unpublished dissertations examined both produced moderate to very large effect sizes. The dissertations were not unpublished because of a lack of an effect. The Fail Safe N's suggest that, for at least three of the dependent variables examined, and especially for the major dependent variable, amount consumed, our findings are robust and that a large number of studies producing results contrary to those we reviewed would be necessary to weaken our conclusions.

Because the literature is small, caution must be taken in making conclusions regarding the moderating variables examined. Although evidence for moderators was found, in many cases the sample sizes within some categories of the moderator were too small to draw any strong conclusions. Cases in which one or two studies exist in a category should not be taken as a good estimate of the effect at that level of the moderating variable. When this occurred it should be taken as a possible indication of an effect but one for which primary research is still needed. We attempted to code variables based on the moderators examined in the literature; however, when moderators were found, one must remember that other variables that were not examined may have covaried along with the variables that were examined and may be responsible for the effects. Although we do not know if other variables could explain the obtained moderating effects, it is clear that additional primary research can help clarify the impact of additional moderating variables. We hope that this empirical review, like the traditional review of Collins and Marlatt (1981), will encourage more research to be conducted on the topic of modeling and alcohol consumption.

Our empirically generated findings regarding the impact of the modeling paradigm on alcohol consumption are consistent with the conclusion reached by Collins and Marlatt (1981). The modeling paradigm is an effective means of manipulating the alcohol intake of moderate to heavy social drinkers, and it can produce variations in drinking behavior that are similar to those observed in natural drinking environments (Aitken, 1985; Rosenbluth et al., 1978). Our findings for the moderating effects suggest that characteristics of the situation, the participant and the model have effects not only on alcohol intake, but also on other alcohol-related outcomes such as BAC, sip frequency and sip volume. Generally, the results from variations of the modeling paradigm are consistent with our knowledge of alcohol use as related to gender, social interaction, and norms regarding the topography of drinking behavior.

Acknowledgments

The authors would like to thank Marc A. Schuckit and two anonymous reviewers for their useful comments on a previous draft of this article. We would also like to thank Martha Hamel-Tuttle for help in coding articles and Ann Sawusch and Jean Wilkins for help in finding and obtaining dissertations.

Notes

(1.) In some cases, statistics were not provided; however, the article did indicate that the comparison between the high consumption model and low consumption model was nonsignificant. In these cases (Collins et al., 1985, Study II; Lied and Marlatt, 1979; Watson and Sobell, 1982), we chose to make a conservative estimate of the effect, entering d = 0.00 and calculating the confidence interval for each effect size based on sample size.

(2.) Caudill and Marlatt (1975) had warm and cold model conditions; however, these manipulations occurred before the drinking session. During the drinking session participants and models were told not to interact. Therefore, the two effect sizes retrieved from this study were coded as participants and model told not to interact. A separate analysis of the moderating effect of nature of the interaction was conducted in which these two effects retrieved from Caudill and Marlatt (1975) were each coded separately as warm and cold manipulations. When this was done there was still heterogeneity between the groups representing the different types of interaction ([chi square] = 7.91, 3 df, p [is less than] .05) and consequently a moderating effect of type of interaction.

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Received: February 24, 1997. Revision: June 20, 1997.

BRIAN M. QUIGLEY, PH.D., AND R. LORRAINE COLLINS, PH.D.

Research Institute on Addictions, 1021 Main Street, Buffalo, New York 14203