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Does it really matter which drug you choose? An examination of the influence of type of drug on type of risky sexual behavior

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Abstract

This study investigates whether certain types of substances are differentially related to certain risky sexual behaviors (RSBs) within the same population and determines whether combination substance use (SU) has additive, redundant or antagonistic effects on RSBs. African-American youth aged 9–19 participated in a large, community-based survey assessing substance use and sexual behaviors. Multilevel modeling was used to predict the differential influence of alcohol, marijuana, and cocaine use on condom use measured in the past 90 days and at last intercourse, sex while drunk/high, and number of sexual partners. Tests of the within-participant relations showed that participants increasing their SU over time concurrently increased their RSBs, establishing a strong link between the two behaviors (alcohol: condom $\beta = -.045$, sex while drunk/high $\beta = .138$, sex partners $\beta = .102$; marijuana: condom $\beta = -.081$, sex while drunk/high $\beta = .255$, sex partners $\beta = .166$; cocaine: condom $\beta = -.091$, sex while drunk/high $\beta = .103$, sex partners $\beta = .031$; all p 's < .01). Tests of the between-participant relations showed that, generally, youth reporting less SU across their teenage years were also more likely to report fewer RSBs over this period (alcohol: condom $\beta = -.128$, sex while drunk/high $\beta = .120$, sex partners $\beta = .169$; marijuana: condom $\beta = -.170$, sex while drunk/high $\beta = .638$, sex partners $\beta = .357$; cocaine: condom $\beta = -.353$; all p 's < .05). Moreover, the combination of some substances has unique redundant or antagonistic effects on RSB. Such findings support the consideration of type of SU, and particular combinations of substances, on RSBs in intervention development.

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Keywords

Substance use; Risky sexual behavior; Adolescent; High-risk; African American

Introduction

The prevalence of risky sexual behaviors (RSBs), or any sex-related behaviors that increases one's risk for sexually transmitted infections (STIs) or unplanned pregnancy, remains relatively high among adolescents and young adults (e.g., Centers for Disease Control and Prevention [CDC], 2011). Youth from the southeastern region of the United States, particularly those of African descent, are especially vulnerable to the effects of STIs due to high rates of poverty, lower access to quality healthcare, STI stigma, and dense sexual networks (Reif, Geonntotti, & Whetten, 2005; Reif et al., 2014; Sales et al., 2013). Considering the aforementioned challenges facing youth in the South, researchers have been compelled to identify variables that reliably predict RSBs within these populations. One variable frequently linked to RSBs is substance use (SU) (Carey, Senn, Walsh, Scott-Sheldon, & Carey, 2016; King, Nguyen, Kosterman, Bailey, & Hawkins, 2012; see Ritchwood, Ford, DeCoster, Sutton, & Lochman, 2015 for review; Tucker et al., 2014).

The study of the relation between SU and RSB is complex and has produced mixed findings; some studies have found strong relations between the two variables (e.g., Tucker et al., 2014) while others have shown more limited associations (e.g., Carey et al., 2016; Walsh, Fielder, Carey, & Carey, 2014). Contradictory findings are partially due to variations in the types of substances and RSBs examined, as well as differences in population-level characteristics (e.g., Leigh, Ames, & Stacy, 2008; Ritchwood et al., 2015). As alcohol and marijuana tend to be the most commonly used substances among youth, the majority of studies on this topic have examined the effects of alcohol use on RSB (e.g., Carey et al., 2016), with fewer studies examining the effects of marijuana (e.g., Anderson & Stein, 2011) and other drug use (e.g., Pagano, Maietti, & Levine, 2014) on RSB among youth. While examinations of the impact of single SU on RSB can be informative, little is known regarding potential differences in the impact of certain types of substances on certain types of RSBs and how these relations might change over time within a target population. Some substances, for example, may have more poignant psychopharmacological effects (e.g., alcohol and cocaine) that link them to sexual behavior than other drugs (e.g., marijuana) (e.g., Johnson et al., 2010; Metrik et al., 2012). Moreover, we know little about the nature of such effects. For example, it is possible that the using two drugs have no effect on RSB above and beyond single drug use. Alternatively, the combination of some types of drugs may further exacerbate engagement in particular types of RSB. To date, no research has examined this relation.

Therefore, the aims of the current study are to: 1) determine whether certain types of substances are differentially related to certain risky sexual behaviors within a sample of high-risk, impoverished African American youth; and 2) determine whether the individual substances have independent additive effects on RSBs. This study is unique in that no other studies on this topic, to date, have examined the differential influence of particular drugs on

particular types of sexual risk behaviors within the same population, a sample of impoverished, African American youth from the South. To do this, we develop multilevel models using longitudinal data, which enables us to independently test both within-participant and between-participant relations among our variables. Examining within-participant variability allows us to determine how differences in SU over time affects whether an individual changes their RSBs, whereas examining between-participant variability allows us to determine whether participants with different mean levels of SU have different mean levels of RSBs. This is the first study to examine both between-participant and within-participant effects in the SU-RSB relation, which enables both cross-sectional and longitudinal interpretations.

Materials and Methods

Sample

Between 1998 and 2008, respondents aged 9–19 were recruited from 13 of the most impoverished neighborhoods in Mobile, Alabama to participate in the Mobile Youth Survey (MYS), which is a community-based study of adolescent risky behaviors (Bolland, Bryant, Lian, McCallum, Vazsonyi, & Barth, 2007). In 1998, the initial sample was composed of 1,771 youth. The initial response rate of youth residing in targeted neighborhoods was between 60% and 70%. In 1999, researchers recruited previous respondents to complete the survey again and also actively recruited a new random sample of participants. For the duration of the project, the researchers used the same recruitment and retention procedure. By 2008, a total of 9,477 adolescents had completed the MYS, 9,211 (97%) of whom were African American. We therefore limited our analyses to African-American participants to provide a clearer context for our results. The analysis data set included 24,782 observations across these 9,211 individuals, with 61.7% providing data for two or more years. The mean number of time points for each youth was 2.69 years and the maximum was 10 years. Time points varied by participants due to the fact that each year after baseline, a small proportion were loss to follow-up and those over aged 19 aged out of the sample. Participants were predominately low-income (85% qualified for free or reduced lunch) and had a mean age of 14.81 years. The sample had more male (60%) than female participants.

Procedures

This study was approved by the Institutional Review Board at a university located in a mid-sized city in the southeastern United States and procedures have been described in detail elsewhere (Bolland et al., 2007). In sum, participants were recruited from both public housing and non-public housing residences. The researchers obtained a list of public housing residences in which youth were listed on the lease and, of these households, 50% were randomly selected and contacted. Although there was no comparable list for non-public housing communities, the researchers attempted to obtain a representative sample by randomly selecting and contacting 50% of the residences in the targeted neighborhoods. These became the active recruitment samples. We passively recruited other youth residing outside of the target neighborhoods using fliers and word of mouth. After parental consent and youth assent were obtained, the survey, which was written at the 5th grade reading level, was administered to youth in groups of 15–30 in local community establishments (i.e.,

schools, community centers). For younger respondents and those experiencing difficulty, questions were read aloud while participants wrote their corresponding responses on the questionnaire. Additional assistance was provided as necessary. Participants were advised of procedures taken to maintain confidentiality and they were given an incentive of \$10 for their participation.

Measures

The MYS consisted of 294 questions focusing on a wide variety of psychosocial characteristics and risky behaviors. Most survey items were adapted from the Youth Risk Behavior Survey and the National Longitudinal Study of Adolescent Health. Participants were identified as living in one of the 13 neighborhoods included. The current analyses focus only on the following measures related to SU and risky sexual behavior. Four SU variables (i.e., alcohol, marijuana, cocaine use, drunk/high on substance) were created using two types of questions. One type asked whether a participant “ever” used substances, respondents selected either “no” or “yes.” The other type asked respondents to select either “no,” “yes,” or “yes, just once” in reference to increasingly shorter periods of time (e.g., sometime, in the past year, in the past 30 days, in the past 7 days). For the current study, we combined these questions into a single item for each substance use category that incorporated the frequency and recency of use (Bolland et al., 2007). Responses to these items were coded as 1 = never used, 2 = used sometime, 3 = used once in the past year, 4 = used more than once in the past year, 5 = used once in the past 30 days, 6 = used more than once in the past 30 days, 7 = used once in the past 7 days, or 8 = used more than once in the past 7 days (Bolland et al., 2007; Ritchwood, Howell, Traylor, Church, & Bolland, 2014).

Risky sexual behavior was represented by four variables: number of sexual partners, frequency of condom use during the last 90 days, condom use at last intercourse, and sex while drunk or high. The response choices for number of sexual partners ranged from 0 (*not sexually active/no change in sexual partner*) to 5 (*5 or more different sexual partners*). The response choices for frequency of condom use during the last 90 days were between 0 and 5 (0 = none of the time, 1 = less than half of the time, 2 = half of the time, 3 = most of the time, 4 = always, 5 = did not have sex). The response choices for condom use at last intercourse were between 0 and 3 (0 = not used, 1 = I don’t know, 2 = used, 3 = never had sex). The response choices for sex while drunk or high ranged between 0 (*no*) and 1 (*yes*).

Data analysis

Data analysis was conducted using Mplus version 6.11 (Muthén & Muthén, 1998–2011). We used multilevel models to estimate the relation of SU with RSBs in the MYS data set with observation at the first level and participant at the second level. We decided to exclude the SU variable related to how often the participant was drunk or high, since this was conceptually a composite of the individual SU variables. Further, we examined the relations among the individual SU and RSB variables rather than combine them into latent constructs because of our interests in understanding how specific types of SU might be associated with specific types of RSBs. Gender, age, and neighborhood were included as covariates in our primary models. Due to the large sample size, R^2 values are provided.

To determine if the joint use of multiple substances influenced the likelihood of an individual engaging in RSBs, we tested whether there were significant interaction effects among the various SU variables when predicting RSBs. We attempted to examine the effects of three interactions (alcohol use by cocaine use, alcohol use by marijuana use, cocaine use by marijuana use) on all four measures of RSBs in the same model; however, the solution failed to converge. We then tested the interactions in separate models, each containing the corresponding main effects as well as gender and neighborhood as blocking factors. The models for the alcohol use by marijuana use and cocaine use by marijuana use converged, but the model for alcohol use by cocaine use did not. We then ran an additional model testing the interaction for alcohol use by cocaine use without including neighborhood as a blocking factor and this model converged and the results are reported below.

We used data from 1998 to 2008 and while most respondents participated in 2–3 followup visits due to aging out of the sample or being lost to follow-up, there was a minimal amount of missing data across the SU and RSBs variables. On these variables, 98% of the values were complete, and 92% of the participants had fully complete data. Examining cases with missing data, we found that the most common patterns involved missing data on a single variable. The rates of missingness were fairly consistent across the variables, although the SU variables were slightly more likely to be missing than the RSBs variables. We used full information maximum likelihood estimation to address any missing data, which has been identified as one of the optimal ways to handle missingness (Peugh & Enders, 2004).

Results

At baseline, 47% of youth reported having had sex and 36% of youth reported that they had sex in the past 90 days. The descriptive statistics for the variables used in our analyses aggregated to the participant level are presented in Table 1. We found that 11.4% reported having sex while drunk or high, and 33.3% reported using a condom during their last intercourse. The participants engaged in low to moderate amounts of both SU and RSBs, although there is also a substantial amount of variability between participants.

Differential relations among type of SU and type of RSBs

Table 2 presents standardized regression coefficients testing the bivariate relations of the variables with the RSBs variables after controlling for age, gender, and neighborhood. These analyses were run separately for each combination of SU and RSBs; therefore, they do not control for collinearity among the SU variables or collinearity among the RSBs variables. From this we see that each SU-RSB relation was significant ($p < .001$), indicating that greater SU is associated with greater RSBs even when controlling for the covariates.

Next, we examined the ability of each type of SU to predict variability in each RSBs variable above and beyond that explained by the covariates and the other SU variables. Because the collection of SU variables were included as predictors in the same model, each coefficient represents the unique ability of that particular substance to predict the RSBs, excluding any effects that might be related to more general tendencies to use or not use substances. All of the relations were tested within a single model, where the SU variables and the RSBs variables were allowed to freely co-vary. The tests of the standardized

coefficients relating the individual measures of SU to RSBs in this model are presented in Table 3. From this, we can see that all of the SU variables have significant independent relations with the RSBs variables in the expected directions (all p 's < .05). This pattern is mostly consistent across both the within-participant and between-participant levels, although cocaine use is only able to predict within-subject variability in having sex while high or the number of sexual partners (p 's < .01). Overall, greater SU is associated with reduced likelihood of using a condom in the last 90 days (p 's < .05), reduced likelihood of using a condom at the last intercourse (p 's < .01), increased likelihood of have sex while high (p 's < .05), and an increased number of sexual partners (p 's < .01).

Additive effects? Interactions among types of SU predicting RSBs

The standardized coefficients for the interaction effects from the convergent models are presented in Table 4. Given that greater SU is consistently associated with more RSBs (i.e., the coefficients are always negative for condom use in the past 90 days or used a condom at last sex and always positive for sex while high in the past 90 days or number of sexual partners), the interactions can be classified into three different categories depending on the nature of the interaction coefficient. A non-significant interaction coefficient would suggest that the use of both substances has an additive effect, where the expected increase in RSBs from using both substances can be determined by simply summing the effects of the individual substances. Evidence of additive effects are apparent in all three interactions terms with each RSB: alcohol by cocaine, alcohol by marijuana, and cocaine by marijuana, though findings varied by within versus between-groups effects ($p > .05$).

If the interaction coefficient is significant and it has the same sign as the main effects (i.e., negative for condom use in the past 90 days or used a condom at last sex, and positive for sex while high in the past 90 days or number of sexual partners), the use of both substances has an antagonizing effect, where the expected increase in RSBs from using both substances would be greater than what we would expect by summing the effects of the individual substances. If the interaction coefficient is significant and its sign is opposite those of the main effects (i.e., positive for condom use in the past 90 days and used a condom at last sex, or negative for sex while high in the past 90 days and number of sexual partners), the use of both substances has a redundant effect, where the expected increase in RSBs from using both substances is less than what we would expect by summing the effects of the individual substances. To make identifying these effects easier, Table 4 presents antagonizing effects with darker shading and redundant effects with lighter shading. From this we can see that the majority of the significant interactions represent redundant effects ($.05 > p < .001$), but the simultaneous use of alcohol and marijuana appear to create an antagonizing effect (within-groups: $\beta = .118$, $SE = .013$, $p < .001$; between-groups: $\beta = .236$, $SE = .092$, $p < .05$).

Conclusions

This study revealed significant relations between substance use (SU) and risky sexual behaviors (RSBs), such that all substances were differentially related to all RSBs. To our knowledge, this is the first study to examine the differential effects of the use of specific substances and engagement in particular types of RSBs within a sample of impoverished,

African-American youth. We found that, overall, there was an additive relationship between cocaine and alcohol use. For youth reporting cocaine use, the addition of alcohol did not cause them to be worse off in terms of sexual risk; however, we found redundant effects for within-participant condom use, such that the addition of alcohol did not decrease condom use over time as much as would have been expected. There were mostly redundant relationships between alcohol and marijuana, such that the addition of marijuana did not increase RSB as much as expected, though this pattern was different for sex while high. Specifically, we found that the addition of alcohol to marijuana increased instances of sex while high. Lastly, we found that the addition of marijuana to cocaine produced mostly additive effects, with the exception of within-subjects effects, in which the addition of marijuana produced redundant effects for condom use and sex while high. The results of this study extend previous research by considering both between-participant and within-participant effects in the examination of this relation. Specifically, tests of the within-participant relations showed that participants increasing their SU over time also concurrently increased their RSBs, establishing a strong link between the two behaviors. Tests of the between-participant relations showed that youth reporting less SU across their teenage years were also more likely to report fewer RSBs over this period.

Our findings suggest that cocaine and marijuana exerted the strongest effects on RSBs within this population, which is in contrast to previous studies that have identified marijuana as less impactful on sexual behavior than other drugs (Metrik et al., 2012). Considering that marijuana use has been associated with stimuli enhancement, disinhibition, and greater senses of well being and excitement (e.g., Reyna & Farley, 2006); it is possible that marijuana use leads an individual to be more focused on the end goal of sexual pleasure rather than on the importance of safe sexual practices particularly if the pharmacological effects of the drug lead individuals to perceive less danger. Alternatively, the effects of cocaine and marijuana use on sexual risk could also be understood from a drug expectancy standpoint. In other words, it is possible that youth who believe that certain substances have the ability to enhance their sexual experience, or believe that their peers have such beliefs, may be more likely to engage in RSBs when under the influence (Cooper, 2006; Metrik et al., 2012). Unlike other studies that have suggested that cocaine use is less frequently used in conjunction with intercourse (e.g., Lane, Cherek, Tcheremissine, Lieving, & Pietras, 2005), our results showed that cocaine use was among the strongest predictors of less condom use. Cocaine, a psychomotor stimulant, is believed to act as a catecholamine agonist, which may have the effect of increasing stamina, sexual arousal, and sexual pleasure (Foxman, Aral, & Holmes, 2006). Such pharmacological effects may influence the sexual situations and motivations of their use, especially for adolescents.

The current study has notable limitations. First, our study relied solely on retrospective self-report data, so we are unable to verify SU through drug testing, which could lead to concerns regarding validity. This limitation, however, is not unique to this study and is often found in behavioral research. Second, our study does not fully consider the role of SU during a particular sexual occasion and its relation to risky sexual behavior during that same occasion. The use of substances at the time of intercourse could further impair one's perception of sexual risk, thereby increasing the likelihood of unsafe sexual practices (Cooper, 2006). Third, this sample represents African-American participants from

impoverished communities in Mobile, Alabama. Our sample is, therefore, neither ethnically nor socioeconomically comparable to those of national datasets. Finally, given the age range of participants and the ways in which the questions were framed, occurrences of sexual abuse may be represented in the responses currently captured as RSBs. Future research should attend to item development and explore ways to differentiate between consensual and nonconsensual or statutory sexual encounters (Finkelhor et al., 2013).

Despite these limitations, our study has several unique strengths. First, our study focuses on high-risk, African-American youth from the Deep South, a group particularly vulnerable to STIs within a geographic location that tends to be largely understudied. Additionally, our study demonstrated associations between type of SU and type of RSB at both the between and within-participant levels. Lastly, our study further extends the literature by providing information on additive, redundant, and antagonistic relationships between drug classes. Findings that substances have differential influences on certain types of RSBs could partially explain lackluster intervention effects and advocates for programs that are more targeted in regards to type of SU (or combination of SU) rather than treating all types of SU equally during intervention.

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Highlights

- This is the first study to look at the independent effects of each type of drug on each type of risky sexual behavior examined within a high-risk sample.
- This study examined both between-groups and within-groups effects, which is rarely done in the literature.
- Our findings provide evidence for aggregating the use of different substances when relating substance use to RSB, as it appears that engagement in substance use predicts engagement in risky sexual behavior, regardless of type.

Table 1

Baseline descriptive statistics.

Variable	N (%)
<i>Risky sexual behavior</i>	
Number of sexual partners (M (SD))	1.98 (1.41)
Condom use in the past 90 days	
No sex in past 90 days	834 (49.6)
None of the time	203 (12.1)
About half the time	67 (4)
Most of the time	107 (6.4)
Always	375 (22.3)
Use of condoms during last sexual experience	
Never had sex	769 (45.5)
No	306 (18.1)
Yes	563 (33.3)
I don't know	52 (3.1)
Having sex while drunk or high	
No	1502 (86.6)
Yes	194 (11.4)
<i>Substance use</i>	
Alcohol use	
Ever drunk alcohol	
No	854 (49.4)
Yes	876 (50.6)
Alcohol in past 30 days	
No	1233 (70.5)
Yes, just once	260 (14.9)
Yes, more than once	256 (14.6)
Alcohol in past 7 days	
No	1363 (78.5)
Yes, just once	204 (11.7)
Yes, more than once	170 (9.8)
Cocaine use	
Ever used crack or cocaine	
No	1678 (96.0)
Yes	70 (4)
Used crack in past year	
No	1680 (96.3)
Yes, just once	47 (2.7)
Yes, more than once	17 (1.0)
Marijuana use in past year	

Variable	N (%)
No	1345 (77.4)
Yes, just once	173 (10.0)
Yes, more than once	220 (12.7)
Drunk/Hi	
Ever drunk on alcohol or high on drug	
No	1343 (77.3)
Yes	395 (22.7)
Drunk/Hi in past 30 days	
No	1452 (83.4)
Yes, just once	133 (7.6)
Yes, more than once	155 (8.9)
Drunk/Hi in past 7 days	
No	1503 (86.6)
Yes, just once	100 (5.8)
Yes, more than once	133 (7.7)
<i>Covariates</i>	
Age (M (SD))	14.81 (2.02)
Gender	
Male	903 (51.0)
Female	867 (49.0)

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Table 2

Standardized coefficients predicting risky sexual behavior from substance use after controlling for covariates.

		R ²			
		Condom use in the past 90 days	Used a condom at last sex	Sex while high in the past 90 days	Number of sexual partners
Covariates	within subjects	0.053	0.110	0.046	0.164
	between subjects	0.099	0.167	0.144	0.386
β (SE) [change in R ²]					
Condom use in the past 90 days					
Alcohol	within subjects	-.115 (.009) [.011]	-.085 (.008) [.005]	.271 (.010) [.064]	.180 (.009) [.025]
	between subjects	-.388 (.031) [.145]	-.403 (.027) [.156]	.648 (.026) [.403]	.430 (.018) [.184]
Cocaine	within subjects	-.121 (.009) [.015]	-.068 (.009) [.004]	.460 (.065) [.036]	.092 (.010) [.010]
	between subjects	-.467 (.052) [.192]	-.401 (.051) [.140]	.669 (.054) [.187]	.232 (.042) [.046]
Being drunk or high	within subjects	-.134 (.009) [.016]	-.085 (.009) [.005]	.366 (.011) [.119]	.203 (.010) [.034]
	between subjects	-.447 (.031) [.184]	-.445 (.028) [.181]	.851 (.022) [.668]	.519 (.020) [.249]
Marijuana	within subjects	-.129 (.009) [.015]	-.099 (.009) [.009]	.337 (.011) [.098]	.221 (.010) [.042]
	between subjects	-.410 (.030) [.157]	-.416 (.027) [.159]	.791 (.023) [.585]	.489 (.019) [.222]

Note: All substance use variables are significantly related to all RSBs variables ($p < .001$). Control variables are age, gender, and neighborhood.

Standardized coefficients testing the unique ability of each type of substance use to predict RSBs after controlling for the other types of substance use and covariates.

Table 3

		β (SE)			
		Condom use in the past 90 days	Used a condom at last sex	Sex while high in the past 90 days	Number of sexual partners
Alcohol	within subjects	-.054 (.009)***	-.045 (.009)***	.138 (.010)***	.102 (.009)***
	between subjects	-.128 (.060)*	-.169 (.055)**	.120 (.056)*	.169 (.037)***
Cocaine	within subjects	-.091 (.009)***	-.041 (.009)***	.103 (.012)***	.031 (.010)**
	between subjects	-.353 (.067)***	-.278 (.064)***	.132 (.072)	.027 (.048)
Marijuana	within subjects	-.081 (.010)***	-.072 (.009)***	.255 (.012)***	.166 (.010)***
	between subjects	-.170 (.062)**	-.165(.058)**	.638 (.059)***	.357 (.039)***

Note:

* = $p < .05$,

** = $p < .01$,

*** = $p < .001$.

Covariates are age, gender, and neighborhood.

Table 4
Standardized coefficients testing the effects of interactions between substance use variables on RSBs.

		β (SE)			
		Condom use in the past 90 days	Used a condom at last sex	Sex while high in the past 90 days	Number of sexual partners
Alcohol×Cocaine	within subjects	.034 (.015) *	.031 (.015) *	-.023 (.020)	-.025 (.016)
	between subjects	.508 (.919)	.989 (.843)	.554 (.850)	.056 (.619)
Alcohol×Marijuana	within subjects	.056 (.010) ***	.061 (.010) ***	.118 (.013) ***	-.044 (.011) ***
	between subjects	.038 (.092)	.223 (.084) **	.236 (.092) *	-.099 (.060)
Cocaine×Marijuana	within subjects	.044 (.016) **	.047 (.014) **	-.054 (.020) *	-.008 (.017)
	between subjects	-.341 (.565)	.402 (.502)	-.442 (.562)	.321 (.400)

Note:

* = $p < .05$,

** = $p < .01$,

*** = $p < .001$.

Covariates are age, gender, and neighborhood. Unshaded cells represent additive effects, darker cells represent antagonizing effects, and lighter cells represent redundant effects.