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Adverse Childhood Experiences, Smoking and Mental Illness in Adulthood: A Preliminary Study

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Background. *Adverse childhood experiences (ACE) are associated with mental illness and smoking in adulthood, but ACE has not been studied as a determinant of this comorbidity. This study was designed to examine effects of ACE on the expression of smoking behavior and mental illness in adulthood.*

Methods. *We examined the relationship between ACE, smoking status, and the expression of serious mental illness in adults (n = 101). Subjects were evaluated with a semi-structured interview that included psychiatric status, smoking status, substance abuse and presence and severity of ACE. Subjects were grouped into four categories based on psychiatric and smoking status: psychiatric smokers (PS), psychiatric nonsmokers (PNS), control smokers (CS) and control nonsmokers (CNS).*

Results. *ACE was associated with serious mental illness or smoking behaviors in adulthood, and to a lesser extent with co-morbid mental illness and smoking. Cumulative number of ACE was highest in the order of PS > PNS > CS > CNS.*

Conclusions. *These preliminary results suggest an association between the presence of ACE and the expression of severe mental illness in adulthood, and possibly to comorbid smoking and mental illness. Longitudinal research using larger samples is needed to determine the causal relationship between ACE and co-morbid smoking and mental illness.*

Keywords Adverse childhood experiences, Smoking, Mental disorders, Schizophrenia, affective Disorders, Addiction Severity Index

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INTRODUCTION

The prevalence of smoking in mentally ill populations has been shown to be at least 2-fold higher than the smoking rates in the general population (1,2). In clinical samples, compared to smoking prevalence in the general population of 25%, elevated smoking rates have been found in schizophrenia (58–88%), bipolar disorder (50–70%), major depression (40–60%), anxiety disorders (35–53%), alcoholism (80–90%) and cocaine and opioid addiction (63–98%) (1–4).

Biological and genetic factors have been posited as explanations for these high rates of smoking across many psychiatric disorders (5,6). However, non-biological risk factors such as childhood trauma and stressful life events are considered risk factors for smoking. For example, in a population-based sample, Anda and colleagues (7) presented compelling evidence to suggest a link between adverse childhood experiences (ACE) and smoking behavior in adulthood, suggesting that such childhood experiences may predict smoking status later in life. Furthermore, it is also known that the mentally ill suffer from ACE at disproportionately higher rates in comparison to non-psychiatric controls (8,9). For example, the likelihood of lifetime psychopathology is increased with a history of childhood abuse (9), the presence of ACE of any type (verbal, physical or sexual) significantly increases the risk of attempting suicide when compared with those reporting no adverse experiences (8), the risk of sexual promiscuity in females (10), male involvement in teen pregnancy (11), and an association between major depressive disorder and childhood physical and/or sexual abuse has been found both in general psychiatric populations as well as in non-clinical populations (12).

Given the high rates of smoking in mentally ill populations, and their frequent experience of ACE, the present study was designed to examine effects of ACE on the expression of smoking behavior and mental illness in adulthood, either alone or in combination. We hypothesized that smokers with psychiatric disorders would report more frequent and severe ACE in comparison to psychiatric patients who were nonsmokers, nonpsychiatric smokers, and nonpsychiatric patient nonsmokers. Our analyses were conducted using a cross-sectional study design that defined comparison groups on the basis of current smoking and psychiatric status and their relationship to ACE and other clinical outcomes. Because stress has been found to be a vulnerability factor for negative affect, mental disorders, high rates of smoking in the illicit drug abuse, medical problems and smoking behavior (13–15), particularly in women (16), it was hypothesized that the combination of mental illness and smoking would be associated with the highest rates and severity of ACE.

METHODS

Subjects

A total of n = 101 outpatient subjects were enrolled in this study. Participants were primarily derived from other ongoing research studies focusing on the chronically mentally ill populations (primarily schizophrenia, bipolar disorder, and major depression) and nonpsychiatric controls (17–19), and were seeking enrollment in treatment and non-treatment studies in The Program for Research in Smokers with Mental Illness (PRISM) at The Connecticut Mental Health Center (CMHC) in New Haven, CT. Nonpsychiatric control subjects (smokers and non-smokers) were also recruited using flyers advertising this study posted in the Greater New Haven area, and through local newspaper advertisements. All subjects were interviewed for this study prior to participation in the primary studies. Written informed consent was obtained on all subjects by trained research staff. Study procedures and advertisements utilized in this study were approved by the Human Investigational Committee at Yale University School of Medicine.

Inclusion/Exclusion Criteria

All participants were screened using the Structured Clinical Interview for DSM-IV (SCID) (20), and those meeting diagnostic criteria for either Schizophrenia, Schizoaffective Disorder, Bipolar Disorder, Major Depressive Disorder or Posttraumatic Stress Disorder (PTSD) were included in the psychiatric sample. Psychiatric subjects were required to be outpatients, psychiatrically stable at the time of interview, and if prescribed psychotropic medications, to be on a stable dose of medication for at least one month prior to the study assessments. Individuals with past histories of co-occurring abuse or dependence on alcohol or illicit drugs were included in the sample, and urine toxicology screens (Medtox, 5-panel, Burlington, NC) and breathalyzers were used to screen for current illicit drug and alcohol use for all participants. Subjects who had positive urine drug screens for cocaine, opioids and marijuana or detectable breath alcohol levels at the screening visit were excluded from study participation. Control subjects demonstrated no current Axis I psychiatric disorder or substance abuse or dependence based on the SCID interview.

Cigarette smoking was assessed using the self-reported timeline follow-back for the number of cigarettes smoked per day over the past seven days (21), and current smoking status was biochemically verified with expired breath carbon monoxide levels ≥10 parts per million (ppm) (22). Level of dependence on nicotine was measured with the Fagerstrom Test of Nicotine Dependence (FTND) (23). We recruited both smokers and nonsmokers into this study. All smokers met DSM-IV criteria for nicotine dependence, and reported smoking ≥10 cigarettes per day on average, with expired CO levels >10 ppm, and FTND scores ≥4. Nonsmokers were defined as those subjects who had a CO level < 10 ppm and: 1) were former smokers and had been abstinent from cigarettes for at least six months; 2) never smokers who reported having smoked < 100 cigarettes in their lifetime (24).

Procedures

A total of n = 102 subjects were screened for study eligibility. One subject was excluded from participation due to suicidal ideation at the time of study eligibility evaluation. Eligible subjects (n = 101) were classified into one of the following four categories based on psychiatric diagnosis and smoking status: 1) psychiatric smoker (PS; n = 27), 2) psychiatric nonsmoker (PNS; n = 24), 3) control smoker (CS; n = 25), 4) control nonsmoker (CNS; n = 25). Once eligibility was determined, subjects were assessed using a battery of semi-structured interview and self-report questionnaires lasting approximately 1.5 to 2 hours, which was conducted by Masters or Doctoral level clinicians.

In order to measure histories of adverse experiences in childhood, all participants were administered the Adverse Childhood Experiences Scale (ACE) (7), a self-report measure comprised of thirteen questions which assessed for the presence of events in childhood considered abusive including verbal, physical, and sexual abuse, as well as questions probing other early types of dysfunctional familial situations (e.g., presence of an incarcerated parent, divorce or separation of parents, substance abuse or mental illness at home) occurring prior to the age of 18 (see Appendix 1). The verbal and physical abuse questions used in this scale were adapted from the Conflict Tactics Scale (CTS) (25), while content questions regarding sexual abuse were derived from Wyatt (26). The ACE has been used extensively in epidemiological studies conducted by Felitti and colleagues (27), while the CTS is a reliable and valid instrument that has been widely used to assess relationship violence over time (25).

The domain of verbal abuse consisted of two questions of increasing severity with response categories based on a 5-point Likert scale with 1 indicating that the event never happened in the home and 5 indicating that it occurred very often. Occurrence of verbal abuse was measured with two questions of increasing severity including: 1) verbal insults by a family member, and 2) verbal threats of physical harm. Occurrence of physical abuse prior to the age of 18 was also measured with two questions of increasing severity using the same 5-point rating scale as the Verbal Abuse questions. These items were presented as to assess for the occurrence of: 1) mild physical assault such as pushing or slapping, and 2) physical assault having caused some bodily injury. The four Sexual Abuse questions, presented in increasing severity, required a Yes/No response by the participant, which included: 1) having been touched in a sexual way by an adult, 2) having been forced to touch an adult in a sexual way, 3) had an older person attempt to have sexual intercourse with them, 4) having been forced to have sexual intercourse with an older person. These experiences may have involved a relative, family friend, or stranger at least five years older than themselves. The remaining five dysfunctional familial items on the ACE also required a yes/no reply in response to the presence of the adverse event in the home. They assessed for the presence of dysfunctional domestic situations during childhood including: 1) a battered mother or parent, 2) substance abuse (alcohol or drugs), 3) mental illness, 4) parental separation or divorce, or 5) an incarcerated family member.

Additionally, the Addiction Severity Index (ASI) (28), a structured interview designed to assess current and past severity of alcohol and substance abuse problems, as well as the Beck Depression Inventory (29) and the Brief Psychiatric Ratings Scale (30) was administered to all subjects.

Statistical Analyses

Comparisons amongst continuous demographic and clinical variables across the four groups were performed using one-way analysis of variance (ANOVA) with post-hoc Least Significant Difference (LSD) testing to compute between-group differences for those analyses with a significant main effect, or with 2×2 Chi square for dichotomous outcome variables. One-way ANOVA with post-hoc LSD tests were also used in order to determine the differences between diagnostic groups on continuous ACE verbal and physical abuse questions, cumulative ACE analysis, as well as examination of the ASI domains and GAF scores. Cumulative number of ACE was determined by summating each endorsed adverse experience, including reports of verbal, physical and sexual abuse, and familial stressors, that were endorsed by each subject, with a range of 0–11 (31). Chi-square analyses were utilized to examine relationships within the dichotomous ACE sexual abuse questions. ANCOVA and multivariate logistic regression analysis was used to correct for the effects of potential confounding demographic differences (e.g., age and educational level) when significant main effects for comparison groups were found for ACE and other clinical outcome measures. Other clinical variables such as the BDI or the BPRS were not covaried because these are state-dependent factors which would not be expected to influence reporting of ACE, and are differences in demographic and clinical characteristics which would be expected between psychiatric and non-psychiatric groups. All statistical analyses were conducted using SPSS v.12.0 for Windows.

RESULTS

Demographic Characteristics of the Study Sample

The study population consisted of 101 subjects, including 51 psychiatric participants and 50 nonpsychiatric controls. The demographic and clinical characteristics of the four groups are presented in Table 1. There were no significant differences between the four diagnostic groups (PS, PNS, CS, or CNS) in terms of age or gender. Both psychiatric and nonpsychiatric control smokers had similar levels of nicotine dependence as measured on the FTND. Smoking behaviors defined by CO levels and cigarettes per day were higher in the psychiatric smoker group as compared to the nonpsychiatric control

Table 1 Demographic and Clinical Characteristics of the Four Subgroups

	Psychiatric (n = 51)		Control (n = 50)		
Demographics	Smoker (N = 27)	Nonsmoker (N = 24)	Smoker (N = 25)	Nonsmoker (N = 25)	p-value
Age	41.6 ± 8.2	42.9 ± 9.2	44.2 ± 10.4	36.4 ± 14.2	0.06
Sex (M/F)	13/14	13/11	13/12	13/12	0.98
Psychiatric Diagnosis	11 SZ/ 3 SA/ 11 MDD 2 BPD	3 SZ/ 8 SA/ 8 MDD/ 4 BPD/1 PTSD	n/a	n/a	0.09
Current GAF	58.0 ± 12.3	61.4 ± 9.8	81.2 ± 9.6	87.1 ± 6.2	**< 0.001**
Race: White	12	19	19	19	0.09
Black	11	5	4	4	
Hispanic	3	0	1	0	
Asian	1	0	1	2	
Education (years)	12.2 ± 1.6[abc]	13.8 ± 2.7[d]	14.0 ± 2.9	15.7 ± 2.9	**< 0.001**
Expired CO Level (ppm)	24.3 ± 15.3[b]	n/a	16.2 ± 8.4	n/a	**< 0.001**
CPD	21.0 ± 9.6	n/a	15.9 ± 7.4	n/a	**< 0.05**
# Quit Attempts	17.3 ± 34.9	n/a	7.5 ± 19.3	n/a	0.09
FTND	5.6 ± 2.6	n/a	4.9 ± 2.5	n/a	0.22
BDI	13.1 ± 10.9[cd]	11.8 ± 7.5	3.7 ± 4.7	1.8 ± 2.4	**< 0.001**
BPRS	33.3 ± 8.8[cd]	34.0 ± 8.8	19.5 ± 2.1	18.8 ± 1.7	**< 0.001**
Alcohol use in last month (days)	2.85 ± 7.4	1.38 ± 3.5	5.72 ± 9.3	5.92 ± 8.9	0.11
Alcohol intoxication in last month (days)	0.12 ± 0.59	0.58 ± 1.9	0.52 ± 2.06	0.68 ± 1.38	0.59
Diagnosis of lifetime alcohol dependence	19%	26%	10%	8%	0.38
Diagnosis of lifetime drug dependence	35%[abc]	4%	15%	0%	**< 0.01**
Drug use in last month (days)	2.69 ± 7.8[ae]	0.0 ± 0.0	1.0 ± 4.0	0.08 ± .28	0.12
ASI – Medical	1.38 ± 1.98[d]	1.61 ± 1.99[d]	0.92 ± 1.68	0.44 ± 0.87	0.08
ASI – Employment	1.54 ± 1.84[d]	2.43 ± 2.64[c d]	0.88 ± 1.69	0.25 ± 0.89	**< 0.01**
ASI – Alcohol	1.23 ± 2.12	1.13 ± 2.05	0.60 ± 1.61	0.32 ± 0.90	0.21
ASI – Drugs	1.08 ± 1.85[d]	0.96 ± 2.06	0.72 ± 2.23	0.0 ± 0.0	0.14
ASI – Legal	0.46 ± 0.95	0.96 ± 2.14	0.40 ± 1.61	0.04 ± 0.20	0.17
ASI Family/Social	2.54 ± 2.45[de]	2.70 ± 2.75[de]	0.68 ± 1.25	0.63 ± 1.24	**< 0.001**
ASI Psychiatric	4.12 ± 2.37[de]	4.22 ± 2.0[de]	0.40 ± 1.0	0.04 ± 0.20	**< 0.001**

[a]$p < 0.05$ vs. PNS, [b]$p = 0.01$ vs. CS, [c]$p < 0.001$ vs. CS, [d]$p < .05$ vs. CNS, [e]$p < .05$ vs. CS.
SZ = Schizophrenia; SA = Schizoaffective Disorder; BPD = Bipolar Disorder; MDD = Major Depressive Disorder; PTSD = Posttraumatic Stress Disorder; GAF = Global Assessment of Functioning Score; CO = Carbon Monoxide; CPD = Cigarette Per Day; FTND = Fagerstrom Test for Nicotine Dependence; BDI = Beck Depression Inventory; BPRS = Brief Psychiatric Rating Scale; ASI = Addiction Severity Index.

smokers ($p < .01$). Psychiatric smokers had significantly less educational attainment than the other groups (PNS, CS and CNS) ($p < .05$, $p < .01$, respectively). Furthermore, a strong trend toward differences in age across the four groups ($p = 0.06$) was observed. Therefore, adjustments for age and educational differences were made in later analyses when main effects were significant. There were significant differences amongst the groups on GAF, BDI and BPRS scores, with psychiatric groups having higher scores than controls as was expected, an effect which was not significantly influenced by smoking status. There were differences on several domains of the Addiction Severity Index (ASI) including the employment severity profile [$F = 5.96$, $df = 3,97$, $p < 0.01$; age and education adjusted; $F = 3.80$, $df = 5,92$, $p < 0.01$] where PNS demonstrated significantly more need for attention in this area that CNS and CS ($p < 0.05$), and PS had significantly higher scores than CNS ($p < 0.05$). Differences also emerged on the ASI Family/Social [$F = 7.58$, $df = 3,97$, $p < 0.001$; age and education adjusted; $F = 5.65$, $df = 5,92$, $p < 0.001$], and the Psychiatric severity profile [$F = 48.28$, $df = 3,95$, $p < 0.001$; age and education adjusted; $F = 29.37$, $df = 5,93$, $p < 0.002$]. For both the Family/Social and Psychiatric domains, PS and PNS were both significantly higher than CS and CNS (all p's < 0.01). From the ASI we were able to determine how many days in the last month subjects had used alcohol or had been intoxicated and no differences were found between the groups. Based on the SCID no differences were found amongst the groups in terms of a history of lifetime alcohol dependence, but a significant main effect was found in terms of a history of lifetime drug dependence, with PS being significantly more likely to have a history of lifetime drug dependence than PNS ($p < 0.05$), CS ($p = 0.01$), and CNS ($p < 0.001$) (Table 1).

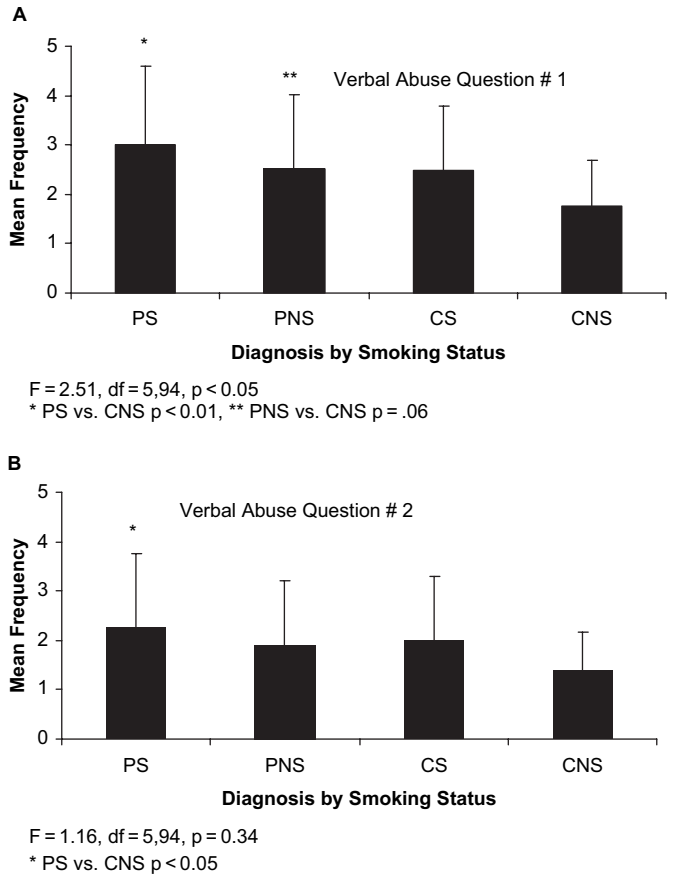

Figure 1 Group Comparison of ACE Verbal Abuse Outcomes: A. Question #1: Report of swearing, insults, put-down; B. Group Comparison of ACE Verbal Question #2: Report of threats of physical abuse among the four groups. Results are shown as Mean ± Standard Deviation. PS = psychiatric smokers, PNS = psychiatric nonsmokers, CS = control smokers, CNS = control nonsmokers.*

*All figures contain age and education adjusted levels of significance.

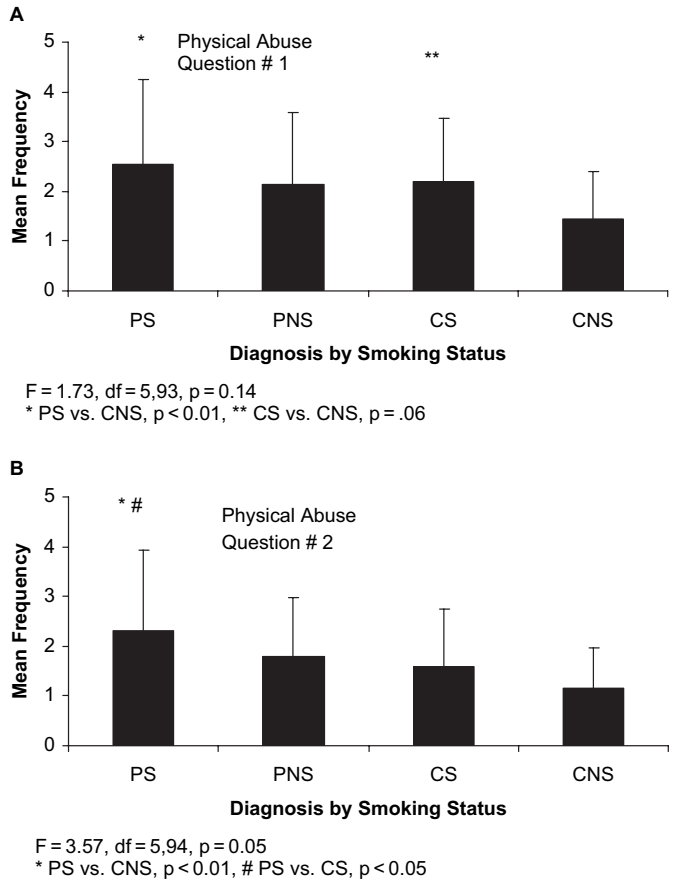

Figure 2 Group Comparison of ACE Physical Abuse Outcomes: A. Question #1: Report of pushing, slapping, throwing, etc.; B. Physical Abuse Question #2: Report of injury due to abuse, among four groups. Results are shown as Mean ± Standard Deviation. PS = psychiatric smokers, PNS = psychiatric nonsmokers, CS = control smokers, CNS = control nonsmokers.

Verbal and Physical Abuse

Analysis of ACE data suggest that the presence of some types of verbal abuse, including swearing, insulting and being put-down differed significantly across the four groups (Verbal Question 1; see Appendix 1) [F = 3.66, df = 3,96 p < 0.05], and the magnitude of this effect was not modified when age and educational level differences were adjusted [F = 2.51, df = 5,94 p < 0.05]. Post-hoc analyses indicate that although there was no significant difference between PS and CS (p = 0.17), the PS group had significantly higher scores compared with the CNS group (p = 0.001). Verbal abuse question 2, assessing for verbal threats of physical assault did not significantly differ between groups [F = 1.94, df = 3,96 p = 0.13]. Reports of less severe physical abuse, in which participants reported being pushed, slapped or having something thrown at them (physical abuse question 1), was significantly different across the study groups [F = 2.79, df = 3,96 p < 0.05], a difference which was reduced after covarying for the effects of age and education [F = 1.73, df = 5,93 p = 0.09]. When asked about the presence of more severe physical maltreatment with physical abuse question 2, such that they were reportedly hit hard enough to have been physically marked or injured, the groups demonstrated an overall effect [F = 3.71, df = 3,96 p = 0.01] a finding that persisted when adjusting for age and years of education [F = 2.26, df = 5,94 p = 0.05]. PS reported a higher level of this type of physical abuse than CS (p < 0.05) and PS scores were significantly higher than CNS (p < 0.01).

Sexual Abuse

The results for self-report of sexual ACE amongst the four groups is presented in Figure 3. When asked about a history of the least severe form of sexual abuse in sexual abuse question 1 (e.g., being touched or fondled in a sexual way; Figure 3A), there was a significant main effect for the group differences [χ^2 = 12.6, df = 3, p < 0.01], which remained significant after adjusting for age and education [B = –3.97, SE = 1.99, Wald

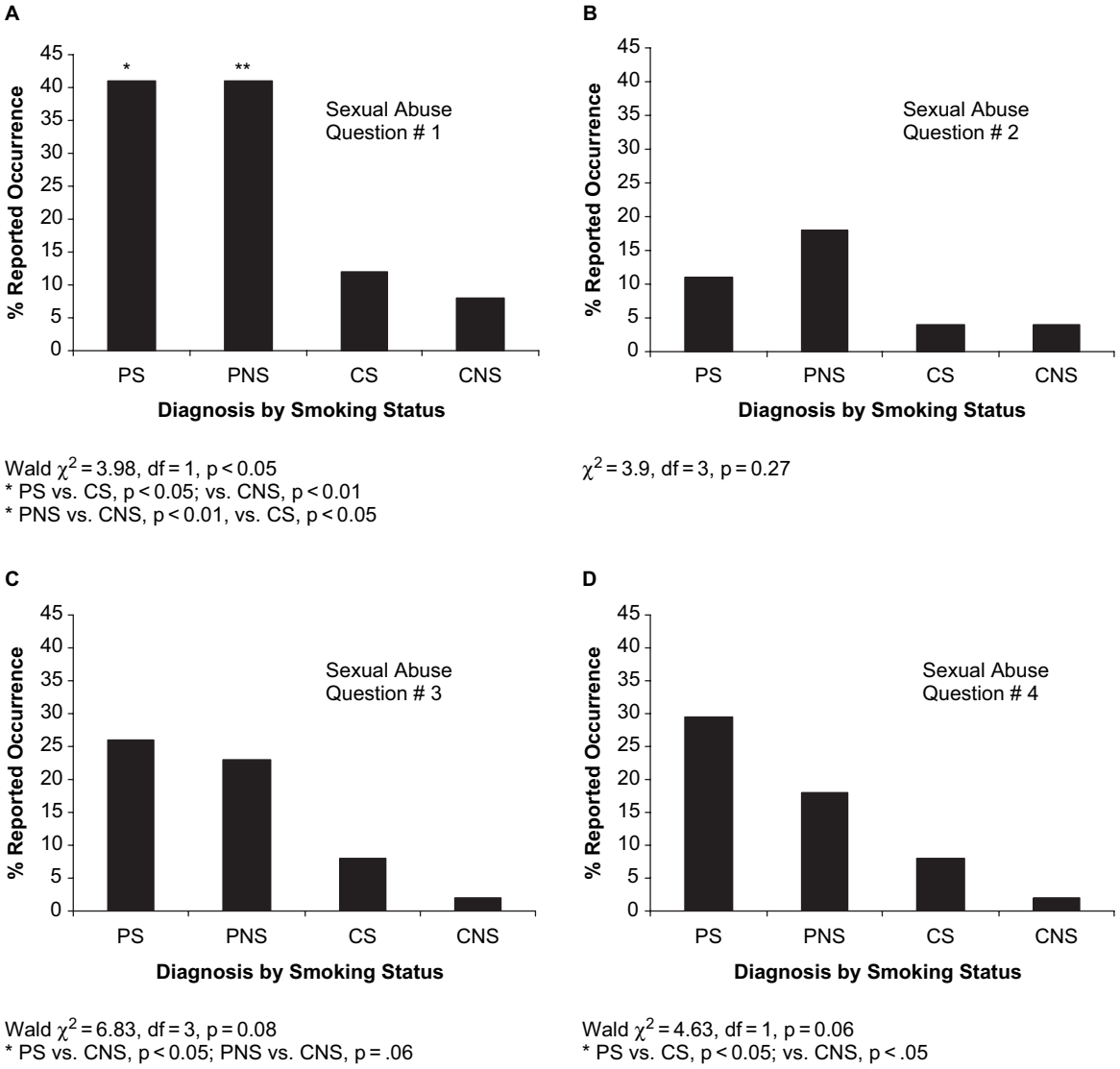

Figure 3 Group Comparison of ACE Sexual Abuse Outcomes: A. Question # 1: Has anyone touched or fondled you?; B. Question # 2: Has anyone had you touch their body?; C. Question # 3: Has anyone attempted to have any type of intercourse with you?; D. Question # 4: Has anyone had any type of sexual intercourse with you? Results are presented as the percentage of each group responding that the event had occurred. PS = psychiatric smokers, PNS = psychiatric nonsmokers, CS = control smokers, CNS = control nonsmokers.

χ^2 = 3.98, df = 1, p < 0.05]. Having a psychiatric diagnosis as well as smoking status appeared to be important contributors to this main effect (Figure 3). In pair-wise comparisons, PS reported significantly more occurrences than CS [χ^2 = 5.45, df = 1, p < 0.05] and CNS [χ^2 = 7.42, df = 1, p < 0.01]. Furthermore, PNS reported more occurrences of this type of event than CNS [χ^2 = 7.07, df = 1, p < 0.01]. For completed sexual assault (sexual abuse question 4) (Figure 3D), there was a significant main effect for group differences [χ^2 = 7.97, df = 3, p < .05], which demonstrated a strong trend after adjusting for age and education [B = -4.63, SE = 2.49, Wald χ^2 = 3.45, df = 1, p = 0.06]. Other forms of reported sexual ACE main effects were either non-significant (sexual abuse question 2: being forced to sexually touch the perpetrator's body [χ^2 = 3.90, df = 3, p = 0.27]; Figure 3B), or showed a strong trend toward a group differences (sexual abuse question 3: attempted sexual assault [χ^2 = 6.83, df = 3, p = 0.08]; Figure 3C). For attempted sexual assault (question 3), there appeared to be dose-dependent effects on these ACE, with PS have the highest reports of occurrence, and CNS the least (Figure 3C).

Cumulative ACE

PS demonstrated the highest number (Mean ± SD) of cumulative ACE (4.8 ± 3.1), followed by PNS (4.5 ± 3.1), CS (3.6 ± 2.5), and CNS (1.8 ± 2.0), with an overall main effect between the groups that was significant [F = 6.15, df = 3,96 p < 0.01];

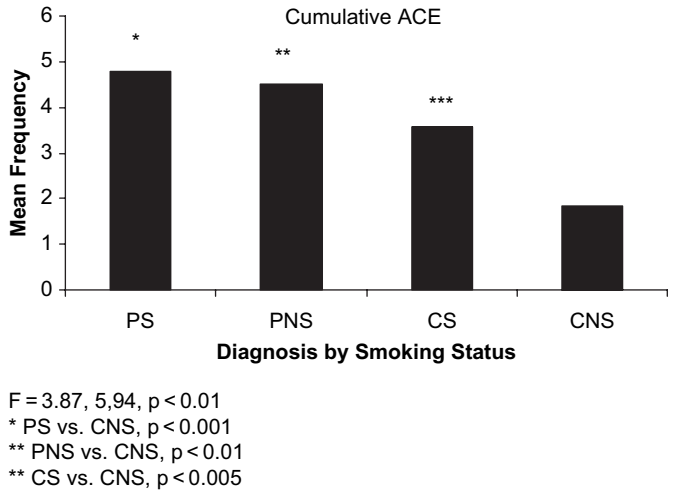

Figure 4 Group Comparison of Cumulative ACE Data. Data are presented as mean number of cumulative ACE reported by each group. PS = psychiatric smokers, PNS = psychiatric nonsmokers, CS = control smokers, CNS = control nonsmokers.

this main effect persisted after adjustment for age and educational differences [F = 3.87, df = 5,94, p < 0.01; Figure 4]. With post-hoc comparisons, PNS demonstrated significantly higher rates of cumulative adverse experiences than CNS ($p < 0.001$) and the difference between PS and CNS was also significant ($p < 0.001$). However, cumulative ACE was not found to significantly differ with respect to smoking status in the psychiatric groups (PS vs. PNS, $p = 0.74$) but was significantly different between the control groups (CS vs. CNS, $p < 0.05$), indicating that although psychiatric status was the main predictor for higher levels of cumulative ACE, the presence of smoking behaviors in the nonpsychiatric group was also associated with a higher number of cumulative ACE.

Familial Stressors

The four study groups were further analyzed with respect to the presence of dysfunctional family situations as presented on the ACE questionnaire. Of the five domains, two demonstrated a significant main effect amongst the groups, including the presence of substance abuse in the home during childhood [$\chi^2 = 12.41$, df = 3, $p < 0.01$] and the presence of a parent with mental illness [$\chi^2 = 12.50$, df = 3, $p < 0.01$], both which were non-significant after adjustment for age and educational differences between groups: [B = -1.39, SE = 1.63, Wald $\chi^2 = 0.73$, df = 1, p = 0.39] and [B = -0.89, SE = 1.81, Wald $\chi^2 = 0.24$, df = 1, p = 0.62], respectively.

DISCUSSION

The purpose of this preliminary study was to determine if the presence and severity of ACE (e.g., verbal, physical, sexual abuse and serious family stressors prior to age 18) was associated with the expression of mental illness, cigarette smoking or their combination in adulthood. Analysis of ACE data partially supported our hypothesis in that: 1) verbal insults (verbal abuse question 1), 2) having been hit so hard that it left marks or injuries (physical abuse question 2), 3) having been touched by an adult in a sexual way (sexual abuse question 1), or 4) having been forced by an adult to have sexual intercourse (sexual abuse question 4), were endorsed at significantly higher frequencies by the psychiatric groups, and in particular psychiatric smokers. One important limitation to this study was our limited power to detect interaction effects between groups due to our small study group sample sizes. Furthermore, there was considerable diagnostic heterogeneity in the psychiatric sample (see Table 1), making comparisons between psychiatric subgroups difficult. Nonetheless, for several types of ACE, we demonstrated modest dose-dependent relationships such that psychiatric smokers reported the highest rate of occurrence of ACE, followed by psychiatric nonsmokers, control smokers, and then control nonsmokers.

Interestingly, the cumulative ACE data (Figure 4) were more supportive of dose-dependent effects of ACE for the co-occurrence of psychiatric disorders and smoking in adulthood, and lend strong support to our prediction that individuals with co-morbid smoking and mental illness have the highest number of cumulative ACE. Anda and colleagues demonstrated a dose-dependent relationship between cumulative ACE in childhood and daily smoking consumption (7). In light of our small group sample sizes, we were not able to examine correlations between amount smoked and cumulative ACE within each of the four subgroups. Further studies of the relationship between smoking and cumulative ACE in psychiatric subgroups using larger samples are suggested.

Taken together, these preliminary findings may have important clinical implications for understanding the relationship between ACE, smoking and mental illness, and suggest that in clinical practice, it may be important to determine the presence and nature of ACE in patients with psychiatric illness and comorbid nicotine dependence. Furthermore, efforts to prevent the initiation and maintenance of smoking and reduce the development of mental illness in adulthood should be targeted at this more susceptible group of young children who have experienced one or more ACE. Given the findings that increasing cumulative numbers of these experiences in childhood increases the risk for mental illness and possibly comorbid smoking in adulthood, such early interventions may be critical to mitigate the collective emotional harm inflicted by the occurrence of ACE, particularly those of a more severe nature such as physical and sexual abuse. Accordingly, early interventions which mitigate the effects of ACE may reduce the prevalence of mental illness and tobacco smoking in the general population, particularly in these high-risk groups. Our data also imply that successful treatment of psychiatric smokers during cessation interventions (17,32–35) may need to address the historical presence of ACE, and the role of ACE as a predictor of

treatment outcome during smoking cessation interventions also needs to be evaluated. Accordingly, more research on the interrelationships amongst ACE, and smoking and mental illness in adulthood, with the use of larger samples, is needed.

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APPENDIX 1

Adverse Childhood Experiences (ACE) Scale (From Ref 7)

Indicate a number next to each of the following questions according to the guide below:

1 = Never
2 = Once or Twice
3 = Sometimes
4 = Often
5 = Very Often

Verbal Abuse:

How often did a parent, stepparent or adult living in your home swear at you, insult you or put you down?

1 2 3 4 5

How often did a parent, stepparent or adult living in your home threaten to hit you or throw something at you, but didn't do it?

1 2 3 4 5

Physical Abuse:

Sometimes parents or other adults hurt children. While you were growing up, that is, in your first 18 years of life, how often did a parent, stepparent or adult living in your home:

1. Push, grab, slap, or throw something at you?

1 2 3 4 5

2. Hit you so hard that you had marks or were injured?

1 2 3 4 5

Answer the following questions Yes or No:

Sexual Abuse:

Some people, while they are growing up in their first 18 years of life, had a sexual experience with an adult or someone at least 5 years older than themselves. These experiences may have involved a relative, family friend, or stranger. During the first 18 years of you life, did an adult, relative, family friend or stranger ever:

1. Touch or fondle your body in a sexual way? Y/N
2. Have you touch their body in a sexual way? Y/N
3. Attempt to have any type of sexual intercourse with you (oral, anal or vaginal)? Y/N
4. Actually have any type of sexual intercourse with you (oral, anal or vaginal)? Y/N

During the first 18 years of your life, did you have the presence in your home of:

A Battered Mother or Parent Y/N
Substance Abuse (Alcohol or Drugs) Y/N
Mental Illness Y/N
Parental Separation or Divorce Y/N
An Incarcerated Family Member Y/N