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Local Tobacco Policy and Tobacco Outlet Density: Associations With Youth Smoking

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Abstract

Purpose—This study investigates the associations between tobacco outlet density, local tobacco policy, and youth smoking. A primary focus is on whether local tobacco policy moderates the relation between outlet density and youth smoking.

Methods—1,491 youth (51.9% male, *M* age = 14.7 years, *SD* =1.05) in 50 midsized California cities were surveyed through a computer-assisted telephone interview. Measures of local clean air policy and youth access policy were created based on a review of tobacco policies in these cities. Outlet density was calculated as the number of retail tobacco outlets per 10,000 persons and city characteristics were obtained from 2000 U.S. Census data.

Results—Using multilevel regression analyses controlling for city characteristics, tobacco outlet density was positively associated with youth smoking. No significant main effects were found for the two tobacco policy types on any of the smoking outcomes after controlling for interactions and covariates. However, statistically significant interactions were found between local clean air policy and tobacco outlet density for ever smoked and past-12-month cigarette smoking. Comparisons of simple slopes indicated that the positive associations between tobacco outlet density and youth smoking behaviors were stronger at the lowest level of local clean air policy compared to the moderate and high levels.

Conclusions—Our results suggest that outlet density is related to youth smoking. In addition, local clean air policy may act as a moderator of relationship between outlet density and youth smoking, such that density is less important at moderate and high levels of this tobacco policy.

Keywords

Local tobacco policy; tobacco outlet density; youth smoking; prevention

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Introduction

Policies limiting access to and availability of tobacco products are often recommended as strategies to prevent youth smoking [1-3]. The purpose of such policies is to increase the effort and resources necessary for youth to obtain tobacco, thus increasing the full costs of smoking or tobacco use [4, 5]. These and other tobacco policies (e.g., clean air laws) may also reinforce community norms against tobacco use and against providing tobacco to youth [6].

Most often, access and availability approaches to preventing youth smoking focus on reducing sales or provision of tobacco to minors. Research suggests that intensive enforcement of compliance laws, for example, may be associated with significant reductions in smoking and in purchase attempts by youth [7, 8]. Another approach to reducing tobacco availability is to restrict the numbers or density of commercial tobacco outlets in a community. The assumption underlying such restrictions is that higher density increases access by decreasing opportunity costs and increasing the likelihood of tobacco sales to minors. Consistent with availability theory, cigarette smoking among youth is expected to be greater when access to tobacco is high. Indeed, results of a Canadian national survey indicated that 33% of smokers said that if they had to travel further to buy cigarettes they would smoke less [9].

Apparently no studies have investigated how changes over time in tobacco outlet density are related to youth smoking, although a small number of studies have investigated naturally occurring variations in density among communities or neighborhoods. Focusing specifically on youth, the findings from this research are mixed. A study found that youth living in communities at the 75th percentile in terms of tobacco outlet density were 13% more likely to have smoked in the past month than youth living in the bottom 25th percentile, after controlling for confounders using a propensity score approach [10]. In another study, young smokers at schools with a greater number of tobacco outlets nearby were more likely to buy their own cigarettes and less likely to have someone else purchase cigarettes for them [11]. The number of nearby outlets, however, was not related to whether a student smoked. In contrast, other research found that the prevalence of current smoking was higher at schools in neighborhoods with the highest tobacco outlet density (>5 outlets) compared to schools in neighborhoods without any tobacco outlets [12]. In a recent study of Latino adolescents, a significant negative association was found between alcohol and tobacco use and the distance between the nearest retailer and adolescents' residence after controlling for various social environment variable [13]. In contrast, a large study of Midwestern communities in the US found that although underage purchase survey sales rates were related to ever smoking and current smoking among youth, tobacco outlet density was not [14]. The number of tobacco outlets was unrelated to school smoking prevalence in another study of Canadian high school neighborhoods [15], and more recently, McCarthy et al. found that among high school students and urban students, but not middle school students or rural students, there was a small but significant relationship between tobacco outlet density near schools and students' reports of smoking initiation [16]. Outlet density was not associated with established smoking in this study.

The different locations, populations, smoking outcomes, and definitions of outlet density in these studies may explain these mixed findings. However, another possible explanation for the mixed findings regarding tobacco outlet density is that its effects may be contingent upon other local tobacco policies. In particular, outlet density may be less important in communities where youth access and other tobacco policies (e.g., clean air laws, restrictions on advertising) are enacted and strongly enforced. For example, it would seem less likely

that outlet density would be related to youth smoking where sales laws were regularly enforced and compliance rates were high.

The present study investigates the relationships among local tobacco policy, tobacco outlet density, and youth smoking in 50 midsized California communities. In addition to considering simple effects, we investigate the extent to which any effects of outlet density are moderated by other local tobacco policies.

We hypothesize that: (1) youth smoking behaviors will be positively associated with tobacco outlet density; (2) youth smoking behaviors will be negatively associated with the strength of local tobacco policy; and (3) local tobacco policy will moderate the relationships between tobacco outlet density and youth smoking, such that outlet density will be more closely associated with these behaviors when local tobacco policies are weaker.

Methods

Study sample and survey methods

This study is based on data from 1,491 youth (51.9% male, *M* age = 14.66 years, *SD* =1.05) in 50 midsized California cities who provided complete data for all study variables. A geographic sampling method was used to select 50 non-contiguous California cities with populations between 50,000 and 500,000. The initial sample frame comprised all 138 California cities with population sizes between 50,000 and 500,000. Specifically, we randomly sampled one city and then eliminated all contiguous cities, all cities contiguous to those cities and those that were within a one-mile radius of the selected city. This process was repeated until 50 cities were selected. The resulting sample of 50 cities is a purposive geographic sample intended to maximize validity with regard to the geography and ecology of the state [17]. The sampled cities tended, on average, to have slightly smaller populations (106,588 vs. 108,000), somewhat less ethnic diversity (e.g., 64% vs. 59% white), smaller household sizes (2.82 vs. 2.93 persons), and lower median household incomes ($50,000 vs. $52,000). Importantly, however, none of these differences were statistically significant. An average of 29.8 youth (range: 15-48, *SD*=6.85) in each city provided information for the study. Sample characteristics are provided in Table 1.

Households for the study were sampled from a purchased list of telephone numbers and addresses from which most non-working and business numbers were purged and that consisted of households identified as likely to contain respondents in the target age range (i.e., 13-16 years old). Youth were surveyed through a computer-assisted telephone interview (CATI). The interviews were given in either English or Spanish at the respondent's request and lasted approximately 40 minutes. Initial contact with respondents was made through a pre-announcement letter, which described the study and invited participation. A toll-free number was given so that youths or their parents could get more information. Follow-up telephone calls were initiated 3-7 days after the letters had been mailed. Once contact was made, it was determined whether the number was within the targeted community, if it belonged to a business or residential household, and if there was an adolescent in the target age range in the household. Where more than one eligible adolescent respondent resided in a household, a random selection procedure was used to choose one to be invited to participate in the survey. Once an adolescent respondent was selected, parental permission was obtained to interview that individual. The fact that the interview was confidential and was to be conducted in private was stressed to parents prior to obtaining their permission. Respondents were informed that the study concerns smoking and drinking behaviors, that it is voluntary, and that they can refuse to participate, refuse to answer specific questions, or decide at any time to end their participation in the study. A $25

payment was made to respondents to compensate them for their time. Institutional review board approval was obtained prior to implementation of the study.

Response rates for list-assisted samples are difficult to calculate because it is impossible to know the number of non-households that were actually eligible (e.g., had youth in the appropriate age group). Similar to other recent studies using household telephone surveys [18, 19], the estimated response rate for this survey was 50.4%..

Measures

Local tobacco policy—The following steps were taken to measure local tobacco policy. First, from April to August 2009 all city municipal codes and various secondhand smoke policy databases (i.e., American Lung Association, American Nonsmokers' Rights Foundation, and California's Clean Air Project) were reviewed. Local tobacco policies included indoor and outdoor clean air laws and tobacco sales laws. Only city laws that are more restrictive than state laws were considered. Cities were then scored on six identified domains as follows:

1. *Tobacco sale laws*. Two types of laws were considered under this domain: (1) laws requiring the seller of any tobacco products to request a photo identification for people who appear to be 27 years of age or younger, and (2) strong local tobacco licensing laws, which are defined by the American Lung Association as laws that include the following four components: (a) requirements that all retailers that sell tobacco products must obtain a license and renew it annually; (b) a fee set high enough to sufficiently fund an effective program, including administration of the program and enforcement efforts and a clearly stated enforcement plan that includes compliance checks; (c) coordination of tobacco regulations so that a violation of any existing local, state or federal tobacco regulation suspends or revokes the license; and (d) a financial deterrent through fines and penalties including the suspension and
2. *Workplace laws*. Two types of laws were considered under this domain: (1) laws that require indoor workplaces to be 100% smoke-free and (2) laws that require entryways (public or workplace building only) to be smoke-free. Cities were scored based on the number of strong laws in this domain (ranging from “none” to “both workplace and its entryways”).
3. *Outdoor places of entertainment*. Three types of laws were considered under this domain: (1) laws that require outdoor sports arenas to be 100% smoke-free or the designation of smoking areas, (2) laws that require parks to be 100% smoke-free, and (3) laws that require outdoor dining areas to be 100% smoke-free. Cities were scored based on the number of strong laws in this domain (ranging from “none” to “three laws”).
4. *Outdoor areas available to and customarily used by the public*. Two types of laws were considered under this domain: (1) laws that require all public building entryways to be smoke-free, and (2) laws that require service areas to be smoke-free. Cities were scored based on the number of strong laws in this domain (ranging from “none” to “two laws”).
5. *Multi-units*. Three types of laws were considered under this domain: (1) laws that require or promote any percentage of units to be smoke-free, (2) laws that require multiunit indoor common areas to be 100% smoke-free, and (3) laws that require either designated smoking areas or 100% smoke-free multi-unit outdoor common

6. *Hotels/motels*. A measure of smoke-free hotel/motel guest rooms was also included, ranging from 35% (California state law permits up to 65% of hotel/motel guest rooms to be designated as smoking rooms) to 100%.

We used principal component analysis to assure that the various policy measures fall into two distinct factors that seem to represent these policy domains (i.e., clean air policy and youth access policy) and do not fall into one general "local tobacco policy" factor. A principal component analysis (direct oblimin) yielded a two-factor solution, accounting for 69.3% of the variance: clean air laws (5 items) with factor loadings ranging from .52-.89 and youth access laws (1 item) with a factor loading of .96. Regression factor scores were calculated to represent "clean air policy" and "youth access policy". By weighting the contribution of each policy measure to its factor, theses regression scores maximize reliability of the policy scales. These factor scores were used as measures of strength of local clean air policy and local youth access policy.

Tobacco outlet density—The number of licensed tobacco retail establishments in each city was obtained from State of California Board of Equalization data-files for September 2009. Outlet density in each city was calculated as the number of retail outlets per 10,000 persons.

City characteristics—Measures of city characteristics were obtained from the 2000 U.S. Census data. City-level characteristics included in this study are: population density (i.e., population per roadway mile), median family income, percentage of population that is white (Hispanic or none-Hispanic whites), percentage of female heads of household with minors and no husband present, percentage of unemployed, and percentages of population ≥25 years of age with a high school education or less. All city-level characteristics were standardized.

Smoking behaviors—Participants were first asked if they ever smoked a whole cigarette in their life, more than just a few puffs ("No" and "Yes"). Respondents who had smoked a whole cigarette were asked about their frequency of cigarette smoking in the past 12 months on a seven-point scale ("Never" to "Every day") and those who smoked cigarettes in the past 12 months were asked about their frequency of cigarette smoking in the past 30 days on a seven-point scale ("None" to "All 30 days"). Because these outcome variables were positively skewed, past-12-month cigarette smoking frequency and past-30-day cigarette smoking frequency were scaled as the $\log_{10}$.

Demographics—Students reported their gender, race/ethnicity, and age. Race/ethnicity was treated as a dichotomy (Hispanic or none-Hispanic white vs. non-white) as the majority of respondents were white (65%).

Data analysis

Multilevel logistic and linear regression analyses were conducted with HLM version 6.04 software to adjust for clustering of observations within cities [20]. Intraclass correlations were .006, .006, and .001 for ever smoked cigarette, frequency of cigarette smoking in the past 12 months, and frequency of cigarette smoking in the past 30 days, respectively. The main effects and interactions between local clean air policy and tobacco outlet density and between local youth access policy and tobacco outlet density on youth smoking behaviors were entered simultaneously. The tobacco outlet density variable was standardized. Population density, race/ethnicity, female heads of household with minors, unemployment, education, and median household income were included as city-level covariates. Gender, race/ethnicity, and age were included as individual-level covariates in each model.

Results

As indicated in Table 2, in the presence of the individual and city-level covariates and the interaction terms, significant main effects of outlet density on ever smoked cigarette and past-12-month cigarette smoking were in the expected directions. That is, tobacco outlet density was positively associated with youth smoking. No significant main effects were found for local clean air policy and local youth access policy on any of the smoking outcomes, once the covariates and interactions were taken into account. Statistically significant interaction effects, however, were found between local clean air policy and tobacco outlet density variables on lifetime and past-12-month cigarette smoking.

The nature of the interactions between local clean air policy and tobacco outlet density on ever smoked and past-12-month cigarette smoking is summarized in Table 3, which shows beta coefficients (SE) or odds ratios (95% confidence intervals) for the relationships between outlet density and smoking behaviors at three conditional values of local clean air policy created by tertiles (i.e., low, moderate and high). Comparisons of regression coefficients (Table 3) indicate that the positive association between tobacco outlet density and youth smoking were stronger at the low level of local clean air policy compared to the moderate and high levels. In fact, there were no relationships between outlet density and youth smoking behaviors at the moderate and high levels of local clean air policy. These interactions are also illustrated in Figures 1 and 2, which show plots of adjusted mean values for ever smoked (Figure 1) and past-12-month cigarette smoking (Figure 2) by three levels of outlet density [i.e., low (4.23-10.35 retail outlets per 10,000 persons), moderate (10.36-13.70 retail outlets per 10,000 persons), and high (13.88-20.29 retail outlets per 10,000 persons), by tertiles] and three levels of local clean air policy (i.e., low, moderate, high, by tertiles). The positive relationships between tobacco outlet density and youth smoking were stronger at the low level of local clean air policy compared to moderate and high levels.

Discussion

The present study investigated the relationships among local tobacco policy, tobacco outlet density, and youth smoking. No main effects of local clean air policy and local youth access policy on youth smoking behaviors were found. Similar to other studies, however, [10-13], our findings indicate that there is a relationship between tobacco outlet density and youth smoking, such that higher levels of outlet density are positively associated with youth smoking.

Tobacco outlet density in the current study was measured at the city-level, which is a larger geographic unit than many other studies have used. These associations may be even stronger if the geographic unit were smaller (e.g., neighborhood or school area). The optimal geographic unit for investigating density effects, however, is unclear. For example, it could be argued that neighborhoods are too small as a unit of analysis given the mobility that youth enjoy and their involvement in extended social networks that cross neighborhood boundaries. In any case, the significant effect of outlet density indicates the importance of this factor as a possible determinant of youth smoking. The cross-sectional design, however, limits our ability to make causal interferences about these relations and it could be that tobacco outlet density is lower in some communities because fewer people smoke and there is less overall demand to cigarettes in those communities. That is, density and youth smoking may both represent the effects of broader community norms.

Our main effects, however, were conditional upon strength of local clean air policy. In the current study, small but statistically significant interaction effects were found between local

clean air policy and tobacco outlet density variables on lifetime and past-12-month cigarette smoking. That is, local clean air policy may act as a moderator of relationships between outlet density and youth smoking, such that the relationships between tobacco outlet density and youth smoking are weaker in communities with stronger clean air policy. Thus, when tobacco outlets are dense and availability to tobacco is high in a particular community, clean air policy may be an important tool in reducing youth smoking. A possible explanation is that stronger clean air policies reinforce community norms against youth tobacco use and against providing tobacco to youth, thus countering the effects of greater density. Again, the cross-sectional design limits our ability to make causal interferences about these relationships.

Interestingly, neither main effects nor interaction effects were found for local youth access policy. The majority of local tobacco policies in our communities, however, are clean air laws which may be more visible to youth in their communities. Although no main effects of local tobacco policies and youth smoking behaviors were found, the current study suggests that the importance of these policies may be conditional upon other environmental determinants such as tobacco outlet density. Including only clean air laws and tobacco sales laws to measure local tobacco policy, however, might be considered a limitation of the current study. Future studies should study communities with other local policies such as restriction on marketing and advertising, enforcement of minor in possession laws, and regulations of places and times of sales.

Finally, results of the current study support both controls over tobacco outlet density and local tobacco policy. Therefore, control over tobacco outlet density together with strong local tobacco policy may have the greatest impact on youth smoking. The Institute of Medicine has recently called for the development, implementation and evaluation of legal mechanisms for restructuring tobacco retail sales and restricting the number of tobacco outlets [2]. Outlet density is still a new frontier for tobacco control [21].

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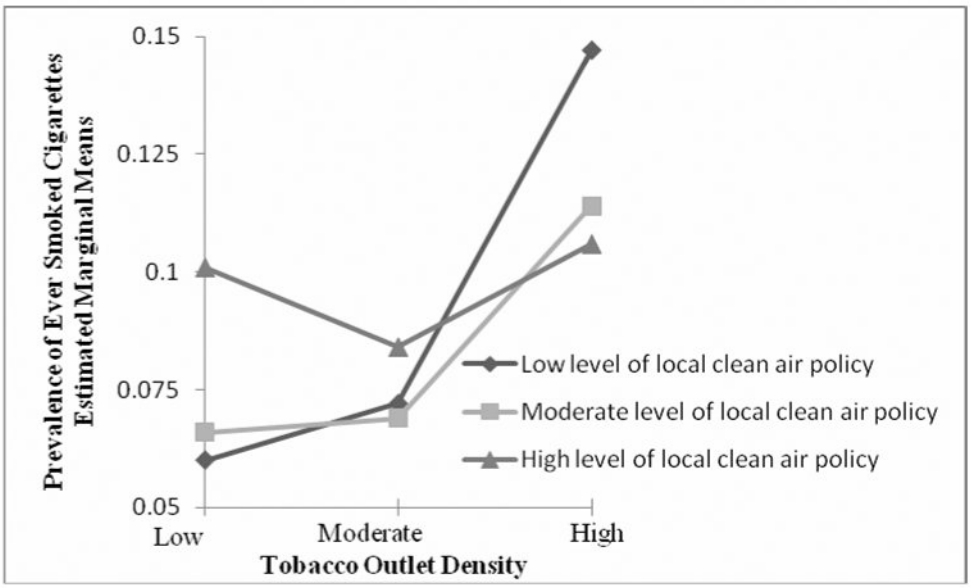

Fig. 1.

Local clean air policy as a moderator of the relationship between tobacco outlet density and prevalence of ever smoked cigarettes in the 50 California communities

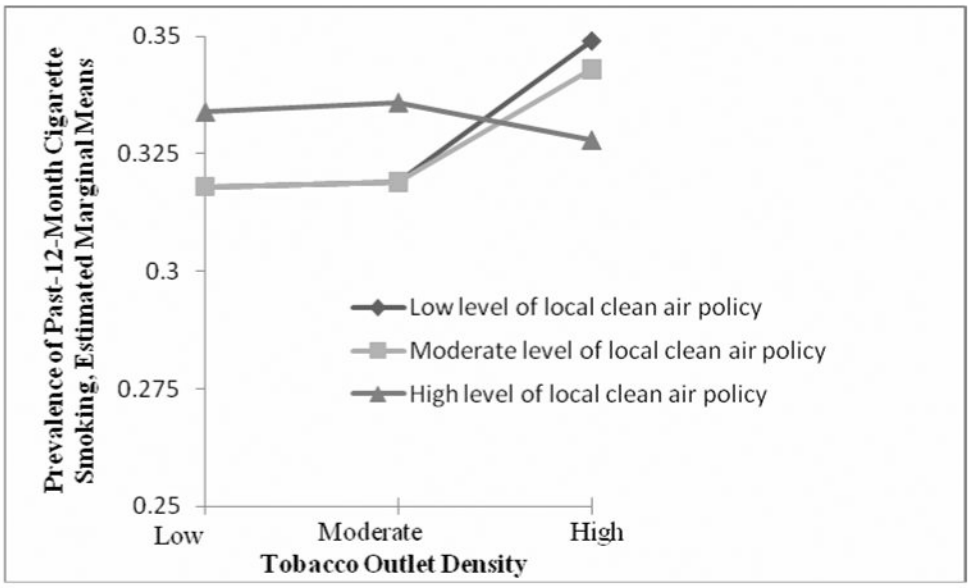

Fig. 2.

Local clean air policy as a moderator of the relationship between tobacco outlet density and prevalence of past-12-month cigarette smoking in the 50 California communities

Table 1
Sample characteristics, percent or mean (SD)

Variable	% or mean (SD)	Minimum-Maximum
Individual level (*N*=1,491)		
Gender (%)		
Male	51.9	---
Female	48.1	---
Race/Ethnicity (%)		
White	64.5	---
Non-white	35.5	---
Age	14.7 (1.05)	13-16
Cigarette smoking behaviors		
Ever smoked a whole cigarette (%)	8.9	---
Any past-12-month cigarette smoking (%)	7.9	---
Frequency of cigarette smoking, past 12 months[a]	1.22 (.90)	1-7
Any past-30-day cigarette smoking (%)	4.4	---
Frequency of cigarette smoking, past 30 days[a]	1.1 (.63)	1-7
City level (*N*=50)		
Local clean air policy[b]	.00 (1.00)	-1.132-3.007
Local reduce youth access policy[b]	.00 (1.00)	-.979-3.297
Tobacco outlet density per 10,000 people	12.125 (3.51)	4.23-20.29
Population density	290.48 (100.71)	128.376-740.644
Percentage of whites	64.3 (16.7)	24.1-88.1
Percentage of female heads of household with minors (no husband present)	7.4 (2.4)	3.1-12.8
Percentage of unemployed	6.8 (2.7)	3.3-13.1
Percentage of population ≥25 years of age with a high school education or less	20.9 (12.7)	3.6-67.8
Median household income	50,108.24 (14,259.2)	26,839-84,429

[a] Mean (*SD*) of 1-7 point response scale

[b] A regression score

Table 2

Results of multi-level regression analyses, beta coefficient (SE) or odds ratio (95% confidence interval) to assess the relationships among local tobacco policy, tobacco outlet density, and youth smoking

Predictors:	Ever smoked a whole cigarette OR (95% CI)	Past-12-month cigarette smoking[a] Beta (SE)	Past-30-day cigarette smoking[a] Beta (SE)
City level (*N*=50):			
Local clean air policy	1.094(0.904,1.323)	.002(.003)	.000(.002)
Local youth access policy	.955(.753,1.211)	-.002(.003)	-.003(.002)
Tobacco outlet density	1.312(1.041,1.655)*	.010(.003)**	.002(.002)
Local clean air policy × outlet density	.852(.743,.977)*	-.006(.002)**	-.003(.002)
Local youth access policy × outlet density	1.046(.866,1.264)	.003(.003)	.003(.002)
Population density	.947(.703,1.275)	-.002(.004)	-.001(.002)
Whites	1.124(.848,1.490)	.002(.004)	.002(.003)
Female HH with minors	1.157(.830,1.615)	.005(.004)	.003(.003)
Unemployed	.866(.555,1.416)	-.006(.005)	-.002(.003)
Education	.997(.716,1.389)	-.000(.004)	-.002(.003)
Median HH income	1.182(.823,1.709)	.005(.005)	.000(.004)
Individual level (*N*=1,491):			
Male	1.338(.952,1.881)	.011(.005)*	.007(.004)*
White	.836(.607,1.151)	-.002(.005)	.002(.004)
Age	1.802(1.503,2.162)**	.015(.002)**	.008 (.002)**

[a] this variable was scaled as the $\log_{10}$

** p≤.005;

* p≤.05

Table 3

Beta coefficients (SE) or odds ratios (95% confidence intervals) for relationships between outlet density and smoking behaviors, by level (tertiles) of local clean air policy

Local clean air policy	Ever smoked OR (95% CI)	Past-12-month cigarette smoking, Beta (SE)
Low (*N*=16 cities)	1.714(1.091,2.693) *	.014(.004) *
Moderate (*N*=17 cities)	.800(0.492,1.303)	.002(.005)
High (*N*=17 cities)	1.010(.689,1.483)	.001(.005)

* p≤.05