

Parent's Socioeconomic Status, Adolescents' Disposable Income, and Adolescents' Smoking Status in Massachusetts

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High adolescent smoking rates continue to present a major challenge to the public health community.¹ Socioeconomic status (SES), as defined by education level, income, or occupation, has been shown to be a powerful predictor of health in adults.² Despite considerable research examining the association between parental SES and adolescent smoking, the nature of the association is still unsettled.^{3–36} After reviewing 21 such prospective studies, Conrad et al.²⁰ concluded that an inverse association between SES and adolescent smoking was supported by 76% of the studies. In a 1998 review article by Tyas and Pederson,³³ parental SES and adolescent smoking were reported to be inversely associated. Most of the studies were conducted in countries other than the United States.^{4–7,10,11,13,14,16–19,21,23–25,28,31,32,34} About half of the US studies supported an inverse association between parental SES and adolescent smoking.^{3,9,12,27,30,36} Other US studies, however, did not report a significant inverse association.^{15,22,26,29,35} Similarly, a number of studies in other countries did not identify a significant association.^{18,23,24,32}

Some researchers have suggested that adolescents, rather than being socially predisposed to risky behaviors (i.e., smoking) because of disadvantaged family and social conditions, become involved in such behaviors because of personal and psychological traits, which contribute to a self-selection process that leads to worse health outcomes. These researchers have also postulated that adolescents' self-perceived socioeconomic position among their peers is a stronger predictor of their smoking behavior than is parental SES.^{8,23,34} Furthermore, the pathways through which low parental SES exerts its effect on adolescent smoking are not fully determined. Some studies have examined the association of parental SES with adolescent smoking only at a bivariate level, without addressing possible confounding/mediating factors.^{7,10,11,21,28,31,32}

Objectives. This study examined the association between parental socioeconomic status (SES) and adolescent smoking.

Methods. We conducted telephone interviews with a probability sample of 1308 Massachusetts adolescents aged 12 to 17 years. We used multiple-variable-adjusted logistic regression models.

Results. The risk of adolescent smoking increased by 28% with each step down in parental education and increased by 30% for each step down in parental household income. These associations persisted after adjustment for age, sex, race/ethnicity, and adolescent disposable income. Parental smoking status was a mediator of these associations.

Conclusions. Parental SES is inversely associated with adolescent smoking. Parental smoking is a mediator but does not fully explain the association. (*Am J Public Health.* 2003;93:1155–1160)

Parental smoking status is a known strong predictor of adolescent smoking, and smoking is more prevalent among low-SES parents.³⁷ Nevertheless, only a few studies have explicitly tested whether parental smoking status is a mediator of the reported inverse association between parental SES and adolescent smoking. Borland³ reported that parental SES as measured by father's occupation was a predictor of adolescent smoking, as were school performance and parental smoking status. He noted that lower parental SES was associated with higher adolescent smoking rates and that parental smoking was positively associated with adolescent smoking, although he did not use statistical tools and appropriate adjustment techniques to examine the association. Green et al.¹⁴ used father's or mother's occupation as a proxy for parental SES and dichotomized the measure as manual versus nonmanual social class. They found that after control for parental smoking status, the association of parental SES with adolescent smoking was reduced but remained significant (crude odds ratio [OR]=2.01; adjusted OR=1.63). Chen¹⁹ reported a sample of Chinese students (aged 8 to 17 years) in which, after adjustment for students' age and sex and presence of an adult smoker in the household, the inverse association between father's education and student's smoking status re-

mained significant. Farkas et al.³⁶ reported that neither father's education nor family income was significantly associated with adolescent smoking after parental smoking status and other covariables (adolescent's age, sex, and race/ethnicity, and father's age) had been taken into account. Finally, Flint et al.²⁹ examined the association of parental education and poverty status with smoking in Black and White teenagers. Although he failed to demonstrate that these 2 proxy measures of SES were significantly associated with adolescent smoking, he found a significant association for having close friends who smoked and a marginally significant association for parental and sibling smoking status.

Depressive symptoms have also been associated with adolescent smoking.³⁸ If depressive symptoms are more common among adolescents of lower SES, such symptoms may act as a mediator of the association of low SES with adolescent smoking. Rebelliousness or problem behavior was thought to be another possible mediator. In addition, close friends' smoking status may be a mediator of the association of low SES with adolescent smoking if more adolescents from low-SES families have close friends who smoke.

Several studies have failed to reveal an inverse association between parental SES and adolescent smoking. Thorlindsson and Vilh-

jalmsson¹⁸ examined a nationally representative sample of Icelandic adolescents and found no association between social class (3 categories based on parental occupation) and adolescent smoking. In contrast, they found that hours of paid work during the school year were associated with adolescent smoking in both the bivariate and the multivariate model. In addition, a few studies have examined adolescents' income or allowance as a predictor of adolescent smoking, mostly at a bivariate level.^{7,11,13,21,23,31} It has been clearly established that increasing the cost of cigarettes reduces smoking among both adults and adolescents. Moreover, youths who have more spending money are better able to afford tobacco and are more likely to smoke cigarettes.^{5,18,25} Children of parents with higher SES levels might have more spending money, and therefore we would not expect this factor to play a mediating role in the association between low parental SES and adolescent smoking. We speculated that adolescents' disposable income might moderate the effect of parental SES on adolescent smoking by modifying the risk of smoking among adolescents of different parental SES categories.

Finally, researchers do not agree on the relative importance of the different SES indicators as independent determinants of adolescent health in general and adolescent smoking status in particular. Some researchers have argued that parental educational attainment is a stronger predictor than other SES indicators, such as household income or parental occupation.^{39–41} They speculate that parents and adolescents who pursue higher education are more likely to adopt health behaviors that will improve their health, not only because of the parents' high level of education but also because of the adolescents' ability to delay gratification.

The objective of our study was to examine the association of parental SES and adolescent smoking by means of the Massachusetts Tobacco Survey and to explore possible mediators and moderators of this association. We also sought to evaluate the relative importance of 2 indicators of parental SES—parental education and household income—in association with adolescent smoking behavior. Our hypothesis was that parental smoking status and close friends' smoking status would be medi-

tors of the association between parental SES and adolescent smoking status. We also considered psychosocial factors such as depressive symptoms and rebelliousness as possible mediators of the association between SES and adolescent smoking. Furthermore, we hypothesized that adolescent disposable income would moderate the association between parental SES and adolescent smoking.

METHODS

Study Sample

We used data collected in the 1993 Massachusetts Tobacco Survey, conducted by the Center for Survey Research, University of Massachusetts, Boston, between October 1993 and March 1994. This survey was based on a probability sample of Massachusetts households drawn by random-digit dialing. After a screening interview with an adult resident was conducted in 11 463 households, a representative sample of adults and youths was selected by the interviewers. Interviews were completed with 75% of the eligible youths, yielding a final baseline sample of 1606 adolescents aged 12 to 17 years. In 298 interviews, the adult who provided the screening information was not the parent or guardian of the adolescent interviewed. These were excluded from analysis, leaving a total of 1308 adolescents in our study.

Measures

Outcome variable. Our outcome measure was a dichotomous indicator of whether the adolescent was an established smoker. Adolescents who had smoked 100 cigarettes were classified as established smokers. Our outcome variable had no missing data.

Primary predictor variables. Our primary predictor was parental SES, for which 2 proxy indicators were available: parental educational attainment and household income. The parental education indicator referred to 1 of the following: the father, the mother, the stepfather, or the stepmother. Parental education was a 4-category variable: no high school diploma, high school graduate, some college education, and bachelor's degree or higher. Parental educational status was missing for 24 subjects (2%), who were not included in the analysis. The highest parental education

category (bachelor's degree or higher) was used as the reference category.

Annual household income as reported by the parent who responded to the survey was originally a 6-category measure (<\$10 000, \$10 001–\$20 000, \$20 001–\$30 000, \$30 001–\$50 000, \$50 001–\$75 000, >\$75 000). To create an indicator of parental SES comparable to parental education, we chose to collapse the 2 categories at both ends of the income distribution and developed a 4-category measure as shown in Table 1. Household income was missing for 322 subjects (24.6%), who again were excluded from the analysis. The highest household income category (>\$50 000) was used as the reference category.

Possible confounding variables. We included adolescent age (3-category measure as shown in Table 1), sex, and race/ethnicity (dichotomous variable of White vs non-White including African American, Hispanic, Asian, and Other) as basic adjustment variables in our models. We used the youngest age group of adolescents, female sex, and White race/ethnicity as our reference categories. These covariables had very few missing values, and subjects with missing data were not included in the analysis.

Hypothesized Mediators

Additional variables were evaluated as potential mediators. Parental smoking status separately for the mother and the father (dichotomous yes/no measure) was introduced in our models. For single-family households, we imputed no smoking for the second parent. Other mediators evaluated were a proxy measure of the adolescent's depressive symptoms (categorical low, medium, high), a proxy measure of the adolescent's rebelliousness (dichotomous low/high), and whether the adolescent had a close friend who smoked (dichotomous yes/no). Depressive symptoms were measured with 6 items adapted from the Center for Epidemiological Studies Depression Scale, and rebelliousness was measured with 6 items that represent several domains of adolescent problem behavior.⁴² These 3 measures (adolescent's depressive symptoms, adolescent's rebelliousness, and adolescent's having a close friend who smoked) also had some missing values, rang-

TABLE 1—Characteristics of Adolescents, by Level of Parental Educational Attainment: Massachusetts, 1993–1994

Characteristic	Parental Educational Status				P Value
	Less Than High School Diploma	High School Diploma	Some College	Bachelor's Degree or Higher	
Adolescent age, y, %					.09
12–13	25.6	36.0	30.0	37.4	
14–15	40.7	33.5	36.4	33.5	
16–17	33.7	30.5	33.8	29.1	
Adolescent sex, % female	49.4	54.3	49.1	49.8	.45
Adolescent race/ethnicity, % White	57.4	73.4	74.1	83.4	<.0001
Household income, US\$, %					<.0001
≤ 20,000	49.5	16.9	13.5	2.8	
20 001–30,000	28.4	24	18.7	9.9	
30 001–50,000	15.6	38.7	39.3	17.4	
> 50 000	6.4	20.4	28.5	69.9	
Paternal smoking status, % yes	26.2	31.6	25.7	16.6	<.0001
Maternal smoking status, % yes	27.3	29.9	25.1	14.4	<.0001
Adolescent depressive symptoms, %					
Low	36.4	33.8	36.4	37.0	
Medium	30.8	31.6	30.8	36.0	
High	32.7	34.6	32.8	27.0	.4
Adolescent rebelliousness, % high	64.6	57	57.7	56.7	.33
Friends' smoking status, % yes	78.6	73.5	75.3	68.2	.048
Received weekly allowance, % yes	52.9	63.2	59.5	64	.06
Earned money from work in previous month, % yes	42.9	57.3	58.4	58.5	.003

ing from 0.8% to 2% of the total sample. We chose to impute the reference value for these covariables. For adolescents with missing values on depressive symptoms, we imputed the low-depressive-symptoms category; for missing values on rebelliousness, we imputed the low category; and for missing values on having a close friend who smoked, we imputed no close friend who smoked. By using imputation, we maintained a stable sample size that enabled us to compare the parameter estimates from different models; this method was a conservative approach because simple imputation (in this case, use of reference categories) is likely to bias the results toward the null hypothesis.

Adolescent disposable income included money from a weekly allowance and money earned from a job during the previous month. The 2 measures of adolescent disposable income (in US dollars) were included in our analyses as quartiles of weekly allowance and the previous month's income, with the lowest quartiles as the reference categories. To ex-

amine a possible moderating effect of adolescent disposable income, we included a term capturing the interaction between weekly allowance and parental education and weekly allowance and household income in the corresponding multivariate models.

Statistical Analysis

We used χ^2 tests and *t* tests to examine the bivariate associations between our primary predictor and the other covariables as indicated. We also compared the distribution of basic demographic characteristics for those with and without missing data on household income. Household income was the variable with the largest percentage of missing values. Both categorical SES indicators were assumed, and statistically modeled, to have a linear relationship with the outcome of interest (adolescent smoking), with equal distance between categories.

Multivariable-adjusted logistic regression models were used to evaluate the effect of parental SES, separately for parental education

and household income, on the prevalence of established smoking among adolescents in our survey. Potential confounders and mediators of the association between parental SES and adolescent smoking were evaluated by comparing the bivariate and multivariate associations with adolescent smoking. We evaluated the potential mediating effect of each of the hypothesized mediators (parental smoking, depressive symptoms, rebelliousness, and close friends smoking) by including them in the multivariate model in consecutive order. We also evaluated the possible interaction effect between adolescent income (weekly allowance) and our primary predictors of parental SES (parental education and household income) by including an interaction term in the multivariable-adjusted logistic regression models. In secondary analyses, we compared the multivariable-adjusted model estimated with parental education and the multivariable-adjusted model estimated with household income using the same sample size.

RESULTS

Parental educational status was missing for 24 subjects (2%), and household income was missing for 322 subjects (24.6%), all of whom were excluded from the analysis. We also compared the age, sex, parental education, and adolescent smoking distributions of those who reported household income and those who did not report household income. There were no statistically significant differences between the 2 groups in terms of age, sex, and adolescent smoking status. We found a significant difference only for parental educational attainment, which was evident in the highest educational category (bachelor's degree or higher). The characteristics of the study sample according to 4 levels of parental education are detailed in Table 1. Adolescent females were distributed evenly among the 4 levels of parental education. More White adolescents had parents with higher education. In the lower parental education categories, there were also more parents who smoked and more adolescents who reported that they had a close friend who smoked. Adolescents from families with higher parental education reported receiving more money as a weekly allowance and were more likely to report income from a job in the past

month. Finally, the household income reported was directly associated with parental education. People with higher education were more likely to report higher household income.

Most of the adolescents' characteristics were significantly associated with being an established smoker at the bivariate level (data not shown). Maternal smoking was associated with an 85% increased risk of the child's being a smoker. Older adolescents were also more likely to be smokers. White adolescents were more likely than adolescents of other races/ethnicities to be smokers. Among all adolescents, having more depressive symptoms, having a close friend who smoked, and being rebellious were associated with a higher risk of being an established smoker. Finally, adolescents who reported receiving a weekly allowance or who had earned money from a job in the previous month were more likely to be smokers. No statistically significant interactions between adolescent disposable income (weekly allowance) and parental SES indicators were seen in the multivariate models.

Parental education was significantly and inversely associated with adolescent smoking status after adjustment for adolescent age, sex, and race/ethnicity (OR=1.31, 95% confidence interval [CI]=1.07, 1.60). Similar results were found for the association between household income and adolescent smoking after adjustment for adolescent age, sex, and race/ethnicity (OR=1.36, 95% CI=1.09, 1.69). When we adjusted for adolescent age, sex, and race/ethnicity and consecutively included parental smoking status, adolescent depressive symptoms, rebelliousness, close friends' smoking status, and adolescent disposable income (weekly allowance), the associations remained significant for both indicators of parental SES. In the multivariate models, the magnitude of the association between parental educational attainment and adolescent smoking behavior was quite similar to the magnitude of the association between household income and adolescent smoking, as 4-category indicator variables. For example, adolescents from families in the lowest parental education category (no high school diploma) were 28% more likely to be smokers than were adolescents from families in the next higher parental education category (high school diploma). Similarly, adolescents from families with an annual household

TABLE 2—Multivariable-Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Association of Parental Educational Attainment and Adolescent Smoking (n = 1250): Massachusetts, 1993–1994^a

Variable	Adjusted OR (95% CI)
Parental education ^b	1.28 (1.04, 1.58)*
Age	2.96 (2.12, 4.13) [†]
Sex	1.13 (0.73, 1.74)
Race/ethnicity	0.36 (0.19, 0.67)**
Paternal smoking status	1.01 (0.63, 1.61)
Maternal smoking status	1.3 (0.82, 2.05)
Adolescent depressive symptoms	1.41 (1.07, 1.86)*
Adolescent rebelliousness	2.71 (1.57, 4.69)***
Friends' smoking status	5.82 (1.79, 18.91)**
Adolescent weekly allowance	1.2 (1.02, 1.42)*

^aMultivariate model included all the variables shown in the table.

^bParental college or graduate education was used as the reference category.

P* < .05; *P* < .01; ****P* < .001; [†]*P* < .0001.

income in the lowest category (\$20 000 or less) were 30% more likely to be smokers compared with adolescents from families in the next household income category (\$20 001 to \$30 000), and so forth. We did not find a significant interaction between adolescent disposable income and parental SES in the multivariate models (Tables 2 and 3).

In Table 4 we present changes in the magnitude of the association of parental SES indicators after we consecutively included the hypothesized mediators in our models. A considerable reduction in the odds ratios was noted (10% in the effect of parental education and 19% in the effect of household income) after the introduction of parental smoking status (father/mother smoking status). An additional small reduction was noted after adolescent depressive symptoms and rebelliousness were included in the models; however, reduction was not an important mediation effect. Similar results were also evident for the mediation effect of having a close friend who smoked. Although adolescent weekly allowance did not appear to have a modifying effect on the parental SES–adolescent smoking association, when we examined its main

TABLE 3—Multivariable-Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) for Association of Household Income and Adolescent Smoking (n = 965): Massachusetts, 1993–1994^a

Variable	Adjusted OR (95% CI)
Household income ^b	1.30 (1.04, 1.63)*
Age	3.31 (2.27, 4.84) [†]
Sex	1.1 (0.67, 1.76)
Race/ethnicity	0.32 (0.15, 0.69)**
Paternal smoking status	1.18 (0.7, 1.97)
Maternal smoking status	1.21 (0.72, 2.04)
Adolescent depressive symptoms	1.43 (1.05, 1.96)*
Adolescent rebelliousness	2.37 (1.29, 4.36)**
Friends' smoking status	5.64 (1.33, 23.84)*
Adolescent weekly allowance	1.15 (0.95, 1.39)

^aMultivariate model included all the variables shown in the table.

^bThe highest household income category (>\$50,000) was used as the reference.

P* < .05; *P* < .01; ****P* < .001; [†]*P* < .0001.

effects in the multivariate model, we found that adolescent weekly allowance increased the magnitude of our primary predictors.

In a secondary analysis, we examined the multivariate model with parental education (model 5 in Table 4) after excluding those with missing data on the household income variable. Parental education and all other factors had the same directional effect as in the previous models; some factors (adolescent age, adolescent race/ethnicity, close friends' smoking status, and adolescent disposable income) were still significant or marginally significant predictors, although parental education was not (OR=1.21, 95% CI=0.79, 1.84).

DISCUSSION

To our knowledge, this is the first study conducted in the United States to report a multivariable-adjusted association of parental SES and adolescent smoking after taking into account the effects of age, sex, race/ethnicity, and a number of possible mediators of this association, such as parental smoking status, adolescent depressive symptoms, rebelliousness, and close friends' smoking status. It is

TABLE 4—Associations of Parental Socioeconomic Status Indicators With Adolescent Smoking After Introduction of Possible Mediators

	Parental Education (n = 1250), OR (95% CI)	Household Income (n = 965), OR (95% CI)
Model 1 ^a	1.31 (1.07, 1.60)	1.36 (1.09, 1.69)
Model 2 ^b	1.28 (1.04, 1.57)	1.29 (1.04, 1.62)
Model 3 ^c	1.27 (1.03, 1.57)	1.28 (1.02, 1.60)
Model 4 ^d	1.26 (1.02, 1.55)	1.28 (1.02, 1.60)
Model 5 ^e	1.28 (1.04, 1.58)	1.30 (1.04, 1.63)

Note. OR = odds ratio; CI = confidence interval.

^aAdjusted for age, sex, and race/ethnicity.

^bAdjusted for age, sex, race/ethnicity, and parental smoking status.

^cAdjusted for age, sex, race/ethnicity, parental smoking status, adolescent depressive symptoms, and rebelliousness.

^dAdjusted for age, sex, race/ethnicity, parental smoking status, adolescent depressive symptoms, rebelliousness, and adolescent friends smoking.

^eAdjusted for age, sex, race/ethnicity, parental smoking status, adolescent depressive symptoms, rebelliousness, adolescent friends smoking, and adolescent weekly allowance.

notable that in this representative sample of adolescents in Massachusetts, both low parental educational status and low household income were significant independent predictors of adolescent smoking.

The magnitude of the association of both parental SES indicators with adolescent smoking was quite similar. Our hypothesis, implicating some psychosocial mediators, was not supported, because depressive symptoms and rebelliousness, although independently associated with adolescent smoking status in the multivariate model, did not appear to have a significant mediating effect on the parental SES association. Although smoking by an adolescent's close friend was a very strong independent predictor of adolescent smoking, it did not appear to mediate the effects of parental SES to a considerable degree. A significant direct association was found between measures of adolescent disposable income (amount of weekly allowance, previous month's job income) and smoking status at the bivariate level. However, the association of the previous month's income was not retained in the multivariate model. The amount

of weekly allowance was directly associated with adolescent smoking status but did not modify the effect of parental SES. It appeared to act as a negative confounder of the association of parental SES because it increased the magnitude of the association after it was introduced in the model.

In contrast to the findings of other studies,^{15,18,22–24,26,29,32,35,43} we found that a relatively sizable and significant inverse association between parental SES and adolescent smoking persisted even after parental smoking status, adolescent disposable income, close friends' smoking status, and other important predictors of adolescent smoking such as age and race/ethnicity were taken into account. We found that parental smoking status was a significant mediator of the association of parental SES and adolescent smoking. The presence of a parental smoker mediated a 10% and a 19% reduction in the effect of parental education and household income, respectively.

The persistence of the effect of SES after control for mediation effects from parental smoking and personal characteristics such as depressive symptoms and rebelliousness suggests that other factors that affect low-SES adolescents may be more important in determining smoking behavior.⁴⁴ Higher parental educational attainment may exert its effect through role modeling and better life opportunities for offspring. Low SES may represent a proxy measure for other community factors, such as the quality of health education in the schools that children attend, the strictness with which smoking bans are enforced in the children's schools,⁴⁵ the availability of tobacco from local merchants, or the extent of restrictions on smoking in public places in the community.⁴³ These factors were not considered in our study.

Low SES may also be a proxy measure for family or community attitudes toward the value of health in general. It is known that low SES is also associated with low participation rates in preventive measures such as the use of seat belts. If children are taught by example not to worry about their future health, they might be less concerned about the long-term consequences of smoking. SES may also be a proxy measure for locus of control. If youths from low-SES backgrounds feel that life is stacked against them and that they

have few opportunities, they may be more likely to seek the immediate gratification that smoking offers. All of these factors could be addressed in future studies of the role of SES in adolescent smoking. Without an understanding of why SES is such a strong predictor of adolescent smoking, it is not clear how the knowledge that it is a strong predictor can be used for prevention except to provide grounds for simply targeting low-SES populations with general preventive measures.

Although the cross-sectional design of our study does not support causal interpretations, parental education is assumed to temporally precede establishment of adolescent smoking, and the directionality of the association can be inferred through logical interpretation. The number of subjects was considerably smaller in the analysis with household income because of missing values. Despite this limitation, which does not allow direct comparison of the 2 parental SES estimates, we found surprisingly similar associations.

The social and economic predictors of adolescent smoking initiation and smoking maintenance are important to efforts to prevent tobacco use and encourage smoking cessation in adolescents. Our study joins previous reports to support the concept that parental SES (measured by parental education and household income) is significantly inversely associated with adolescent smoking status and that indicators of parental SES have equivalent utility in examinations of the effects of SES. The apparent mediating effect of parental smoking status, in our findings, suggests that implementing smoking cessation programs for low-SES adults may be an effective way to target adolescents. Our findings do not provide support for the self-selection hypothesis of adolescent smoking behavior. Further research is needed to identify important mediators of the association of low parental SES with adolescent smoking and to develop effective programs to prevent smoking initiation and promote smoking cessation among adolescents. ■

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This article was accepted July 4, 2002.

Contributors

E. Soteriades developed the study hypotheses, reviewed the relevant literature, analyzed the data, and wrote the article. J. DiFranza supervised the study development process and data analysis and contributed to the writing of the article.

Acknowledgments

This project was supported by an educational grant (03496) from the Robert Wood Johnson Foundation and the Massachusetts Department of Public Health (Health Protection Fund). The authors are grateful to Dr Lois Biener for valuable comments, Dr Michael Nicolaou for skillful data analytic assistance, and Amy Nyman for excellent data management.

Human Participant Participation

This study was approved by the institutional review board of the University of Massachusetts.

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