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Protective and Risk Factors in Health-Enhancing Behavior Among Adolescents in China and the United States: Does Social Context Matter?

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An explanatory model of adolescent health-enhancing behavior based on protective and risk factors at the individual level and in 4 social contexts was used in a study of school-based samples from the People's Republic of China (n = 1,739) and the United States (n = 1,596). A substantial account of variation in health-enhancing behavior—and of its developmental change over time—was provided by the model for boys and girls, and for the 3 grade cohorts, in both samples. In both samples, social context protective and risk factors accounted for more unique variance than did individual-level protective and risk factors, and context protection moderated both contextual and individual-level risk. Models protection and controls protection were of particular importance in the explanatory account.

Keywords: adolescent, social context, health behavior, protective factors, risk factors

The focus of this study is on the role of the everyday social context in accounting for variation in adolescents' engagement in health-enhancing behavior and its development over time. The research uses a theoretical framework about three kinds of protective factors (models protection, controls protection, and support protection) and three kinds of risk factors (models risk, opportunity risk, and vulnerability risk) to articulate the explanatory content of the social contexts that adolescents traverse in their daily lives. Linkages are examined between protective and risk factors in four key contexts—the family, the peer group, the school, and the neighborhood—and involvement in health-enhancing behavioral practices, including eating a healthy diet, engaging in regular exercise, getting adequate sleep, engaging in safety practices such as seatbelt use, and practicing good dental hygiene.

Broad influences on adolescent health behavior, such as the proliferation of soft drink vending machines in schools and an increasingly sedentary lifestyle that includes more TV viewing and recreational use of video games and computers, have been widely noted in the literature, especially in regard to concern about eating, exercise, and obesity, not only in the United States but worldwide (see, e.g., Bell, Ge, & Popkin, 2002; Caballero & Popkin, 2002; Hill, Wyatt, Reed, & Peters, 2003; Horgen & Brownell, 2002; Wadden, Brownell, & Foster, 2002; World Health Organization, 2002). Recently, there has been increased recognition that health-related behavior in adolescence is influenced by more immediate social and environmental factors, such as family members, peers, schools, and communities. Social context characteristics, such as parental models and encouragement for physical activity, family closeness, and parental support and warmth, have been shown to be associated with greater participation in exercise behavior among adolescents (Cowell & Marks, 1997; DiLorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998; Field, Diego, & Sanders, 2001; Sallis, Prochaska, & Taylor, 2000). Family connectedness (perceived parental support and caring) has also been linked with adolescents' fruit and vegetable intake (Neumark-Sztainer, Story, Resnick, & Blum, 1996), whereas characteristics of the neighborhood context, such as poverty, crime level, and social disorganization, have been associated with poorer dietary habits (Lee & Cubbin, 2002) and lower levels of physical activity (Gordon-Larsen, McMurray, & Popkin, 2000) among youth.

The theories most commonly used to predict variation in health behavior, the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 1991; Godin & Kok, 1996), give primary emphasis to individual-level psychosocial attributes highly proximal to (i.e., directly implicating) health behaviors. Although social–contextual correlates of health behaviors are also engaged by these theoretical approaches, they are mostly proximal to health behaviors and include such contextual characteristics as parental and peer models for dietary and exercise behaviors (e.g., Woodward et al., 1996; Zakarian, Hovell, Hofstetter, Sallis, & Keating, 1994), perceived social norms for engaging in health-enhancing behaviors (e.g., Baker, Little, & Brownell, 2003; Lytle et al., 2003), and parental and peer support for and/or encouragement of health behaviors (e.g., McGuire, Hannan, Neumark-Sztainer, Cossrow, & Story, 2002; Zakarian et al., 1994).

The explanatory model of adolescent health-enhancing behavior used in the present research emphasizes social–contextual as well as individual-level protective factors and risk factors, and it delineates protective and risk factors in the family, the peer group, the school, and the neighborhood contexts. The model derives from problem-behavior theory (Jessor, Donovan, & Costa, 1991; Jessor,

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Graves, Hanson, & Jessor, 1968; Jessor & Jessor, 1977), but constructs of controls and instigations in that theory have been reformulated into constructs of protection and risk, and three types of each have been specified.

Conceptually, protective factors increase the likelihood of engaging in health-enhancing behavior by providing models for health-enhancing and prosocial behaviors, by providing personal and social controls against health-compromising behaviors, and by providing a supportive social environment. Risk factors, in contrast, decrease the likelihood of engaging in health-enhancing behavior by providing models for health-compromising behaviors or for problem behaviors that are incompatible with health-enhancing behaviors, by providing greater opportunity for engaging in health-compromising behavior or problem behavior, and by constituting greater personal vulnerability to health-compromising or problem behavior involvement. The protection–risk model, thus, consists of three types of protection and three types of risk that together, and in interaction, provide an account of variation in adolescent behavior and development. The reformulated model was initially explicated in Jessor (1991), and the particular protection and risk constructs it includes have evolved from a systematic series of studies over the past decade (Costa, Jessor, & Turbin, 1999; Jessor, Turbin, & Costa, 1998a, 1998b; Jessor et al., 2003; Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995) as well as from the larger developmental literature (e.g., Barber & Olsen, 1997).

The model takes into account not only the main effect of protective factors in promoting positive health-enhancing behavior and deterring health-compromising behavior, but also the Protection $\times$ Risk interaction or the moderator effect that protection can have on the impact of exposure to risk. That is, it posits that high protection can attenuate the impact of risk. The conceptual model as applied to health-enhancing behavior in the present article, and illustrating both the main and moderator effects, is shown in Figure 1.

An invitation to undertake a collaborative study of adolescent behavior and development in the People's Republic of China (see Jessor et al., 2003) resulted in the present cross-national, longitudinal research. This collaboration provided the opportunity to test the generality of the model of protection and risk by extending it to adolescents growing up in a society very different from the United States. An earlier report from this research (Jessor et al., 2003) demonstrated that the model of psychosocial protection and risk provided a substantial account of adolescent problem behavior (delinquency, problem drinking, and cigarette smoking) in both the United States and China samples, even though average levels of problem behavior, protection, and risk differed between the two settings. In those analyses, protective factors and risk factors accounted for approximately equal proportions of variance in adolescent problem behavior. Controls protection and models risk were found to be the most important predictors in both samples.

The present study was designed to test the applicability of the same theoretical model to a domain different from adolescent problem behavior, namely, health-enhancing behavior. A successful outcome for the model in this domain could have important implications for the design of health promotion programs. Data on various health-enhancing behaviors were available from the same samples of adolescents described in the earlier report noted above. Such local, school-based samples in China and the United States cannot, of course, represent those countries as a whole; what they do allow is an examination of the generality of the explanatory model for health-enhancing behavior across samples from two very different societies with different political and economic systems and different immediate social ecologies, thus permitting a very strong test of the model's applicability or reach.

In sum, the present study seeks to advance understanding about the role of protective and risk factors—both individual-level and social–contextual—in accounting for variation in health-enhancing behavior in samples of adolescents drawn from two very diverse societies. Four major research questions are addressed:

1. Does the protection and risk model provide an account of variation in adolescent health-enhancing behavior in school-based samples from both China and the United States?

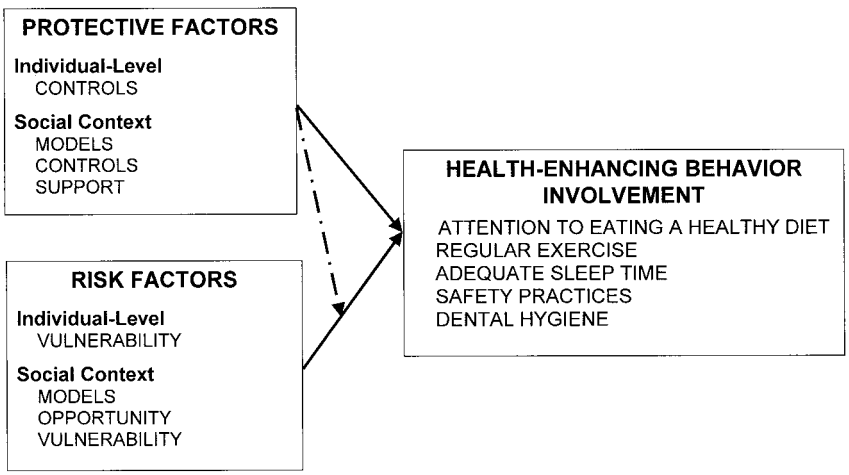

Figure 1. Explanatory model of main effects of individual-level and social context protective and risk factors on adolescent health-enhancing behavior as well as the moderator effect of protection on risk.

2. Do social context protective and risk factors alone provide a significant account of variation in health-enhancing behavior when variation in individual-level attributes is controlled?

3. Does change in protective and risk factors over time account for change in health-enhancing behavior in adolescence?

4. Does change in social context protective and risk factors over time account for change in health-enhancing behavior in adolescence when change in individual-level attributes is controlled?

Method

Participants

The analyses reported in this article use data from two successive waves—a year apart—of a questionnaire survey of samples of adolescents in Beijing, China, and in a large urban area in the Rocky Mountain region of the United States. At the first wave of data collection (Fall 2000), the 1,739 study participants from Beijing (883 boys, 856 girls) and 1,596 participants from the United States (753 boys, 843 girls) were students in Grades 7, 8, and 9. In each country, the sample was drawn from schools chosen in consultation with the school district administration to best represent variation in the socioeconomic backgrounds of the students and, in the United States, to reflect the racial/ethnic composition of students in the district. In Beijing, seven junior high schools (Grades 7, 8, and 9) were selected from two districts—one within the city and the other in the suburbs—and, in each district, schools known to vary in educational quality were selected. In the United States, six middle schools (for Grades 7 and 8) and three high schools (for Grade 9) were selected. In each school, students were randomly sampled within grade for participation in the study.[1]

In both research sites, active parental permission and personal assent were required, and confidentiality was explained and guaranteed. Each student received a token payment for filling out the questionnaire—in the United States, $5 at Wave 1 and $10 at Wave 2; in China, $2 each time plus a gift to each school. More details regarding the composition of the samples were reported in Jessor et al. (2003).

Materials

A 36-page Adolescent Health and Development Questionnaire was used to assess a broad range of behaviors as well as protective and risk factors in five domains: the individual (including beliefs, values, attitudes, and expectations) and four key social contexts—the family, the peer group, the school, and the neighborhood or community. The Adolescent Health and Development Questionnaire had been developed over the past several decades, with its content theoretically derived from the constructs in problem-behavior theory, and was translated into Chinese (and back-translated) with great care to ensure meaning equivalence (see Jessor et al., 2003).

Measurement of Health-Enhancing Behavior

Measures of five self-reported health-enhancing behaviors were included in the Adolescent Health and Development Questionnaire: Attention to Eating a Healthy Diet, Regular Exercise, Adequate Sleep Time, Safety Practices, and Dental Hygiene. The measure of Attention to Healthy Diet is the average of seven items (Cronbach's alpha = .87 in the U.S. sample, .85 in the China sample) that start with the stem "Think about your usual eating habits. Do you pay attention to:" and follow with "seeing that your diet is healthy," "keeping down the amount of salt you eat," "keeping down the amount of fat you eat," "eating some fresh vegetables every day," "eating in a healthy way even when you're with friends," "eating healthy snacks like fruit instead of candy," and "eating foods that are baked or broiled rather than fried?" Response options are 1 (*none*), 2 (*some*), and 3 (*a lot*). Typical (mean and median) scores on each item were around 2 (*some*). Regular Exercise is measured as the sum of three items (α = .63, .71) asking how many hours each week are spent playing sports, working out, and practicing physical activities. Six response options ranged from 1 (*none*) to 6 (*8 or more hours a week*), and the most typical scores for each item were around 2 (*one hour a week*). Adequate Sleep Time was measured by averaging two indicators assessing number of hours of sleep (α = .77, .74). One indicator is an item that asks, "How much sleep do you usually get each night?" The other indicator is computed from two items—usual time to go to sleep during the school week and usual time to wake up on school days. Scores ranged from 5 to 11.5 hrs, with a mean of 8.3. Carskadon et al. (1980) have reported that adolescents need over 9 hrs of sleep for optimal alertness, and 99% of our participants reported sleeping less than 10 hrs. Within the range of these data, therefore, we considered more sleep to be more health-enhancing. Safety Practices is a two-item scale (αs = .74, .75). In the United States sample, it assesses frequency of using a seatbelt when riding with a parent and when riding with a friend; and in the China sample, it assesses frequency of waiting for red lights when biking and when walking. The modal response was 4 on a scale ranging from 1 (*hardly ever*) to 4 (*almost always*). Dental Hygiene is a two-item scale in the U.S. sample (α = .57) assessing frequencies of brushing teeth and using dental floss; in the China sample, a single item asked about tooth brushing.[2] Four response options vary from 1 (*every couple of days*) to 4 (*after every meal*) for brushing, and from 1 (*almost never*) to 4 (*once a day or more*) for flossing. The most typical responses (mean, mode, and median) were 3.

Most of these measures have high internal consistency, with Cronbach's alpha in the .70s (range = .57–.87), and considerable stability over time, with 1-year stability coefficients in the .40s and .50s. Although the alpha for the Dental Hygiene component scale was lower than desirable (.57), that measure was nevertheless retained in the analyses to maintain a more comprehensive assessment of the health-enhancing behavior domain. For the most part, alpha reliabilities of the behavior measures are very similar between the two samples.

Group means for the five health behavior measures were compared in a 2 (sex) × 2 (sample) analysis of variance, followed by post hoc Scheffé tests among the four sex-by-sample groups (not tabled; table available from the authors). In the China sample, the boys or the girls, or both, reported significantly higher levels than in the U.S. sample on three of the five health-enhancing behavior measures: Attention to Healthy Diet, Regular Exercise, and Safety Practices. The U.S. sample had a significantly higher

[1] To address the possible nonindependence of observations on the criterion measure within schools and the possible need for hierarchical linear modeling, we computed the intraclass correlations of all the criterion measures within schools. They ranged from .00 to .05 and all had 95% confidence intervals (adjusted for unequal cluster sizes) that included zero, so they were deemed negligible, and the students' responses were treated as independent observations.

[2] Societal differences precluded using identical behavior measures in the case of Dental Hygiene and Safety Practices. Dental floss is not widely used in China, and many more adolescents in China ride bicycles than ride in cars. For each sample, therefore, we used health-enhancing behaviors clearly relevant to the experience of the participants. In that regard, for Safety Practices and Dental Hygiene, we sought to make the measures more comparable in meaning, rather than making them identical, as is the case for all the other behavior measures.

mean on Dental Hygiene, and there was no significant difference on Adequate Sleep Time. The main effect for sex was significant for four of the five health-enhancing behaviors but not in the same direction for all four behaviors. The boys had significantly higher means than the girls on Regular Exercise and Adequate Sleep Time. The girls had significantly higher means than the boys on Safety Practices and Dental Hygiene. Overall, then, there was no consistent sex difference across all the health-enhancing behaviors in either sample.

A composite index of involvement in the five health-enhancing behaviors, the Health-Enhancing Behavior Index (HEBI), was calculated as the mean of the five component behavior scores, standardized to provide equal weighting in the continuous composite score. A factor analysis of the five health behavior measures was conducted within each sample; it showed that just one common factor was obtained (by the scree test) and that single factor accounted for about 30% of the items' variance. The composite measure should be considered a cumulative index of involvement in the five different domains of health-enhancing behavior rather than a scale of parallel items. As with all such indexes, high internal consistency is not to be expected (Babbie, 1998), and indeed, the factor analysis showed only modest covariation.

The stability of the HEBI across a 1-year interval was substantial: .62 in the U.S. sample, and .51 in the China sample. The correlation of the HEBI with a self-rating of general health ("In general, how is your health?") was significant, .27 and .25 in the U.S. and China samples, respectively. The HEBI also correlated negatively, as expected, with a summary index of adolescent problem behavior involvement (delinquency, problem drinking, and cigarette smoking): −.33 (United States) and −.19 (China). On the basis of this stability and validity information, the HEBI was used as the primary criterion measure to summarize health-enhancing behavior in the present study. Analyses of each of its behavioral components were also conducted.

Measurement of Protective Factors and Risk Factors

Composite measures of protective factors (models, controls, and support) and risk factors (models, opportunity, and vulnerability) were computed as averages of equally weighted, standardized (within each sample) items with means of zero. A factor analysis, for each protective and risk factor, showed each measure's items to load on a single factor, which accounted for 26% to 78% of the items' total variance.

Individual-Level Protective and Risk Factor Measures

Although the major emphasis of this study is on the unique contribution of social context protection and risk factors to variation in adolescent health-enhancing behavior, the full explanatory model also includes individual-level protective and risk factors. Two individual-level summary measures of protection and risk were used.

Individual-level protective factor. Controls Protection—Individual is a summary measure of personal controls against health-compromising behavior; it is composed of 11 items that assess both personal value on health (e.g., "How important is it to you to keep yourself in good health all year round?") and perceived health effects of health-compromising behaviors (e.g., "Do you think not getting enough exercise can have an effect on the health of young people your age?"). Individual-level controls are protective because they indicate the personal importance of health and a commitment to health-promotive behaviors as well as a perception of negative outcomes that should serve to discourage health-compromising behaviors.

Individual-level risk factor. Vulnerability Risk—Individual is an 18-item summary measure assessing depression (e.g., "In the past six months, have you just felt really down about things?"), low self-esteem (e.g., "How well do you make decisions about important things in your life?"), and low expectations for future success in life (e.g., "What are the chances that you will have a happy family life?"). Vulnerability constitutes individual-level risk because it can compromise the maintenance of health and can instigate coping behaviors, such as drug use, that may be incompatible with health-enhancing behaviors.

Perceived Social Context Protective and Risk Factor Measures

The respondent was asked to report on protection and risk in each of the four social contexts, that is, the questionnaire essentially placed the adolescent in the role of "quasi ethnographer" describing the settings of everyday life. Thus, all of the context measures are actually *perceived* context measures.

Context protective factors. Models Protection—Family assesses maternal and paternal models for four health-enhancing behaviors: eating a healthy diet, getting enough exercise, getting sufficient sleep, and using seat belts (e.g., "Does your mother pay attention to eating a healthy diet?"). Models Protection—Peers assesses peer models for those same four health-enhancing behaviors (e.g., "How many of your friends make sure they get enough exercise?"). Models for health-enhancing behaviors are protective in providing opportunities to learn those behaviors and indicate that they are characteristic of two important reference groups.

Controls Protection—Family includes two items about the strictness of rules "about what time you go to bed at night" and "about when and how much TV you can watch." Controls Protection—Peers is a single item asking "If you were doing something that is bad for your health, would your friends try to get you to stop?" Informal social controls serve to protect against or discourage engaging in health-compromising behavior.

Support Protection—Family consists of four items, three of which ask whether parents show interest in the adolescent (e.g., "Are your parents interested in what you think and how you feel?"), and the fourth asks "When you are having problems, can you talk them over with your parents?" Support Protection—Peers consists of two items: "Are your friends interested in what you think and how you feel?" and "When you have personal problems, do your friends try to understand and let you know they care?" Support Protection—School includes four items about teachers' interest in, caring about, and helpfulness to students (e.g., "Do teachers at your school try to help students when they are having problems?"). Support Protection—Neighborhood includes three items about neighbors' friendliness and helpfulness (e.g., "In your neighborhood, do people help each other out and look after each other?"). Perceived support is protective in providing a context in which reference group models and controls would be expected to be influential.

Context risk factors. Models Risk—Family consists of two items, "Does anyone in your close family smoke cigarettes?" and "How many of the people in your family eat a lot of 'junk food' instead of a healthy diet?" Models Risk—Peers consists of three items assessing peer models for smoking cigarettes, for eating junk food, and for sitting around a lot rather than getting some exercise. Models Risk—School is a single item, "How many of the students at your school smoke cigarettes?" Models Risk—Neighborhood is a single item, "How much cigarette smoking is there among adults in your neighborhood, as far as you know?" Models for health-compromising behaviors constitute risk because they facilitate learning those behaviors and practicing them as well.

Opportunity Risk—Family is a single item, "If you wanted some cigarettes to smoke, would you be able to get some at home?" Availability of health-compromising substances makes engaging in health-compromising behavior more likely.

Vulnerability Risk—Family is a six-item scale assessing emotional distance and conflict among family members (e.g., "Is there tension or stress at home in your family?"). Vulnerability Risk—Peers is a single item, "In the past six months, how much stress or pressure have you felt in your personal or social life?" Vulnerability Risk—School is a single item, "In the past six months, how much stress or pressure have you felt at school?" Vulnerability can compromise the maintenance of health and can

instigate coping behaviors such as drug use that are incompatible with health-enhancing behaviors.

Reliabilities of the protective and risk factors are for the most part quite similar between the two samples, and except for two measures, all were in the range of .62 to .89. Stability coefficients were mostly in the .30s and .40s, showing considerable stability over a 1-year period of time, even for the single-item measures.

Correlations among the eight social context protective factor measures are similar in the two samples, mostly in the .20s. The only nonsignificant correlation between protective factors in both samples is between Support Protection—Peers and Controls Protection—Family. Correlations among the eight social context risk factors are also similar between the two samples, mostly smaller than .20 but ranging up to .46. There is one nonsignificant correlation between risk factors in the U.S. sample (Models Risk—School with Vulnerability Risk—Peers), and there are two in the China sample (Vulnerability Risk—Peers with Models Risk—Family and Opportunity Risk—Family). Correlations between the eight protective factors and the eight risk factors are mostly smaller than .20 in absolute value, ranging from −.52 to −.03 in the U.S. sample and −.49 to .06 in the China sample, negative as expected (with that one exception). Protection and risk are considered to be conceptually distinct, rather than opposite ends of the same dimension, and they have been shown to relate differently to various external criterion measures (see Jessor et al., 1995). Overall, the correlations are of similar magnitude in the two country samples.

Procedures

In both research sites, administration of the questionnaire was conducted in large groups at school by research staff with teachers absent. At Wave 1, questionnaires were filled out by 98% of the China sample and by 74% of the U.S. sample. At the Wave-2 data collection in the Fall of 2001, questionnaires were completed by 2,985 of the original participants (1,364, 85% of the U.S. sample; 1,621, 93% of the China sample). The Wave-1 cross-sectional analyses were conducted on the complete Wave-1 sample, and the Wave-2 replications and the analyses of change were conducted on the two-wave longitudinal sample.

Results

Presentation of the results is organized according to the four research questions posed in the introduction. First, we present hierarchical multiple regression analyses to explore the cross-sectional account of variation in adolescent health-enhancing behavior involvement provided by the theoretical set of protective factors and risk factors in the two country samples. Second, we present results that show the proportion of variance accounted for uniquely by social context protection and risk, beyond that accounted for by protection and risk at the individual level. Third, we apply the explanatory model to account for developmental changes in health-enhancing behavior involvement from Wave 1 to Wave 2. Fourth, we show the proportion of variance accounted for uniquely by change in social context protection and risk, beyond that accounted for by change in protection and risk at the individual level.

Accounting for Cross-Sectional Variation in Health-Enhancing Behavior Involvement

Hierarchical multiple regression analyses were conducted, for each country sample, to examine the relations of individual-level and social–contextual protective and risk factors with health-enhancing behavior involvement. First, the HEBI criterion measure was regressed on sociodemographic background measures to partial out effects of sex, school attended, grade in school, intact family (both biological parents living together), socioeconomic status (father's job level and father's and mother's education), and ethnicity (United States only). Then, at Step 2, the two individual-level protective and risk factor measures were entered. At Step 3, the eight social context protective factors and, at Step 4, the eight social context risk factors were entered. Detailed regression results are presented first for the HEBI criterion measure in Table 1. Subsequently, we present regression results for the measures of the five component health-enhancing behaviors separately.

The bivariate correlations in Table 1 show the expected positive relations between the protective factor measures and the HEBI and the expected negative relations between the risk factor measures and the HEBI. All but one of the correlations were significant (one-tailed, $p < .05$). Correlations of the individual-level measures of protection and risk (Controls Protection—Individual and Vulnerability Risk—Individual) with the HEBI were .45 and −.44, respectively, in the U.S. sample and .41 and −.36 in the China sample. The social context protection measures with the largest bivariate correlations (.30 to .50), in both samples, were Models Protection—Family, Models Protection—Peers, and Support Protection—Family. Among the social context risk factors, moderate correlations (at least in the .20s) were found in both samples for Models Risk—Peers, Vulnerability Risk—Family, and, in the U.S. sample only, for Models Risk—Family, Models Risk—School, and Opportunity Risk—Family.

With regard to the hierarchical regression results, the sociodemographic measures, entered at Step 1, accounted for 7% of variance in the HEBI in the U.S. sample and 8% in the China sample, primarily reflecting the effect of grade in school (7, 8, or 9), the only background measure with even a moderate correlation with the criterion (−.21, United States; −.26, China). The negative sign of the correlations shows that scores on the HEBI were lower among older adolescents than among younger adolescents.

The measures of individual-level protection and risk, entered at Step 2, accounted for an additional 26% of the variance in the U.S. sample and 19% in the China sample, both substantial increments. The eight measures of social context protection were then entered at Step 3, accounting for an additional 11% of the variance in the U.S. sample and 13% in the China sample. Finally, the eight measures of social context risk factors, entered at Step 4, accounted uniquely for another 1% of variance in each sample, over and above the variance accounted for by the already-entered social context measures of protective factors, the individual-level measures of protection and risk, and the sociodemographic measures. Altogether, the final regression model accounted for a substantial proportion of the variance in the HEBI in both countries—45% in the U.S. sample and 41% in the China sample. These results provide strong support for the explanatory model and also for its generality across samples from two such diverse societies.

Because the social context protective and risk factors share common variance, their order of entry was reversed in supplementary analyses to establish the unique variance accounted for by each. When entered after the social context risk factors, the social context protective factors accounted uniquely for 8% of variance in the U.S. sample and 9% in the China sample, much greater than the unique influence shown at Step 4 in Table 1 for the risk factors (1%). Similarly, because some portion of the variance accounted

Table 1
Hierarchical Regression of the Health-Enhancing Behavior Index on Individual-Level and Social Context Protective and Risk Factors, Wave 1 (2000)

Step and measures entered	U.S. sample				China sample			
	r	β, final step	ΔR^2	R^2	*r*	β, final step	ΔR^2	R^2
1 Sociodemographic background			.07***	.07			.08***	.08
Gender (−1 = boys, 1 = girls)	.01	.07*			−.06*	−.06**		
Grade in school	−.21***	−.04			−.26***	−.14***		
Intact family	.08*	.05			.07**	.11*		
Socioeconomic status	.06*	.02			.04	−.031		
School attended[a]								
Ethnic group[b]								
2 Individual-level measures			.26***[c]	.33			.19***[c]	.27
Controls Protection—Individual	.45***	.22***			.41***	.21***		
Vulnerability Risk—Individual	−.44***	−.17***			−.36***	−.12***		
3 Social context protective factors			.11***[d]	.44			.13***[d]	.40
Models Protection—Family	.47***	.20***			.46***	.20***		
Models Protection—Peers	.44***	.18***			.45***	.20***		
Controls Protection—Family	.27***	.06*			.20***	.06**		
Controls Protection—Peers	.30***	.05*			.24***	.04*		
Support Protection—Family	.37***	.05			.36***	.03		
Support Protection—Peers	.08***	−.07**			.17***	.01		
Support Protection—School	.29***	−.01			.28***	−.03		
Support Protection—Neighborhood	.32***	.06**			.29***	.02		
4 Social context risk factors			.01***	.45			.01***	.41
Models Risk—Family	−.29***	−.02			−.14***	−.01		
Models Risk—Peers	−.35***	−.07*			−.22***	.00		
Models Risk—School	−.21***	−.02			−.19***	−.07**		
Models Risk—Neighborhood	−.13***	.01			−.14***	−.05**		
Opportunity Risk—Family	−.23***	−.03			−.18***	−.05*		
Vulnerability Risk—Family	−.34***	.01			−.29***	−.05*		
Vulnerability Risk—Peers	−.15***	−.06*			−.04	.01		
Vulnerability Risk—School	−.18***	−.05*			−.09***	−.01		

Note. N = 1,209 (U.S. sample), 1,582 (China sample). All R^2 values are significant at $p < .001$.
[a] Dummy variables for 9 schools (U.S. sample) and 7 schools (China sample) were entered here to partial out school differences; only 1, in the China sample, has a significant regression weight, as a suppressor variable, having a zero correlation. [b] Dummy variables entered to partial out small mean differences across 4 non-white ethnic groups (U.S. sample); only Hispanic, as a suppressor variable, has a significant positive regression weight. [c] Variance accounted for uniquely by individual-level protective and risk factors = .06*** (U.S. sample), .05*** (China sample). [d] Variance accounted for uniquely by social context protective factors = .08*** (U.S. sample), .09*** (China sample).
* $p < .05$. ** $p < .01$. *** $p < .001$.

for by individual-level protection and risk measures was shared with the social context measures, an additional regression was run reversing their order of entry and entering the individual-level measures after the social context measures. That analysis showed the unique variance of the individual-level measures to be 6% for the U.S. sample and 5% for the China sample. This contrasts with the unique variance shown for the social context measures in Table 1, 12% (11% + 1%) for the U.S. sample and 14% (13% + 1%) for the China sample, two to three times that of the individual-level measures.

Key social context protective factors in both samples, as shown by their beta weights in Table 1, were Models Protection—Family and Models Protection—Peers. Also significant, but not as strong, were Controls Protection—Family, Controls Protection—Peers, and Support Protection—Neighborhood (U.S. sample only). Four social context risk factors were significant in the China sample, and three others were significant in the U.S. sample, as shown by the beta weights in Table 1; no single social context risk factor was significant in both samples in the final regression model. In the U.S. sample, Support Protection—Peers was a suppressor variable; its beta weight was −.07, but its bivariate correlation was .08. A suppressor effect is evident when a significant independent variable's correlation with the dependent variable is essentially zero or has a sign opposite that of its regression weight (see Wills, Resko, Ainette, & Mendoza, 2004, for further discussion of suppressor effects of peer support).

In previous work, applying a similar theoretical model to the analysis of adolescent problem behavior (Jessor et al., 2003, 1995), we established that protective factors, beyond their main effect, also moderated the impact of risk factors. To examine moderator effects in the present analyses of health-enhancing behavior, we relied on both the theory and our prior moderator findings to specify a set of 15 key interactions out of the possible 81 (9 [protection] × 9 [risk]). We tested the interactions of models protection and controls protection in both the family and peer contexts and Controls Protection—Individual (five protective factors) as moderators of Models Risk—Peers, Vulnerability Risk—Peers, and Vulnerability Risk—Individual (three risk factors). Those 15 interaction tests yielded six moderator effects that were significant ($p < .05$) in one or both country samples. In both

samples, Controls Protection—Family and Controls Protection—Peers moderated Models Risk—Peers. Also in both samples, Models Protection—Peers moderated Vulnerability Risk—Individual. Controls Protection—Individual in the U.S. sample and Models Protection—Peers in the China sample also moderated Models Risk—Peers. Finally, in the China sample, Controls Protection—Individual moderated Vulnerability Risk—Peers. The findings do, indeed, establish moderator effects in the health behavior domain.

To examine the applicability of the model across sexes and grade cohorts, we tested the interactions of sex and of cohort with all of the individual-level and social context protective and risk factors. Among all the sex interactions and cohort interactions, there was just one significant ($p < .05$) interaction: In the U.S. sample, Vulnerability Risk—Individual was not significant in the 7th-grade cohort, although it was significant in the 8th- and 9th-grade cohorts. With that one exception, there was no evidence that the model differs across sexes or grade cohorts.

To determine whether the theoretical model differed significantly between the two country samples, we carried out supplementary analyses, combining the two samples and testing for the interaction of each of the 15 significant protective or risk factors (see betas in Table 1) with a dummy variable for country sample. Only 1 interaction out of the 15 tested was significant (the effect of Models Risk—Peers was significantly stronger in the U.S. sample [−.07] than in the China sample [.00], $p < .05$). Thus, the model is essentially the same in the two country samples.

In summary, the protection–risk theoretical model accounted for similar and substantial amounts of variance in the HEBI in both country samples. The social context protective and risk factor measures were important, accounting uniquely for more variance than did the individual-level protective and risk factors. Protective factors, as measured, accounted for much more unique variance than did the risk factors, as measured. The most important social context protective factors in the account, Models Protection—Family and Models Protection—Peers, were the same in both samples. Social context protective factors moderated both context and individual-level risk factors in both countries. The explanatory model has demonstrated substantial cross-national, cross-sex, and cross-grade-cohort generality.[3]

Replication of the analyses of the HEBI were carried out on the second wave of data, collected from most of the same participants 1 year later (not tabled; table available from the authors). As in the Wave-1 findings, the protective factors were more strongly correlated with the HEBI criterion measure than were the risk factors. Although smaller proportions of variance were accounted for overall (40% in the U.S. sample, 27% in the China sample) compared with the Wave-1 analysis (45% and 41%, respectively), similar proportions were accounted for uniquely by the social context protective factors (10%, U.S. sample; 8%, China sample) and risk factors (1%, each sample). Key social context protective factors were, again, Models Protection—Family, Models Protection—Peers, and Controls Protection—Family. One social context risk factor was significant in each sample: Vulnerability Risk—Family in the China sample and Vulnerability Risk—School in the U.S. sample. Together, the social context protective and risk factor measures accounted for about three times as much variance in the HEBI as did the individual-level protective and risk factor measures. There was one significant moderator effect in the Wave-2 analyses: Controls Protection—Individual moderated Models Risk—Peers in the U.S. sample. In general, the pattern of the Wave-1 results was largely supported by the findings from the second data wave of the study.

Accounting for Developmental Change in Health-Enhancing Behavior Over Time

The availability of two waves of longitudinal data permitted an examination of developmental changes in health-enhancing behavior involvement over a year-long interval. Mean change from Wave 1 to Wave 2 in the five health-enhancing behaviors was tested for significance by paired-sample *t* tests within each sex group in each country sample (not tabled; tables available from the authors). From Wave 1 to Wave 2, the mean level of the measures of Attention to Healthy Diet and of Adequate Sleep Time decreased significantly for both sexes in both the U.S. and China samples. Significant declines also obtained, for both sexes, for Regular Exercise and Safety Practices in the China sample and for Dental Hygiene in the U.S. sample. Thus, involvement in each health-enhancing behavior declined over the span of 1 year in either one or both of the two samples, and neither group showed a significant increase in any health-enhancing behavior.[4]

To account for developmental change (the overall decline) in health-enhancing behavior over the 1-year interval, we examined the role of changes in protective and risk factors. Change in involvement in health-enhancing behavior was operationalized by entering the Wave-1 HEBI at Step 1 of a hierarchical regression analysis, with the Wave-2 HEBI as the criterion (not tabled; table available from the authors). This yields a Wave-2 HEBI criterion measure, the variance of which is unrelated to the Wave-1 HEBI, that is, a measure of change in the HEBI criterion over time (see Cohen & Cohen, 1983; Dalecki & Willits, 1991).

At Step 2 of the regression, sociodemographic background measures were entered. At Step 3, the Wave-1 individual-level protective and risk factor measures were entered, followed by their Wave-2 measures at Step 4. The Wave-1 and Wave-2 measures of social context protective factors were then entered at Steps 5 and 6, respectively. Wave-1 measures of the social context risk factors were entered at Step 7, followed by their Wave-2 measures at Step 8. The Wave-2 theoretical predictors, entered at Steps 4, 6, and 8, reflect variation in Wave-2 protection and risk that is unrelated to their Wave-1 protection and risk measures. Their regression coefficients represent the relation of change in protective and risk factors to change in the HEBI.

A significant proportion of variance in the Wave-2 HEBI (with Wave-1 HEBI controlled) was accounted for by change in the individual-level protective and risk factors at Step 4 (7% U.S. sample, 6% China sample, $p < .001$) and by change in the social

[3] To examine cross-behavior generality, we applied the same explanatory model separately to each of the five component behaviors of the HEBI and found very similar results (tables available from the authors).

[4] Theoretically, the decline in health-enhancing behavior should be paralleled by declines in protective factors, increases in risk factors, or both. Paired-sample *t* tests within each sex group in each country sample (not tabled; tables available from the authors) showed that, in both samples, an erosion in health-enhancing behavior over time was, indeed, paralleled by erosion in social context protective factors and, to a lesser extent, an increase in social context risk factors.

context protective factors at Step 6 (6% and 5%, $p < .001$). Very little additional variance (0.5% in both samples, nonsignificant) was accounted for by change in the social context risk factors at Step 8. In both country samples, 4% of the variance in change in health-enhancing behavior was uniquely accounted for by change in the protective factors when they were entered after the risk factors. When individual-level protection and risk measures were entered after the social context protection and risk measures, change in the individual-level measures accounted uniquely for 2% of variance ($p < .001$) in each sample, about half as much as the variance accounted for by change in the social context measures.

To examine the generality of this analysis of change across sexes and grade cohorts, we tested the interactions of sex and the interactions of cohort with all of the Wave-2 social context protective and risk factors in each sample. Neither set of interactions provided a significant ($p < .05$) increment in the squared multiple correlation in either sample. Thus, there is no evidence that the explanation of change differs across sexes or grade cohorts.

Consistent with the cross-sectional findings, the key social context protective factors in these longitudinal analyses were change in Models Protection—Family, change in Models Protection—Peers, change in Controls Protection—Family (U.S. sample only), and change in Support Protection—Neighborhood (U.S. sample only). Additional significant context protective factors were change in Support Protection—Family, change in Controls Protection—Peers (China sample only), and change in Support Protection—Peers (China sample only). The significant social context risk factors in the U.S. sample were change in Models Risk—Family and change in Vulnerability Risk—Family; in the China sample, change in Models Risk—Peers was significant. In sum, these results show that change in individual-level protective and risk factors and in social context protective factors accounts for significant variation in change in health-enhancing behavior over time in these adolescent samples.

Discussion

The key conclusions of the present study are that a differentiated model of psychosocial protection and risk accounts for substantial variation in adolescent involvement in health-enhancing behavior and that protection and risk in the social context of everyday adolescent life play an especially important role. Protective and risk factors assessed across the family, peer, school, and neighborhood contexts add a substantial increment to the account of variation in involvement in health-enhancing behaviors beyond that provided by individual-level protection and risk and by sociodemographic background. Further, and importantly, social context protection was shown to moderate social context risk and individual-level risk. Changes in those same social context protective and risk factor measures over a year-long interval were also shown to add significantly and uniquely to the explanation of developmental change (decline) in adolescent health-enhancing behavior involvement.

The articulation of both protection and risk in adolescent social contexts and of three types of protection—models, controls, and supports—and three kinds of risk—models, opportunity, and vulnerability—revealed that protection accounted for more variation in involvement in health-enhancing behavior than did risk. In both the cross-sectional and the developmental analyses, social context protective factors contributed a considerably larger amount of unique variance than the social context risk factors. Additional analyses showed that the relative importance of protection versus risk also held at the individual level; individual-level protection contributed 3.5% unique variance in each sample, whereas individual risk contributed only 1%. These differentials may well reflect the differential adequacy of the measurement of protection and risk: several of the risk factor measures were single-item measures; two were indexes with low internal consistency, rather than scales of parallel items; the protective factor measures were generally more reliable; and it is possible that risk was simply not measured as well as protection in this study. However, the greater importance of protection is conceptually consistent with the promotive role of protective factors when the behavioral criterion is positive or pro-social behavior. The findings also illuminate the kinds of protection and the kinds of risk that are most important in relation to adolescent involvement in health-enhancing behaviors. What emerges consistently from both the cross-sectional and the longitudinal analyses is the preeminent role of models protection, in both the family and the peer contexts. Although controls protection in those contexts is also significant in the final regression model, and in both country samples, its contribution is considerably weaker. From a social-psychological perspective, these findings suggest that engagement in health-enhancing behavior is more readily fostered by the modeling of such behavior by family and peers, rather than by their efforts to control engagement in health-compromising behavior. This conclusion is of particular interest in contrast with earlier findings about adolescent problem behavior that showed controls protection as substantially more influential—both directly and as moderators—than models protection (Jessor et al., 2003). Findings such as these attest to the propaedeutic importance of the articulation of protection and risk in the explanatory model.

The findings were strengthened by the multiple tests across two different data waves a year apart, across both sexes, across grade cohorts, across diverse health-enhancing behaviors, and in samples from two very different societies—the People's Republic of China and the United States—as well as by the demonstration of longitudinal and cross-sectional predictiveness. Both the consistency of the findings and the generality of the explanatory model are noteworthy.

The consonance of the present findings with the larger literature about the role of the social context (e.g., Cowell & Marks, 1997) is encouraging, especially because work in the health behavior field has tended to emphasize individual-level attributes. In our effort to establish the salience of social context variables in accounting for health-enhancing behavior involvement, we measured individual-level variables as well. Although the individual-level protection and individual-level risk measures were single measures, each was a composite of well-established subscales, and each had good alpha reliability. When entered into the hierarchical regression at Step 2 (see Table 1), they indeed accounted for a substantial increment in variance explained—26% in the U.S. sample and 19% in the China sample. However, when entered after the social context measures in additional regression analyses, the individual-level measures were shown to account for much less unique variance (6% and 5% in the United States and China, respectively) than the social context measures (12% and 14%,

respectively). Although differential adequacy of measurement needs to be considered, these findings nevertheless strengthen the claim that social context variables are important and suggest that future research on adolescent health behavior would do well to give increased attention to the social context of adolescent life.

Beyond findings about the applicability and generality of the explanatory model, the descriptive findings about the various health behaviors, especially about their change over-time, are also of interest. As pointed out earlier, there was evidence of a decline in involvement in the various health-enhancing behaviors between Wave 1 and Wave 2. Evidence for this over-time decline was buttressed by cross-sectional analyses that showed Wave-1 mean levels of involvement in health-enhancing behavior significantly lower in the older (9th-grade) cohort than in the younger (7th-grade) cohort, in both the U.S. and China samples and for both sexes. These findings are also similar to those previously reported for a different U.S. sample of adolescents (Jessor et al., 1998a), and together they suggest a developmental erosion of involvement in health-enhancing behavior during adolescence, now seen in a sample from China as well.

That erosion between Wave 1 and Wave 2 was shown to be predictable from changes in protective and risk factors over the same time interval. Changes in Models Protection—Family and Models Protection—Peers were, again, the most important predictors in both country samples. The possibility that declining involvement in health-enhancing behavior during adolescence is paralleled by the declining importance or impact of parental and peer models for such behavior is important to consider in thinking about efforts to promote healthy behavior. Efforts to sustain the importance of such models would be apposite, but it also may be that a different kind of protection, controls protection, becomes developmentally more important later on in adolescence and that efforts need to focus in that direction as well. Studies in the later segment of the adolescent life stage are obviously needed to clarify this issue.

The demonstration that protective factors can moderate the impact of exposure to risk on adolescent health-enhancing behavior is important and, to our knowledge, novel for a non-U.S. sample. The findings have obvious implications for those prevention and/or intervention efforts that have tended to emphasize risk reduction. What the present findings suggest is that attention to enhancing protective factors can increase their effectiveness because they actually play a dual role: promoting adolescent health behavior involvement and buffering the impact of exposure to risk factors.

Further with regard to prevention/intervention, the present findings call for a greater contextual-level focus, particularly on modeling processes in the family and peer contexts. Modeling health-enhancing behavior, for example, whether at home (e.g., parental healthy eating), at school (e.g., teachers' eating behavior in the cafeteria or their soft drink consumption), or in the media would seem an apposite effort. Changing informal social controls about health-compromising behavior and the opportunity structure to engage in it also gains support from the thrust of our contextual findings.

The generality of findings for societies as different as the United States and China is less remarkable than it may at first seem. At a descriptive level, the differences are wide-ranging—from economic system, to cultural tradition, to food preferences. Indeed, in regard to the various health behaviors themselves, there were differences in mean level of involvement between the two country samples. However, the present study was undertaken at a theoretical rather than a descriptive level, and it would be strange if a special theory were needed for each descriptively different country, any more than for different ethnic or sex subgroups within a given country. What the findings suggest is that the underlying processes determining adolescent involvement in health-enhancing behavior have a degree of commonality in both societies.

The inferences that can be drawn from the present results are constrained by the study's limitations. First, as pointed out in the Method section earlier, our samples were drawn from local, urban, school-based settings in each country, and they do not represent either China or the United States as nations. The data are appropriate only for inferences about the samples assessed and the urban, school-based populations they may represent.

A second limitation is that, despite the care taken with the translation process and favorable reviews of the translation by native Chinese scholars fluent in English, some of the measures could still have different meanings for the Chinese and the U.S. adolescent respondents. The congruent pattern of explanatory findings in both country samples, and for both sexes in the present analyses, is a source of reassurance about meaning equivalence (see Jessor et al., 2003, for further discussion of this issue).

A third limitation is that measures of both the predictor and criterion variables are based on self-reports, and the obtained relationships could have been influenced by common method variance. However, tests of the validity of self-report data about health behaviors have generally indicated that self-reports are reliable and valid indicators in adolescent samples (see, e.g., Booth, Okely, Chey, & Bauman, 2001, 2002; Prochaska, Sallis, & Rupp, 2001; Sirard & Pate, 2001; Smith et al., 2001; Wolfson et al., 2003). Furthermore, we were able to compare participants' self-reports of their perceived social contexts with independent reports of those same social contexts obtained from the parents of a subsample of the adolescent participants (see Jessor et al., 2003). Those comparisons revealed a significant degree of consistency, with most correlations in the range of .15 to .34, providing some indication of the external validity of the self-reported perceptions of social contexts.

Despite these limitations on the inferences that can be drawn from the present findings, it should be noted that the results are consistent across two waves, both sexes, three grade cohorts, multiple behaviors, and in two samples from very different countries. The study has provided support for the usefulness of the protection–risk explanatory model and added to its generality in accounting for adolescent involvement in health-enhancing behavior. A greater focus on the delineation and assessment of social context protective factors in future research on adolescent health behavior, especially in regard to the role of family and peer models, should enhance understanding and contribute to the design of more effective initiatives to promote adolescent health behavior.

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