

## Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior

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### Abstract

This study identified factors that influence regular soda consumption among 707 female students, aged 13–18 years, attending North Los Angeles County public high schools. Participants completed a group-administered Theory of Planned Behavior-based questionnaire. Almost all of the participants, 96.3%, reported that they currently drink soda; 50.1% reported drinking 2 glasses of soda or more per day during the past year. Students reported drinking regular soda more than diet soda and reported drinking phosphoric acid-containing soda more than non-phosphoric acid-containing soda. Attitude, subjective norm and perceived behavioral control had statistically significant positive associations with intention, and were each significant predictors of intention to drink regular soda and together explained 64% of its variance. The strongest predictor was attitude, followed by perceived behavioral control and subjective norm. Our results suggest that efforts to reduce soda consumption among female adolescents should include parents and friends. It is also important that soda should not be excessively available at home or widely accessible to teenagers at schools. Healthy eating messages for adolescents need to be developed and incorporated into existing and future campaigns to reinforce the perception that there are other

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healthier drinks that quench thirst and that taste good as well.

### Introduction

Among the countries with high soft drink consumption, the US is ranked first (Mazariegos-Ramos *et al.*, 1995). The National Soft Drink Association reported that during 1998, Americans drank over 14 billion gallons of soft drink; thus, averaging more than 56 gallons of soft drinks per person (National Soft Drink Association, 1999). Results from US Department of Agriculture's 1996 Continuing Survey of Food Intakes by Individuals (CSFII) indicate that 50.3% of Americans consume carbonated soft drinks (US Department of Agriculture, 1996). Furthermore, the average daily consumption of soft drinks for male and female adolescents aged 12–19 years old was 20.2 and 13.2 fl oz/day, respectively (a regular can of soft drink is 12 fl oz). Adolescents indicated that besides school and restaurants, home was the most popular source for obtaining soft drinks (Morgan *et al.*, 1985). To encourage this increased consumption of soft drinks, Coca-Cola alone spends \$500 000 per day on advertising (Wardlaw and Insel, 1996).

The high level of soda consumption has some health consequences. First, Guenther found that soft drink intake was negatively correlated with intake of milk, and the nutrients calcium, magnesium, riboflavin, vitamin A and ascorbic acid (Guenther, 1986). Mazariegos-Ramos *et al.* found a significant association between the intake of at least 1.5 l/week of soft drinks containing phosphoric acid (Coca-Cola and Pepsi-Cola) and hypocalcemia in children 2.4–5.6 years of age

(Mazariegos-Ramos *et al.*, 1995). Second, the high sugar and acid contents of soda have consequences for teeth. Studies investigating the effect of carbonated beverages on the wear of human and animal enamel showed that exposure to the carbonated beverage accelerated the enamel wear (Shabat *et al.*, 1975; Harrison and Roeder, 1991; Mistry and Grenby, 1993; Al-Hiyasat *et al.*, 1998). Kock and Martinsson's study (Kock and Martinsson, 1971) and Martinsson's study (1972) [as cited in (Birkhed, 1984)] reported that children with a high caries frequency more often reported that they frequently consumed Coca-Cola compared to children with low caries frequency. Jarvinen *et al.* (Jarvinen *et al.*, 1991) found that there was considerable risk of dental erosion when soft drinks were consumed daily. Recent studies showed that not only the refined sugar in regular soda contributes to tooth decay (Birkhed, 1984), but also the phosphoric acid ( $H_3PO_4$ ) in it tends to cause erosive lesions (Rytomaa *et al.*, 1988). Phosphoric acid is used in carbonated beverages as an acidulent and flavoring agent (Massey and Strang, 1982). It occurs in regular and diet colas, and ranges from 44 to 70 mg per 12 oz serving (Anderson, 1995). Third, Wyshak and Frisch (Wyshak and Frisch, 1994) found a strong association between carbonated cola beverage consumption and bone fractures in 76 girls, 8–16 years old. Cola beverages were significantly associated with risk of fractures among school-age children 7–14 years old (Petridou *et al.*, 1997). Wyshak found an association between carbonated beverage consumption and bone fractures among teenage girls (Wyshak, 2000).

Phosphorus (P) and calcium (Ca) coexist in dairy foods, and function together as the inorganic mineral component of bone. Until 1997, a Ca:P ratio of 1:1 was recommended to help achieve an adequate bone mineral density (Anderson, 1995). A ratio less than this has been considered unhealthy for bones (Anderson, 1995). In 1997, the 1989 RDAs were replaced by the new DRIs (Institute of Medicine, 1997). The new phosphorus recommendation for adolescents aged 9–13 years is 1250 mg/day, while that for calcium is 1300 mg/day

(Institute of Medicine, 1997). Data from the 1996 CSFII conducted by the US Department of Agriculture show that the daily mean phosphorous intake of female adolescents (1081 mg) exceeds their daily mean calcium intake (739 mg).

Calvo *et al.* reported that high phosphorus and low calcium consumption for 1 month among 15 young adult women 18–25 years of age caused persistent elevation of serum parathyroid hormone (Calvo *et al.*, 1990). These researchers suggested that nutritional secondary hyperparathyroidism could be unfavorable to achieving maximum positive bone balance and is not conducive to optimizing peak bone mass.

Overall, these studies suggest that too much phosphorus in the diet relative to calcium may increase bone loss from the skeleton and contribute to low bone mass which increases the risk for osteoporotic fractures. As 50% of total bone mineral in females is deposited between 9 and 18 years of age, the adolescent years are very important in achieving a maximal bone mass. This, with maintenance of skeletal integrity during adulthood, is the best protection against fractures (Johnston and Longcope, 1990; Matkovic *et al.*, 1990; Lindsay *et al.*, 1993; Fassler and Bonjour, 1995; Weaver *et al.*, 1995). It is essential, then, to identify and target those behaviors that impact bone health, particularly those associated with attaining peak bone mass in the adolescent years. Evidence suggests that soft drink consumption may be a risk factor. However, there is a paucity of research available to describe the factors influencing high soft drink consumption among female adolescents.

The main purpose of this study was to use the Theory of Planned Behavior (Ajzen, 1989) as a framework to identify those factors which influence regular soft drink consumption among female adolescents.

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### Theoretical model

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This study utilized Ajzen's Theory of Planned Behavior to predict intention to drink regular soft drinks. The predictive power of this theoretical model has been established in many social and

health behavior studies (Libbus, 1995; Godin and Kok, 1996; Millstein, 1996). The Theory of Planned Behavior, a modified version of the Theory of Reasoned Action (Ajzen and Fishbein, 1980), is an expectancy-value model that addresses the problem of incomplete volitional control (Blue, 1995). Ajzen proposed that behavior is best predicted by intention (Ajzen, 1989). Intention is in turn determined by attitude toward the behavior (favorable or unfavorable), subjective norm (perception of social pressures to perform or not perform the behavior) and perceived behavioral control (perception of ease or difficulty of performing the behavior). Perceived behavioral control is also assumed to have a direct link to behavior. Persons' beliefs about the outcomes of the behavior (salient behavioral beliefs) and their evaluation of those outcomes (outcome evaluations) influence their attitude. Persons' beliefs about what others who are important to them want them to do (normative beliefs) and the motivation to comply with what those others want, influence their subjective norm. Persons' beliefs about the availability of resources and opportunities necessary to achieve the behavior (control beliefs) and how each of those resources and opportunities facilitates the behavior (perceived facilitation) influence their perceived behavioral control. In summary, Ajzen proposed that 'individuals will intend to perform a behavior when they evaluate it positively, believe that important others think they should perform it, and perceive it to be under their own control' [(Courneya and McAuley, 1995), p. 501].

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## Method

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### Participants

There are a total of six public high schools in The Antelope Valley Union High School District located in North Los Angeles County. Piloting of the final questionnaire was conducted in one high school located approximately 20 miles east of the five remaining high schools in the district. The final questionnaire was administered in those five

schools. No data were collected from private high schools in this district. A total of 756 female adolescents, aged 13–18 years, participated in this study between February 1999 and March 1999. Teachers who chose to participate in this study selected various periods from four grade levels from biology, chemistry and healthful living classes during which the study was conducted. A total of 707 participants (93.5%) provided complete data and their data are included in this report. Data were also collected from male students; however, their data will be the subject of a future manuscript.

### Instrument

A questionnaire was developed using a two-stage process guided by the Theory of Planned Behavior (Ajzen and Fishbein, 1980). The first stage consisted of developing an initial open-ended questionnaire to obtain the salient beliefs underlying soft drink consumption. Utilizing 18 open-ended questions, the participants were asked to list behavioral, normative and control beliefs related to regular soda and diet soda consumption. This questionnaire was administered to students with characteristics similar to the target population until saturation was reached (Strauss and Corbin, 1990). Saturation occurred when additional pre-tests resulted in no new information regarding the questions asked. A total of 45 public high school female students from four grade levels participated in the initial phase of the questionnaire development process. A content analysis was conducted and the results were utilized to develop the final questionnaire.

The final instrument was designed to determine how salient beliefs relate to high soft drink consumption. The final questionnaire consisted of 80 items and was divided into three sections.

- (1) Demographic characteristics of the survey respondents (four questions).
- (2) Soda intake (12 questions).
- (3) Behavioral intentions, attitudes, subjective norms, and perceived control related to daily regular soda consumption (64 questions).

Two types of scales were used for Section 3 of the questionnaire: (1) semantic differential scales

with bipolar adjective pairs (e.g. good–bad) and (2) Likert-like scales (e.g. not at all–very much).

The time provided by the school district did not permit the assessment of regular soda and diet soda consumption. We chose regular soda consumption as the dependent variable based on two observations. First, results from a USDA 1996 survey showed that 58.0% of females in the 12–19 age group drank regular carbonated soft drinks and 5.9% drank diet (low calorie) carbonated soft drinks. Second, results of a survey we conducted during the pre-testing phase showed that 91.15% of adolescent participants reported that they drink regular soda and 8.85% reported that they drink diet soda. The 80-item final questionnaire was pre-tested on four public high school female students to detect ambiguous items and to determine the mean time of questionnaire completion. The final questionnaire was piloted on 38 female students. Students were also asked to record the time when they started and finished the survey, and also to write comments or recommendations regarding the survey content or construction directly in the space provided on the survey instrument. The mean time of questionnaire completion was approximately 15 min. An item analysis on the final regular soda scales showed reliability coefficients ( $\alpha$ ) of 0.94 for intention, 0.93 for attitudes, 0.74 for subjective norms and 0.62 for perceived behavioral control.

## Measures

### *Behavior*

Soda consumption questions included items regarding average soda consumption. Participants indicated whether they drink soda, type of soda they usually drink (colas:  $H_3PO_4$  containing or non-colas: non- $H_3PO_4$  containing) and how frequently they drank different types of soda during the past 12 months (never/less than 1 glass, bottle or can per month, 1 glass per week or less, 2–6 glasses per week, 1 glass per day, 2 glasses per day, 3 glasses per day, more than 3 glasses per day).

### *Behavioral intention*

Participants rated on an eight-point scale (0 = Strongly disagree, 7 = Strongly agree; 0 = Very

unlikely, 7 = Very likely) three items: ‘I intend to drink regular soda daily,’ ‘How likely is it that you will drink regular soda daily?’ and ‘If everything goes as I plan, I will drink regular soda daily.’

### *Attitude*

Participants rated on three, eight-point bipolar adjective-opposite scales the following item: ‘When you think about drinking regular soda daily, how do you feel?’ (0 = Very bad, 7 = Very good; 0 = Very worthless, 7 = Very valuable; 0 = Very unpleasant, 7 = Very pleasant).

### *Subjective norm*

Participants rated on an eight-point scale (0 = Strongly disagree, 7 = Strongly agree; 0 = None at all, 7 = A great deal) three items: ‘Most people who are important to me think I should drink regular soda daily’, ‘Important people in my life say I ought to drink regular soda daily’ and ‘How much pressure do you feel from other people to drink regular soda daily?’.

### *Perceived behavioral control*

Participants rated on an eight-point scale (0 = Very little, 7 = Complete control; 0 = Very difficult, 7 = Very easy; 0 = Strongly disagree, 7 = Strongly agree) each of these three items: ‘How much control do you have over drinking regular soda daily?’, ‘For me drinking regular soda daily would be...’ and ‘If I chose to I would be able to drink regular soda daily’.

### *Scales*

The factors underlying attitudes, subjective norm and perceived behavioral control were drawn from the initial elicitation, and were measured on eight-point scales (0–7). The labels for the scales are shown in the table footnotes. Scales on normative beliefs and control beliefs were re-calibrated (–3.5 to +3.5). Then, each pair of underlying factors (behavioral beliefs/outcome evaluation, normative beliefs/motivation to comply, control beliefs/perceived facilitation) was multiplied to obtain product scores of the strength of beliefs underlying attitudes, subjective norms and perceived behavioral control.

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## Procedure

The Antelope Valley Union High School District and the Loma Linda University Institutional Review Board approved the study protocol. This study used an active parental consent protocol, but a passive student assent protocol. Parents or guardians gave written approval for participation of their adolescent children, but the students were provided with a letter accompanying the final questionnaire which explained that they had the option not to answer the survey questions.

A total of 20 teachers, three to five from each of the five public high schools, selected eight to 12 classes in which to conduct the study. Choice of classes was based on having no time overlap of classes so that the principal investigator would be able to be present in all classes during data collection. To assure representation from the four grade levels, two to three classes per grade level per public high school were selected. A total of 50 classes participated in this study. One 55-min class period each devoted to completing the questionnaire. The survey was conducted on a voluntary and anonymous basis. While males were not the target for this study, data was also collected from them during all phases of the study to avoid the disruption that would be inherent in separating the males from the females. These data are available for later analyses.

The final questionnaire was group-administered to the selected Grade 9–12 grade biology, chemistry and healthful living classes. To reduce inconsistencies of questionnaire administration, the principal investigator was present at all times during data collection. Upon completion of the survey, students were asked to place the response sheets into an envelope, seal it and hand it in to the principal investigator. Students who completed their questionnaire early were asked to work on attached puzzles and not distract other students. Additionally, those students who did not wish to participate and those who were not given parental permission to participate or did not return the parent reply card as well as those who had filled out the survey in previous classes were asked to work on the puzzles as an alternative activity.

## Data analysis and power

Data was entered into the Statistical Package for the Social Sciences (SPSS, 1998) using an IBM-compatible computer. Simple descriptive statistics were used to analyze the demographic data. Central tendency measurements and 95% confidence intervals were utilized to summarize the distribution of variables and their variability. Chi-square tests of independence were conducted to evaluate the differences between cases with complete data and cases with missing data. A paired-samples *t*-test was conducted to determine the mean difference in consumption of phosphoric acid-containing soda (colas) and non-phosphoric acid-containing soda (non-colas). Pearson correlation was used to examine the associations among the variables of the theoretical model. A five-step hierarchical multiple regression analysis was performed to determine the predictors of participants' intention to consume regular soft drink. Behavior was regressed on intention and on the perceived behavioral control. Intention was regressed on attitudes, subjective norms and perceived behavioral control. Attitudes were regressed on the product of behavioral beliefs and outcome evaluations. Subjective norms were regressed on the product of normative beliefs and motivation to comply. Lastly, perceived behavioral control was regressed on the product of control beliefs and perceived facilitation. A *P* value of 0.05 was considered significant for all statistical tests conducted. With our sample size there was 80% power to detect an effect size of 0.022 using 10 independent variables, which was the maximum number actually used in a regression analysis in this study.

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## Results

### Characteristics of respondents

Of the 756 students who participated in this study, a total of 707 participants (93.5%) provided complete data. Results for this study were based only on the 707 cases with the complete data. Missing data analysis was conducted to evaluate whether there were consistent differences between the cases with



complete data and those cases with missing data. The results of the  $\chi^2$ -test indicated that there were no significant differences among the ethnic backgrounds in amount of missing data [ $\chi^2$  (5,  $N = 749$ ) = 9.277,  $P = 0.099$ ].

The response rate for this study was high. While exact counts were not kept of those students who failed to return the parental reply cards, they were, however, very few. The typical classes ranged in size from approximately 25–30 students and within a class no more than two or three students failed to return the reply cards. In many classes all students returned the reply cards. Out of 756 female students, only 10 parents refused to let their children complete the questionnaire. The high response rate may have been due to the ‘Got Milk’ posters that were promised as incentives for students to return the parental reply cards. Students had verbally expressed strong desires to have those posters.

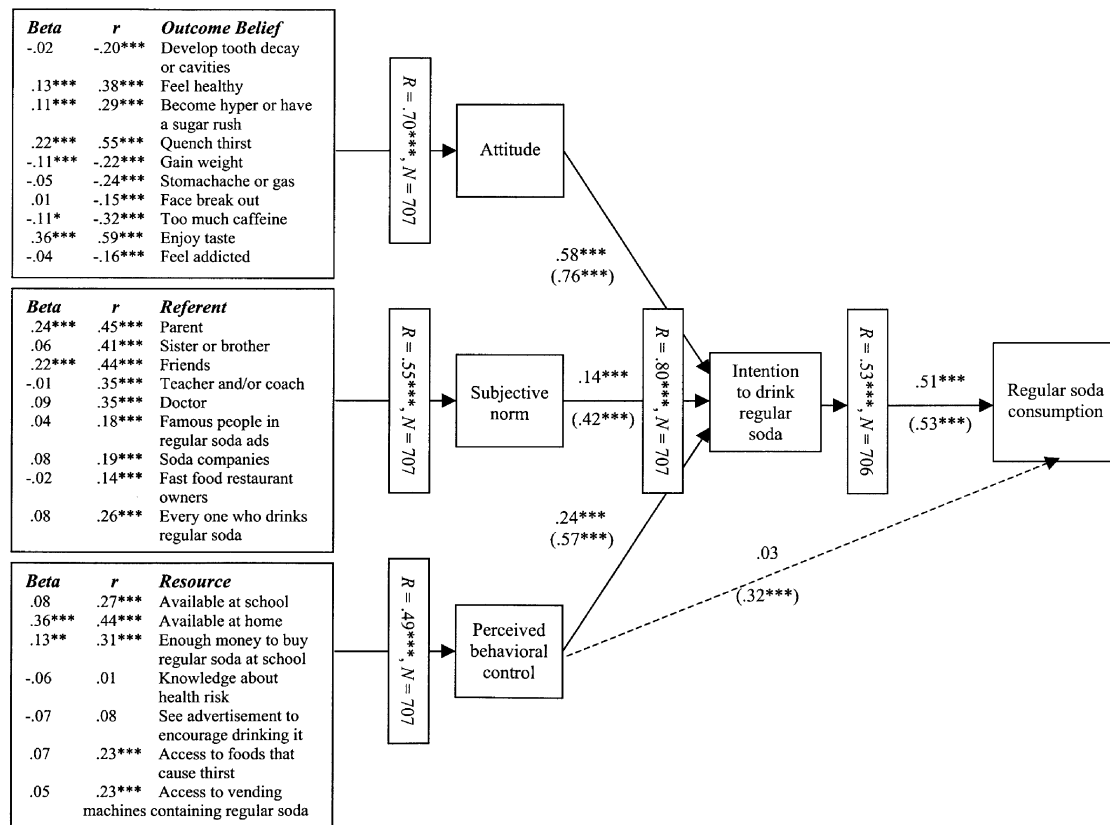
The participants ranged in age from 13 to 18 years. The 15 year olds [27.3% ( $n = 193$ )] and 16 year olds [26.4% ( $n = 187$ )] were the most represented in this study, followed by the 17 year olds [20.5% ( $n = 145$ )] and the 14 year olds [16.7% ( $n = 118$ )], whereas the 13 year olds [0.4% ( $n = 3$ )] and 18 year olds [8.6% ( $n = 61$ )] were the least represented. The distribution of respondents by grade level was fairly equal. The majority of participants were White/Anglo-Americans [54% ( $n = 382$ )] followed by Hispanics or Latinos [18.7% ( $n = 132$ )], Other [10.2% ( $n = 72$ )], Black/African-Americans [9.6% ( $n = 68$ )], Asian/Pacific Islanders [5.8% ( $n = 41$ )] and Native Americans [0.8% ( $n = 6$ )]. Compared to the ethnic mixture of California public high schools (California Department of Education, 1999), this study sample had fewer Hispanic/Latinos and Asian/Pacific islanders, but more other minorities.

**Patterns of soda consumption**

Almost all the participants, 96.3% ( $n = 681$ ), reported that they currently drink soda, while only 3.4% ( $n = 24$ ) reported that they do not. In response to an item asking students to indicate which type of soda they usually drink, 58.8% ( $n =$

**Table 1.** Patterns soda consumption during the past year among public high school females students in The Antelope Valley Union High School District, 13–18 years old, 1999

Glasses of soda consumed	Phosphoric acid-containing soda			Non-phosphoric acid-containing soda			Diet non-cola, e.g. Diet 7-UP or Diet Sprite ( $n = 707$ )		
	Regular Coke, Pepsi or other cola ( $n = 707$ )	Regular Dr Pepper ( $n = 707$ )	Diet Coke, Diet Pepsi or other diet cola ( $n = 707$ )	Regular non-cola, e.g. 7-UP or Sprite ( $n = 707$ )	Regular Mountain Dew ( $n = 707$ )	Regular Mountain Dew ( $n = 707$ )	Regular non-cola, e.g. 7-UP or Sprite ( $n = 707$ )	Regular Mountain Dew ( $n = 707$ )	Regular Mountain Dew ( $n = 707$ )
	<i>n</i>	<i>n</i>	%	<i>n</i>	<i>n</i>	%	<i>n</i>	<i>n</i>	%
Never/less than 1 glass per month	119	306	43.3	489	69.2	69.3	472	66.8	80.5
1 glass per week or less	121	196	27.7	104	14.7	11.3	131	18.5	10.9
2–6 glasses per week or less	199	103	14.6	50	7.1	5.2	63	8.9	3.8
1 glass per day	89	41	5.8	22	3.1	5.1	14	2.0	2.5
2 glasses per day	100	31	4.4	19	2.7	4.6	13	1.8	1.0
3 glasses per day	32	9	1.3	9	1.3	1.5	3	0.4	0.1
More than 3 glasses per day	44	17	2.4	8	1.1	1.3	8	1.1	0.3
Missing	3	4	0.6	6	0.8	0.6	3	0.4	0.8



**Fig. 1.** Path diagram for prediction of regular soda consumption. Based on the Theory of Planned Behavior. Numbers in rotated boxes are *R*s from multiple regression. Numbers in parentheses next to arrows are correlations, numbers not in parentheses are  $\beta$  coefficients. *N* represents cases with complete data. \* $P \leq 0.05$ , \*\* $P \leq 0.001$ , \*\*\* $P \leq 0.0001$ .

416) chose regular Coke, Pepsi or other cola, 25.5% ( $n = 180$ ) chose regular non-cola, e.g. 7-UP or Sprite. Additionally, 9.3% ( $n = 66$ ) chose Diet Coke, Diet Pepsi or other diet cola and 2.8% ( $n = 20$ ) chose diet non-cola beverages. Table I shows patterns of various soda types consumed during the past year among study participants. Students in this study reported drinking regular soda more than diet soda and reported drinking phosphoric acid-containing soda more than non-phosphoric acid-containing soda. Results of a paired-samples *t*-test indicated that the mean intake for phosphoric acid containing soda ( $M = 1.58$  glasses per day; 95% CI 0.13) was significantly greater than the mean intake for non-phosphoric acid containing soda [ $M = 0.78$  glasses

per day; 95% CI 0.08,  $t(703) = 12.3$ ,  $P = 0.000$ ]. We did not directly ask students about their total soda consumption. To obtain an estimate of total soda consumption per day we coded 1 or less glasses per week as 1/7th glass per day, 2–6 sodas per week as 0.5 glasses per day; 1, 2 and 3 glasses per day as 1, 2 or 3 glasses per day; and more than 3 glasses per day as 4 glasses per day. Then we summed these values across all six types of soda listed in Table I. When these figures were used, approximately half (50.1%) of the students reported that they drank 2 or more glasses of soda per day during the past year. Moreover, one-third (32.2%) reported that they drank 3 glasses of soda or more per day during the past year.

### Constructs of the Theory of Planned Behavior

Figure 1 shows a path diagram representing the results of the five multiple regression analyses for predicting regular soda consumption. The diagram presents associations (simple correlations) of predictors with dependent variables ( $r$ ) and the independent association of each predictor with the dependent variables when other variables were held constant ( $\beta$ ).

In predicting regular soda consumption among the female public high school participants, both intention and perceived behavioral control were positively associated with the behavior. However, intention alone was the only significant independent predictor of the behavior. These two predictors together explained 28% of the variance in regular soda consumption.

### Intention as a function of attitude, subjective norm and perceived behavioral control

Attitude, subjective norm and perceived behavioral control were each significant predictors of intention to drink regular soda, and together explained 64% of its variance. The strongest predictor was attitude, followed by perceived behavioral control and subjective norm. All three components also had moderate to high statistically significant positive associations with intention and these remained when the associations were assessed independently in a multiple regression.

### Underlying factors of attitude, subjective norm and perceived behavioral control

#### *Attitude—outcome beliefs and evaluation*

A regression (results shown in Figure 1) showed that the outcome products ( $R^2$ ) explained 49% of the variance in attitude towards regular soda consumption. While all the outcome variables measured were significantly associated with attitude, there were only six variables that had independent predictive power. The primary positive predictors were whether students enjoyed the taste, it quenched their thirst, they became hyper or had

**Table II.** Means and 95% CI for regular soda consumption behavioral beliefs and outcome evaluations

Outcome	Behavioral beliefs ( $n = 707$ )	Outcome evaluations ( $n = 707$ )
Develop tooth decay or cavities	5.69 ± 0.13	6.36 ± 0.10
Too much caffeine	5.06 ± 0.16	4.57 ± 0.16
Become hyper or have a sugar rush	4.91 ± 0.17	2.62 ± 0.18
Enjoy taste	4.90 ± 0.16	4.52 ± 0.16
Gain weight	4.49 ± 0.17	5.61 ± 0.16
Feel addicted	4.25 ± 0.18	4.74 ± 0.16
Quench thirst	3.46 ± 0.17	2.54 ± 0.17
Face break out	3.27 ± 0.18	6.44 ± 0.09
Stomach ache or gas	3.26 ± 0.18	5.95 ± 0.13
Feel healthy	2.34 ± 0.16	6.47 ± 0.09

The behavioral beliefs scale ranged from 0 (Very unlikely) to 7 (Very likely). The outcome evaluations scale ranged from 0 (Not important) to 7 (Extremely important).

a sugar rush and whether they thought drinking regular soda would make them feel healthy. Furthermore, one predictor was that students would have a negative attitude towards drinking regular soda if they felt that drinking it might cause them to gain weight. The outcome product of thinking it had too much caffeine was a relatively weak predictor of attitude. The other outcomes, however, had no independent influence in predicting regular soda consumption. Table II shows which beliefs were most strongly and least strongly accepted. Students most strongly believed that drinking regular soda leads to tooth decay and getting too much caffeine. The outcomes that were rated most important were feeling healthy followed by face breaking out and developing tooth decay or cavities. Quenching thirst and becoming hyper or having a sugar rush were rated by the typical student as least important. The apparent contradiction that an item rated by most students as least important ('quenched thirst') was also a strong predictor of attitude is simply because those who did rate the outcome of 'quenched thirst' more likely and of higher importance were the ones that had a positive attitude toward soda consumption.



**Table III.** Means and 95% CI for regular soda consumption normative beliefs and motivation to comply

Referent	Normative beliefs ( <i>n</i> = 707)	Motivation to comply ( <i>n</i> = 707)
Soda companies	6.17 ± 0.12	1.27 ± 0.14
Fast food restaurant owners	5.68 ± 0.14	1.22 ± 0.14
Every one who drinks regular soda	4.13 ± 0.16	1.45 ± 0.15
Famous people in regular soda ads	2.98 ± 0.19	1.16 ± 0.14
Friends	1.96 ± 0.15	2.78 ± 0.16
Sister or brother	1.70 ± 0.15	2.39 ± 0.16
Parent	1.51 ± 0.13	4.45 ± 0.15
Teacher and/or coach	1.27 ± 0.13	3.15 ± 0.16
Doctor	1.04 ± 0.13	4.73 ± 0.16

The beliefs about whether these people wanted them to drink regular soda (normative beliefs scale) ranged from 0 (not at all) to 7 (very much). The motivation to comply scale ranged from 0 (not at all) to 7 (very much).

#### *Subjective norm—normative beliefs and motivation to comply*

A regression (see Figure 1) showed that the referent products ( $R^2$ ) explained 30% of the variance in subjective norm. While all the normative variables measured were positively associated with the subjective norm, there were only two that had independent predictive power. The two primary predictors were parent and friends. Table III shows which beliefs were most strongly and least strongly accepted. It seems that students most strongly believed that soda companies and fast food restaurant owners wanted them to drink regular soda daily. Participants reported that they were motivated to comply the most with what their doctors wanted them to do, followed by what their parents wanted them to do.

#### *Perceived behavioral control—control beliefs and perceived facilitation*

Six out of the eight resources were positively associated with perceived behavioral control. A regression (see Figure 1) showed that the resource products ( $R^2$ ) explained 24% of the variance in perceived behavioral control. Out of the eight resources, only two had independent predictive power. The primary predictor was availability of

regular soda at home. The weaker predictor was whether they had enough money to buy it at school. Table IV shows which resources students believed were most and least available. Students most strongly believed that availability of soda at school and access to vending machines containing regular soda help facilitate its consumption daily. The resources that were rated most important were knowledge about the health risks of regular soda followed by having enough money to buy it at school and having access to vending machines containing regular soda.

## Discussion

The results of this study are consistent with the findings of Harnack *et al.* (Harnack *et al.*, 1999), where the majority of adolescents (82.5%) were categorized as consumers of soft drinks and 25% of adolescents consumed more than 26 oz of soft drink per day. Harnack's conclusions were based on data collected as part of the 1994 CSFII. Information on food and nutrient intake was derived from 2 days of dietary recall data collected via an in-person interview. In this study we found that almost all students (96.3%) reported that they currently drink soda. More than 80% consumed 1 or more glasses of soda per day during the past year. Since this study is concerned with the bone health of female adolescents, and since a strong association was found between carbonated cola beverage consumption and fractures in children (Petridou *et al.*, 1997) and teenagers (Wayshak and Frisch, 1994), we studied the difference in consumption between cola- and non-cola-containing soda. Results showed that cola consumption among participants was significantly greater than non-cola consumption. Harnack *et al.* (1999) found that adolescents drinking 13–25.9 oz soft drink per day were 3.53 times more likely to drink less than 8 oz milk per day compared to adolescents who do not drink soft drinks. Their data suggests that teenagers are replacing milk and fruit juice with soda. We found that approximately half (50.1%) of the students reported that they drank 2 or more glasses of soda per day during the past year. The

**Table IV.** Means and 95% confidence intervals for regular soda consumption control beliefs and perceived facilitation

Resource	Control beliefs (n = 707)	Perceived facilitation (n = 707)
Regular soda available at school <sup>a</sup>	6.64 ± 0.08	4.79 ± 0.16
Access to vending machines containing regular soda <sup>b</sup>	6.54 ± 0.09	5.03 ± 0.15
Access to foods that make you thirsty <sup>c</sup>	5.90 ± 0.12	3.81 ± 0.17
See advertisement to encourage to drink it <sup>d</sup>	5.54 ± 0.13	2.28 ± 0.17
Enough money to buy regular soda at school <sup>e</sup>	5.54 ± 0.15	5.05 ± 0.15
Regular soda available at home <sup>f</sup>	4.77 ± 0.16	4.65 ± 0.16
Knowledge about the health risks of regular soda <sup>g</sup>	4.31 ± 0.15	5.28 ± 0.14

The degree to which this resource was believed to be available for items ranged from <sup>a,f</sup>0 (Not available) to 7 (Very much available), <sup>b,d</sup>0 (None at all) to 7 (Very much access), <sup>c</sup>0 (Not often) to 7 (Very often) and <sup>e,g</sup>0 (Not enough) to 7 (More than enough).

The perceived facilitation scale ranged from 0 (Not important) to 7 (Extremely important).

threat of developing weak bones and increased risk for bone fractures becomes greater when milk is replaced by soda, especially cola-containing sodas (Wyshak and Frisch, 1994), during the teenage years when approximately 50% of bone mass is developed (Anderson, 1995).

Intention to drink regular soda was found to predict its consumption. Perceived behavioral control did not contribute independently to regular soda consumption; however, it was significantly and positively correlated with it. Intention to drink regular soda was significantly influenced by the attitudes, subjective norm and behavioral control. The strongest predictor was attitude followed by perceived behavioral control and subjective norm. This predictive pattern was consistent with other studies that utilized the Theory of Planned Behavior to research eating behaviors in adults (Godin and Kok, 1996).

Taste enjoyment of regular soda was one of the most predictive expected outcomes of regular soda consumption among the female participants. Another important predictor of attitude toward drinking soda was a belief that sodas tend to quench their thirst. Moreover, in response to an item asking students to indicate which type of drink would most likely quench their thirst, approximately one-third (31.6%) chose soda, 64.1% chose water and 4.3% chose milk. This belief that sodas are useful in quenching thirst needs to be changed as those students who drink soda to re-hydrate themselves are actually at risk

of more immediate dehydration (Brouns *et al.*, 1998). It also appears that those expecting and valuing a sugar rush as a result of drinking soda are more likely to drink it.

On the other hand, those with negative attitudes toward drinking regular soda were more likely to believe that they will gain weight and have too much caffeine after its consumption, thus they tended to avoid it. Although the long-term effects of caffeine on humans are not clearly known, caffeine, which is a drug that acts as a psychotropic stimulant to the central nervous system, is added to cola and pepper-type soft drinks. A study investigating the withdrawal symptoms of terminating low doses of caffeine concluded that withdrawal occurred when the consumption of caffeine, at roughly the equivalent to the amount in three cans of caffeinated soft drink, was interrupted (Griffiths, 1990). The withdrawal symptoms included headache, muscle pain/stiffness, fatigue, flu-like feelings, nausea/vomiting and craving for caffeine.

Although the average student moderately believed that regular soda tended to make them gain weight and strongly believed that it is important not to gain weight, the majority drank regular soda regularly. Obesity among adolescents is a serious public health issue. Obesity is a risk factor for diabetes and heart disease. Regular soft drinks are sweetened with refined sugar, cane syrup or corn syrup. The average 12-oz can of cola contains 9–10 teaspoons of sugar and approximately 150

calories. Thus, students who drink 2 cans of soda a day consume about 300 calories from sugar with practically no other nutrients. Ludwig *et al.* reported a 1.6-fold increase in obesity in school children (age 11.7 years, SD 0.8) for each additional serving of sugar-sweetened beverage consumed daily (Ludwig *et al.*, 2001). The role of soda consumption in obesity among adolescents needs to be considered in future investigations.

The potential for regular soda to cause tooth decay did not contribute to prediction of attitude. Students did not vary much regarding their belief that regular soda helps develop tooth decay and they strongly believed that it did. They also strongly believed that it is extremely important to avoid developing tooth decay. However, participants still drank 1–2 cans of soda a day. This suggests that health education directed at making students believe that soda helps develop tooth decay or cavities will not be useful, because students are already convinced of this point.

While all referents were associated with the subjective norm to some extent, the only two that had independent predictive power were parent and friends. Parents and friends were the most influential people with regards to regular soda consumption. Friends (Barr, 1994) and parental influence were reported by others studying factors affecting nutrition behavior and dietary habits of adolescents (Doyle and Feldman, 1997; De Bourdeaudhuij and Van Oost, 1998; Neumark-Sztainer *et al.*, 1999).

Of the factors that were found to be significant predictors of perceived behavioral control, availability of regular soda at home was the strongest. Female adolescents were more likely to drink regular soda if it was available at home. Participants believed that regular soda was very much available at home and they believed that its availability at home made it easy for them to drink it. This finding suggests that parental influence may also be important in an indirect way, as they are the ones most likely to purchase soft drinks for the home. Students believed that they have moderate knowledge about the health risks of regular soda and they strongly believed that it is very important

for them to know the health risks of regular soda. In response to an item asking students to indicate whether they would drink something healthier if they ran out of soda at home, two-thirds of the students (66.4%) reported that they strongly would do that. Only 4.5% reported that they would not. Messages to reduce regular soda consumption should be targeted at parents as well as the teens themselves. Having enough money to buy regular soda at school was the second significant predictor. Female teenagers were more likely to drink regular soda if they had the money to buy it. The soft drink industry keeps its prices low, e.g. supermarket data through 1997 showed that 12-pack prices for all top nine brands (Coke Classic, Pepsi, Diet Coke, Sprite, Dr Pepper, Mountain Dew, Diet Pepsi, 7-UP, Caffeine-free Diet Coke and RC Cola) were under \$3 (*Beverage Digest*, 1997).

In this population, access to vending machines containing regular soda did not contribute to their drinking it; however, that appeared to be primarily because students have very ready access to such machines. A high mean control belief score of 6.54 with low variability suggests that almost all students felt that vending machines containing regular soda tended to be mostly available and this lack of variation eliminated any chance in this study of soda vending machine availability predicting soda consumption. However, adolescents believed that availability of such machines is important for them to drink regular soda. This suggests that if vending machines containing regular soda are less available then adolescents may be less likely to drink it. Unfortunately, school districts are sending their students messages to drink soda when they contract with soda companies and give them exclusive rights to sell soft drinks. Such agreements allow soda companies to place soda-containing vending machines and display soda logos throughout the campuses. Although some schools have rejected exclusive soda contracts (Schweitzer, 2000), one source reported that approximately 150 school districts in the US have contracts with soda companies that allow sales of only that company's products (Aratani, 1999). This is of concern because the more soda is sold to

students, the more dollars the school gets from the contracting soda company, thus students are urged to drink more soda in schools. Influential personnel in school districts need to be involved in promoting the health of their students by reducing the number of soda-containing vending machines and replacing soda with more nutritious drinks.

This use of self-report from the respondents may limit the generality of the study. Retrospective self-reporting may be affected by memory consolidation or poor recall (Marx *et al.*, 1996). Self-reports of dietary intakes and lifestyle behaviors may be influenced through researcher expectancies and social desirability (Cook and Campbell, 1979). Anonymity should have reduced this bias because the students were told the researcher and the teacher would not know what the students wrote; therefore, the students should have had no particular reason to try to impress the experimenter or teacher. Another limitation of the study is potential selection bias. Teachers chose which classes to participate in the study. Moreover, the high response rate might also be explained, in part, by the fact that teachers selected classes to participate; teachers may have selected classes they expected would be willing to participate. Generalizability of the study is limited by the sample of students who participated in the research, including their age, type of class they are enrolled in, ethnic mixture and region of the country. Additionally, while a test-re-test stability assessment of the instrument was not conducted, the fact that the  $\alpha$ s were quite high suggests that stability might also have been adequate.

When examining soda consumption, the reasons why adolescents drink regular or diet (low calorie) soda may differ. However, the time provided by the school district did not permit the assessment of the full Theory of Planned Behavior model for both types of soda. Thus, we cannot determine the factors that influence adolescents' intention to consume diet soda. This makes it more difficult to identify points of intervention to plan effective and comprehensive educational programs to improve the health of adolescents. Future research should investigate both variables.

The findings of this study may have implications for health educators. Efforts to reduce soda consumption among female adolescents should include parents and friends. It is also important that soda should not be excessively available at home or widely accessible to teenagers at schools. Healthy eating messages for adolescents need to be developed and incorporated into existing and future campaigns to reinforce the perception that there are other healthier drinks that quench thirst and that taste good as well, such as water.

### Acknowledgements

The authors would like to thank all the participating students, teachers, principals and, in particular, Mikie Loughridge, the Director of Curriculum and Instruction of The Antelope Valley Union High School District. The authors would like to thank the following agencies that donated educational materials and 'Got Milk' posters to all the participating individuals: Dairy Council of California, MilkPEP, and National Institute of Child Health and Human Development.

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Received on October 31, 2000; accepted on January 2, 2002