

**Negative Affect as Predictive of Cigarette Cessation in Dual Users of Cigarettes/ENDS over
12 Months**

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THESIS

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LIST OF ABBREVIATIONS

CES-D Center for Epidemiological Studies Depression inventory

CDC Centers for Disease Control and Prevention

ENDS Electronic nicotine delivery systems

FDA Food and Drug Administration

MASQ Mood and Anxiety Questionnaire

NDSS Nicotine Dependence Syndrome Scale

SUMMARY

Dual use of cigarettes and electronic nicotine delivery systems (ENDS) has grown increasingly common in adults, and many smokers use ENDS as a cigarette cessation aid. However, more research is needed to understand factors predicting which smokers who try ENDS will successfully quit cigarettes. Self-report data from a sample of adult cigarette smokers who recently began using ENDS ($N = 364$) was collected at baseline and 12-month time points in a longitudinal observational study. Self-reported cigarette use at 12 months, with abstinence defined as no smoking for the past 7 days, was the primary outcome variable in analyses. Baseline levels of depression symptoms (CES-D), anxiety symptoms (MASQ), and negative affect expectancies for smoking were entered as predictors, with baseline nicotine dependence for cigarettes (NDSS), motivation to quit, age, race/ethnicity, rate of cigarette smoking at baseline, and ENDS usage at baseline and 12 months as covariates. Interactions between CES-D, MASQ, and negative affect smoking expectancies were examined. No baseline mood variables (CES-D, MASQ, and negative affect smoking expectancies), were significantly associated with stopping smoking at 12 months. Negative affect expectancies for smoking did not moderate relationships between anxiety or depression and quitting. Baseline nicotine dependence for cigarettes, gender, and race/ethnicity significantly predicted the likelihood of cigarette cessation. Therefore, depression, anxiety, and negative affect smoking expectancies traditionally predictive of quitting success in conventional smoking did not predict cigarette cessation in a sample of non-treatment seeking dual users over and above nicotine dependence for cigarettes, gender, and race/ethnicity. Further investigation is needed to understand whether and how negative affect impacts cigarette cessation in dual users.

Negative Affect as Predictive of Cigarette Cessation in Dual Users of Cigarettes/ENDS over 12 Months

The prevalence of combustible cigarette smoking has declined substantially over the past decade in the United States (Creamer et al., 2019), and individuals are increasingly using potentially less harmful non-combustible tobacco products, such as e-cigarettes or electronic nicotine delivery systems (ENDS; Creamer et al., 2019; McMillen et al., 2015; Owusu et al., 2019). Conventional smokers make up the majority of ENDS users in relation to smokers who have quit or those who have never smoked (King et al., 2015; Patel et al., 2016; Pearson et al., 2012). ENDS are often viewed as cessation aids for adult smokers, and between 30 and 58 percent of smokers report using ENDS as a method to quit cigarettes (Pepper et al., 2014; Pulvers et al., 2015; Rutten et al., 2015). Although the Food and Drug Administration (FDA) has not approved ENDS as a cessation aid, research suggests that more smokers are using ENDS to facilitate quit attempts than they are using nicotine replacement therapy and other pharmacological quit aids approved by the FDA (Caraballo et al., 2017; Zhuang et al., 2016). ENDS could facilitate quit attempts by mitigating withdrawal symptoms through consistent nicotine delivery (Jorenby et al., 2017), while potentially reducing harms associated with exposure to carcinogens and toxins found in conventional cigarettes (Lukasz et al., 2014; Robertson et al., 2019; Wagener et al., 2012). However, the health effects of using ENDS long term have been questioned (Bozier et al., 2020), and research examining ENDS as a cessation aid for current smokers has produced equivocal results (Coleman et al., 2019; Eaton et al., 2018; McRobbie et al., 2014). More work is needed to clarify ENDS as an effective quit aid or replacement for current adult smokers, a population at particular risk for continued harms associated with long-term smoking.

The Effectiveness of ENDS as a Cessation Aid for Cigarette Smokers

Some research has identified ENDS as a highly effective quit aid for smokers, showing greater effectiveness in helping smokers quit when compared to nicotine replacement therapy in a cessation trial (Hajek et al., 2019). Other research has highlighted that the frequency and duration of ENDS use are both associated with the likelihood of ENDS aiding quitting in smokers, such that smokers who report using ENDS daily over a month (Biener & Hargraves, 2015) and over a year (Berry et al., 2019) have higher odds of quitting cigarettes than smokers not using ENDS on a daily basis over these time periods. Further, Zhuang et al. (2016) identified that smokers in a longitudinal study who report using ENDS at both baseline and 2-year time points had greater likelihood of quitting than smokers who reported using at only one time point. These findings suggest that long-term or consistent ENDS use is beneficial for smokers attempting to quit. However, many smokers attempting to quit report replacing some, but not all, of cigarettes smoked with ENDS, thereby failing to stop smoking completely (Caraballo et al., 2017). Piper et al. (2019) found that dual users and smokers not using ENDS consume comparable amounts of nicotine daily, even though dual users smoked significantly fewer cigarettes. Martínez et al. (2020) similarly found that dual users substituting smoking with ENDS reduced their cigarettes, but increased their overall nicotine intake and overall nicotine dependence.

The Centers for Disease Control and Prevention (CDC) has warned against potential harms associated with long-term use of both cigarettes and ENDS (Furlow, 2015) in light of concerns regarding dual use delaying cigarette cessation. Research has corroborated concerns related to the effectiveness of ENDS for quitting, such that ENDS use in smokers has been associated with less likelihood of quitting as compared to those not using ENDS (Kalkhoran &

Glantz, 2016; Weaver et al., 2018), and ENDS has been identified as less effective for quitting when compared to financial incentives, nicotine replacement therapy, or pharmacological quit aids (Halpern et al., 2018). Although dual users may report more quit attempts (Nayak et al., 2016; Zhuang et al., 2016) and more motivation to quit (Piper et al., 2019) than those not using ENDS, Brose et al. (2015) found that dual users may not be successful in quitting despite more reported attempts. Further, Jorenby et al. (2017) reported that dual users trying to quit had lower motivation than individuals who were only smoking cigarettes and also trying to quit. Currently, there is a lack of substantial evidence that ENDS can replace cigarettes completely for all smokers, and the National Academies of Sciences, Engineering, and Medicine (Eaton et al., 2018) has cited inadequate research support for ENDS as a quit aid. Therefore, more research is needed to elucidate individual-level factors among dual users that promote successful transition away from conventional cigarettes or predict difficulty in this transition.

The Role of Negative Affect in Smoking Behavior

Although cigarette smoking has declined in the general population (Creamer et al., 2019), cigarette smoking in those with a diagnosed mental illness has not declined as substantially (Szatkowski & McNeill, 2015; Trosclair & Dube, 2010). The negative affect reinforcement model of addiction (Baker et al., 2004), wherein the alleviation of negative affect is hypothesized to be the primary driver of drug consumption, supports the high rates of smoking in those with higher levels and propensity toward negative affect. Motives to reduce negative affect through smoking increase the likelihood of relapse for smokers in cessation trials (Shiffman et al., 2007), and the induction of negative affect may increase urges to smoke (Vinci et al., 2012). Regular smoking also confers risk for increased negative affect, such that regular smokers are more vulnerable to psychiatric disorders (Breslau et al., 2004), depression (Khaled et al., 2012), and

disrupted mood regulation functioning (Lyvers et al., 2014). Thus, elevated negative affect is both a vulnerability for and a consequence of regular smoking (Fluharty et al., 2017) that can significantly impair efforts to quit (Fluharty et al., 2017; Leventhal & Zvolensky, 2015; Shiffman et al., 2007).

Of interest in the current study are depression and anxiety, two prominent dimensions of negative affect that present across a wide range of mental illnesses. Depression and anxiety together have been considered as a transdiagnostic vulnerability for the development and maintenance of cigarette addiction (Leventhal & Zvolensky, 2015). Those with anxiety disorders become nicotine dependent faster after taking up smoking than those without anxiety disorders (Kushner et al., 2012). Depression longitudinally predicts nicotine dependence and cigarette smoking (Boden et al., 2010; Fergusson et al., 2003), while smoking has also been reported as a risk factor for the development of depression (Boden et al., 2010). Further, smokers with depression and anxiety have more difficulty quitting cigarettes (Fluharty et al., 2017; Leventhal & Zvolensky, 2015). As dual use grows more common for current adult smokers (King et al., 2015; McMillen et al., 2015), more work is needed to examine how depression and anxiety may contribute to dual users' likelihood of cigarette cessation.

Links Between Dual Use and Negative Affect

Extant work suggests compelling links between negative affect variables and dual use across adolescents, young adults, and adults. Adolescent dual users report significantly higher levels of emotional dysregulation (Wills et al., 2015) as compared to both adolescents who use neither product and adolescents who only use ENDS, and more psychiatric comorbidity, anhedonia, and externalizing psychopathology as compared to adolescents using only cigarettes, only ENDS, or those using neither product (Leventhal et al., 2016). Research in adolescent dual

users is critical for framing prevention efforts and understanding risk factors for smoking escalation. However, adult smokers make up the majority of ENDS users (King et al., 2015; Patel et al., 2016), and adult smokers report higher rates of using ENDS as a quit method (Brose et al., 2015; Pulvers et al., 2015; Zhuang et al., 2016), furthering the need to examine negative affect domains as predictive of quitting in adult dual users.

Dual users are more likely to report a history of mental health problems than those who only smoke cigarettes (Piper et al., 2019; Spears et al., 2020). Psychological distress, a construct meant to encompass symptoms of both anxiety and depression (Kessler et al., 2003), has been noted as a significant predictor of dual use (Park et al., 2017), and of currently or ever using ENDS in cigarette smokers (Spears et al., 2020). More specifically, dual users report higher anxiety and depression as compared to adults only smoking cigarettes (Wang et al., 2018). In young adults, those reporting dual use of ENDS and cigarettes report significantly more negative reinforcement expectancies, such as reduction of anxiety and mood management, than those only using one product or no products (Peltier et al., 2019). Depression has been associated with dual use and increased nicotine dependence in adult ENDS users (Pulvers et al., 2015), and the presence of depression in current adult smokers predicts the report of dual use one year later (Wiernik et al., 2019).

Current cigarette smokers who initiate dual use may successfully (Berry et al., 2019; Biener & Hargraves, 2015; Hajek et al., 2019; Zhuang et al., 2016) or unsuccessfully (Brose et al., 2015; Caraballo et al., 2017; Kalkhoran & Glantz, 2016; Piper et al., 2019) use ENDS as a quit method. Considering the established impact of elevated negative affect on cigarette cessation (Fluharty et al., 2017; Leventhal & Zvolensky, 2015; Shiffman et al., 2007), more work

is needed to examine depression, anxiety, and expectancies toward the reduction of negative affect through smoking as predictors of cigarette cessation in current smokers who are early in their use of ENDS and have just begun dual use of both products.

Study Overview and Hypotheses

To date, no known studies have examined smokers longitudinally as they are just beginning to use ENDS, in order to capture how factors typically predictive of cigarette cessation, such as elevated negative affect, may place some smokers more at risk than others for long-term dual use rather than cigarette cessation. The current research aimed to understand the role that negative affect variables may play in the likelihood of quitting in dual users. Using a longitudinal observational study of these regular smokers over a one-year period, we aimed to answer the following questions: (a) Do elevated depression and anxiety predict a lower probability of quitting cigarettes in dual users over a one year period? (b) Do negative affect expectancies for cigarette smoking moderate relationships between depression and anxiety and the likelihood of quitting, such that smokers who hold stronger expectancies that cigarettes can alleviate negative affect are less likely to stop smoking in the presence of elevated depression or anxiety than those with lower expectancies for smoking to relieve negative affect? (c) How do variables such as nicotine dependence for cigarettes, rate of ENDS and cigarette use, and motivation to quit predict likelihood of quitting relative to depression, anxiety, and negative affect expectancies in a sample of dual users? The following hypotheses regarding negative affect in dual users were made considering these study aims:

Hypothesis 1

Literature has identified that elevated depression and anxiety (Fluharty et al., 2017; Leventhal & Zvolensky, 2015), and heightened negative affect smoking expectancies (Shiffman et al., 2007) are associated with long-term smoking and more difficulty quitting. Cross-sectional research has suggested that this strong association between negative affect and smoking applies to dual users, such that dual users report elevated depression (Kim et al., 2020; Pulvers et al., 2015; Wang et al., 2018), anxiety (Wang et al., 2018), psychological distress (Park et al., 2017; Spears et al., 2020), higher mental health history (Piper et al., 2019; Spears et al., 2020), and that depression is a predictor of dual use initiation in current smokers (Wiernik et al., 2019). Based on this work, dual users may be a group particularly at risk for elevated negative affect, which has implications for difficulty quitting cigarettes (Leventhal & Zvolensky, 2015). Therefore, it is predicted that higher depression, higher anxiety, and higher expectancies for smoking to relieve negative affect will predict less likelihood of quitting over 12 months in the current sample of dual users.

Hypothesis 2

Motives to reduce negative affect through smoking are well documented as a barrier to quitting (Shiffman et al., 2007), and the presence of negative affect can impact the urge to smoke in order to relieve negative affect (Vinci et al., 2012). Further, research has identified that dual users report higher expectancies for smoking to relieve negative affect than individuals using only ENDS or individuals only smoking cigarettes (Peltier et al., 2019). Therefore, it is hypothesized that negative affect expectancies for smoking will significantly moderate relationships between both depression and anxiety and the likelihood of quitting, such that those with stronger reported negative affect expectancies will be less likely to quit when experiencing

elevated depression and anxiety as compared to those holding lower expectancies for cigarettes to relieve negative affect.

This study has the potential to clarify whether negative affect variables traditionally predictive of quitting success in conventional smoking are also predictive of quitting success in a sample of dual users when accounting for demographic variables and other predictors of quitting such as dependence and motivation, and to further elucidate questions regarding the utility of ENDS as a quit method for adult conventional smokers.

Method

Participants

Data come from the baseline and 12-month questionnaires of a longitudinal observational study of 410 dual users of cigarettes and ENDS in the Chicago area collected from 2015-2019. Participants were eligible if they were 18 years or older and were a current regular smoker, defined as smoking conventional cigarettes at least once a week in the last 30 days. Participants also must have used ENDS in the past 14 days, but not on a daily basis, and must have responded as moderately likely or very likely to two questions "How likely are you to use an e-cigarette in the next 2 weeks?" and "How likely are you to purchase an e-cigarette in the next 2 weeks?" These questions aimed to capture smokers who were highly susceptible to continuing ENDS use. There were no inclusion criteria for wanting to reduce or quit smoking. Participants were recruited on a rolling basis using a combination of social media posts (e.g., Facebook), Craigslist, electronic listservs, and print advertisements in local tobacco retail outlets. Participants included in analyses for the current study include only those who completed both the baseline and the 12-month follow-up questionnaires ($N = 364$; 88.7% of baseline). Completers and non-completers did not differ on any of the tobacco use or negative affect variables at baseline. Means and standard deviations for the overall sample on demographic and study variables are provided in Table 1.

Measures

Demographics

Participants self-reported their age, race/ethnicity, highest level of education completed, and gender.

Depression

Depression symptoms were assessed via the Center for Epidemiological Studies Depression inventory (CES-D; Radloff, 1977). The CES-D is a widely used 20-item measure that assesses the frequency of depressive symptoms experienced in the past week, from 0 = *rarely or none of the time* to 3 = *most or all of the time*. The CES-D assesses specific areas of depressive symptomatology, including depressed affect, happiness, somatic symptoms and psychomotor retardation, and interpersonal difficulties. Responses are summed to create an overall scale score, with higher scores indicating greater frequency of symptoms of depression. The cutoff for clinical levels of depression in adults is 16 (Radloff, 1977). Coefficient alpha in the current sample at baseline was $\alpha = .92$.

Anxiety

Anxiety was assessed with 12 items from the Mood and Anxiety Symptom Questionnaire (MASQ; Clark & Watson, 1991; Watson et al., 1995). Items assessing anxiety included those regarding tension and hyperarousal (e.g., “feeling dizzy or lightheaded”; “muscles were tense or sore”) as well as more general symptoms of anxiety (e.g., “feeling nervous” and “unable to relax”). Participants rated the extent to which they had experienced each symptom in the past week according to a 5-point Likert-type scale, ranging from 1 = *not at all* to 5 = *extremely*. Item scores were summed to yield a scale score, with higher scores indicating greater frequency of anxiety symptoms. Coefficient alpha in the current sample at baseline was $\alpha = .87$.

Negative Affect Expectancies for Smoking

Smoking expectancies were measured with the negative affect reduction subscale from the Smoking Expectancies Scale (Copeland et al., 1995), originally based on Brandon and Baker’s (1991) Smoking Consequences Questionnaire. Respondents were asked to indicate their

agreement with a series of 4 questions regarding smoking (i.e., “Smoking calms me down when I feel nervous.”, “When I’m feeling down, a cigarette can really make me feel good.”) Responses were made on a 4-point scale where 1 = *disagree*, 2 = *disagree a little*, 3 = *agree a little*, and 4 = *agree*. Responses were averaged to create the overall scale score, with higher scores reflecting greater expectancies for negative affect regulation through smoking cigarettes. Coefficient alpha for the subscale in the current sample at baseline was $\alpha = .90$.

Nicotine Dependence for Cigarettes and ENDS

Participants completed the Nicotine Dependence Syndrome Scale (NDSS; Shiffman et al., 2004), a 19-item, multidimensional assessment of nicotine dependence. The NDSS assessed dependence symptomatology across 5 dimensions, including craving and withdrawal avoidance, priority of smoking/vaping, tolerance, resistance to behavioral change, and constancy.

Participants responded to each of the items on a 5-point Likert-scale ranging from 1 = *not at all true* to 5 = *extremely true*. Only those participants who had indicated that they had smoked at least a puff or indicated at least one vaping event in the prior 30 days completed these scales.

The NDSS was indexed by averaging responses to all items, with higher scores indicating more nicotine dependence. Both the cigarette ($\alpha = .85$) and ENDS ($\alpha = .88$) versions of the NDSS demonstrated good reliability in the current study at baseline.

Motivation to Quit Cigarettes

Participants self-reported their motivation to quit cigarettes on 10-point scale, where 1 = *not at all motivated* and 10 = *extremely motivated*.

Cigarette Smoking and Vaping Rates

Daily rates of cigarette smoking and ENDS use in the past 7 days were assessed at baseline and 12-month follow-up. Participants responded to questions asking how many days in the past 7 days they smoked cigarettes; how many days they used ENDS, and how many cigarettes were smoked or how many ENDS use events or sessions they had in each day. Daily smoking and vaping rates were calculated by averaging the total number of cigarettes and ENDS use sessions reported across the 7-day intervals. Abstinence (quitting smoking) was defined as self-reported no use of cigarettes at all over the past 7 days. Individuals were divided into two primary outcome groups: those who quit smoking completely, and those who did not quit smoking completely.

Analytic Approach

Analyses were conducted using R version 4.0.0 (R Core Team, 2020). Multivariable logistic regression models were used to examine how baseline CES-D, MASQ, and negative affect smoking expectancies predicted likelihood of smoking cessation at 12 months. The interactions between CES-D and negative affect smoking expectancies and MASQ and negative affect smoking expectancies were examined. Baseline measures of nicotine dependence for cigarettes, baseline cigarette smoking rates, ENDS vaping rate reported at baseline and 12 months, motivation to quit at baseline, age, race/ethnicity, and gender were entered as covariates.

Results

Participant Descriptive Data

Table 1 presents the descriptive data for the overall sample. Participants were predominately male and were racially and ethnically diverse. Overall, the sample reported somewhat elevated levels of depressive symptoms on the CES-D (see Table 1) relative to community-based norms for the measure typically ranging from averages of 6.87 to 9.25; Radloff, 1977).

Smoking and Vaping Rates Over Time

On average, the average daily smoking rate in the sample decreased from baseline to follow-up, but the vaping rate remained similar from baseline to follow-up (see Table 1). Motivation to quit smoking was moderate at best. At 12 months, 23.9% ($n = 87$) of the sample reported not smoking in the past 7 days, and 39.6% of the entire sample reported they had quit ENDS at 12 months ($n = 144$). Of those who quit cigarettes at 12 months, 29.9% ($n = 26$) reported 7-day abstinence from ENDS at 12 months, such that 7.1% of the entire sample had quit both cigarettes and ENDS at 12 months.

Bivariate Correlations Across Study Variables

Table 2 presents the bivariate correlations among the key study variables. As can be seen from the table, both baseline depression and baseline anxiety were significantly associated with higher levels of nicotine dependence for cigarettes and ENDS. Higher negative affect smoking expectancies at baseline were also significantly associated with higher depression and anxiety at baseline and were significantly associated with higher rates of cigarette smoking at baseline and 12 months. Higher negative affect smoking expectancies were additionally significantly associated with higher nicotine dependence for cigarettes at baseline and 12 months, but higher

nicotine dependence for ENDS at baseline only. In addition, higher negative affect smoking expectancies were significantly associated with greater frequency of past reported quit attempts.

Higher baseline motivation to quit was associated with lower cigarette rate and lower nicotine dependence for cigarettes at follow-up. Higher baseline motivation also correlated with greater frequency of past reported quit attempts, and greater ENDS use at baseline. Further, higher ENDS use at 12 months was associated with lower nicotine dependence for cigarettes at 12 months, and higher nicotine dependence for ENDS at both baseline and 12 months. Younger age in the current sample was associated with higher self-reported anxiety and depression, and higher ENDS rate at baseline and follow-up. Older age was associated with more past reported attempts to quit, and increased cigarette rate and nicotine dependence for cigarettes at both baseline and follow-up.

Logistic Regression

Results of multivariable logistic regressions (see Table 3) showed that lower baseline nicotine dependence for cigarettes was a significant predictor of likelihood of quitting cigarettes at follow-up. Among demographic variables, Black, not of Hispanic origin dual users were less likely to quit at follow-up as compared to dual users of White, non-Hispanic origin, and females were less likely to quit than males. None of the baseline negative affect variables under investigation (Baseline MASQ, CES-D, and negative affect expectancies for smoking) significantly predicted likelihood of quitting cigarettes at follow-up, nor did the rate of ENDS use at baseline or follow-up. The interaction between CES-D scores and negative affect expectancies for smoking was not significant (OR = 0.97 [0.94-1.01], $p = .189$). Similarly, the interaction between MASQ scores and negative affect expectancies for smoking was not significant, (OR = 1.00 [0.95-1.05], $p = .795$). Thus, both interaction terms were removed, and

the final model was re-analyzed without the interaction terms. Results of the final multivariable logistic regression model are presented in Table 3.

Post-hoc Race/Ethnicity Differences

Given that Black, not of Hispanic origin dual users were significantly less likely to quit at follow-up when compared to White, not of Hispanic origin dual users (see Table 3), we examined post-hoc differences between race/ethnicity categories on key study variables. Participants of different races and ethnicities in the current sample differed significantly by age, $F(4, 405) = 27.78, p < .001$. Black participants ($M = 42.5, SD = 12.0$) were significantly older than White participants ($M = 32.1, SD = 12.1$), $t(405) = 7.86, p < .001$, and Hispanic participants ($M = 33.7, SD = 11.1$), $t(405) = 4.65, p < .001$. Hispanic participants and White participants did not differ significantly in age, $t(405) = 0.89, p = .378$. There were no significant differences across race/ethnicity in terms of baseline motivation to quit, $F(4, 405) = 0.69, p = .602$.

Dual users differed significantly in baseline anxiety across race/ethnicity, $F(4, 401) = 5.32, p < .001$, such that Black participants ($M = 22.6, SD = 8.2$) reported significantly lower anxiety as compared to White participants ($M = 27.1, SD = 9.0$), $t(401) = 4.38, p < .001$ and Hispanic participants, ($M = 27.0, SD = 10.1$), $t(401) = 2.98, p = .003$. Hispanic participants and White participants did not differ in baseline anxiety, $t(401) = 0.10, p = .920$. There were no significant differences in baseline depression, $F(4, 401) = 1.88, p = .113$, or baseline negative affect smoking expectancies, $F(4, 405) = 1.29, p = .274$, across race/ethnicity.

Participants differed in baseline nicotine dependence for cigarettes across race/ethnicity, $F(4, 405) = 2.68, p = .032$. Black participants ($M = 3.0, SD = 0.6$) reported significantly higher baseline nicotine dependence for cigarettes than did White participants ($M = 2.8, SD = 0.8$), $t(405) = 2.64, p = .009$. Significant differences did not emerge in baseline nicotine dependence

between Black participants and Hispanic participants ($M = 2.8$, $SD = 0.7$), $t(405) = 1.51$, $p = .131$, or Hispanic participants and White participants, $t(405) = 0.34$, $p = .731$. Participants differed significantly in baseline cigarette rate across race/ethnicity, $F(4, 405) = 4.32$, $p = .002$. However, contrasts did not reveal any significant differences between Black participants ($M = 10.1$, $SD = 9.0$) and White participants ($M = 8.4$, $SD = 7.7$), $t(405) = 1.78$, $p = .076$, Black participants and Hispanic participants ($M = 7.9$, $SD = 10.1$), $t(405) = 1.60$, $p = .111$, or White and Hispanic participants, $t(405) = 0.36$, $p = .719$.

Dual users differed significantly across race/ethnicity in baseline ENDS rate, $F(4, 405) = 4.31$, $p = .002$. White participants ($M = 5.9$, $SD = 7.7$) had significantly higher baseline ENDS rates than did Black participants ($M = 2.7$, $SD = 6.3$), $t(405) = 3.90$, $p < .001$. Significant differences did not emerge in baseline ENDS rate between Black participants and Hispanic participants ($M = 4.4$, $SD = 8.2$), $t(405) = 1.49$, $p = .135$, or Hispanic participants and White participants, $t(405) = 1.27$, $p = .205$. Participants additionally differed significantly by race/ethnicity in terms of ENDS rate at 12 months, $F(4, 359) = 5.98$, $p < .001$. White participants ($M = 6.5$, $SD = 10.0$) had significantly higher ENDS rate at 12 months than did Black participants ($M = 2.0$, $SD = 3.4$), $t(359) = 4.75$, $p < .001$, and Hispanic participants ($M = 3.6$, $SD = 6.7$), $t(359) = 2.15$, $p = .033$. Black participants and Hispanic participants did not differ in 12-month ENDS rate, $t(359) = 1.20$, $p = .232$.

Post-hoc Gender Differences

Given the significance of gender as a predictor of cigarette cessation (see Table 3), we examined post-hoc differences for gender across all key study variables. Females ($M = 36.8$, $SD = 13.6$) were significantly older than males ($M = 33.2$, $SD = 11.8$), $t(325.7) = 2.76$, $p = .006$. Females ($M = 26.5$, $SD = 9.3$), compared to males ($M = 24.5$, $SD = 8.5$), had higher baseline

levels of anxiety, $t(335.8) = 2.16, p = .031$. Females ($M = 3.3, SD = 0.7$) reported higher baseline negative affect expectancies for smoking than did men ($M = 3.1, SD = 0.7$), $t(360.2) = 2.88, p = .004$, but females ($M = 15.9, SD = 11.7$) did not report significantly higher baseline levels of depression than men ($M = 14.3, SD = 11.0$), $t(343.4) = 1.36, p = .173$. Females ($M = 3.1, SD = 6.1$) had a significantly lower ENDS rate than men ($M = 4.9, SD = 8.8$) at 12 months, $t(361.9) = 2.30, p = .022$, but females ($M = 4.2, SD = 7.4$) did not differ from males ($M = 4.1, SD = 6.9$) in rate of ENDS use at baseline, $t(306.5) = 0.114, p = .909$. Females ($M = 9.2, SD = 9.1$) did not differ from males ($M = 7.9, SD = 7.0$) in rates of cigarette smoking at baseline, $t(268.45) = 1.37, p = .170$. Females ($M = 2.7, SD = 0.9$) had higher nicotine dependence for cigarettes at 12 months as compared to men ($M = 2.4, SD = 0.8$), $t(306.8) = 3.33, p < .001$, but did not differ in baseline nicotine dependence for cigarettes ($M = 2.9, SD = 0.8$) as compared to men ($M = 2.8, SD = 0.7$), $t(330.0) = 1.61, p = .107$. There were no significant gender differences in reported baseline motivation to quit, $t(344.6) = 0.89, p = .375$.

Discussion

Contrary to predictions, negative affect variables traditionally implicated in smoking cessation, particularly anxiety and depression, were unrelated to the likelihood of quitting cigarettes among this sample of dual users of cigarettes and ENDS. Negative affect expectancies for smoking were significantly associated with smoking rates 12 months later when examined on a bivariate level, but were not associated with quitting in the multivariable regression. Our findings were contrary to research linking negative affect to dual use, particularly research finding that dual users, in comparison to users of only ENDS or only cigarettes, report higher negative reinforcement expectancies (Peltier et al., 2019), depression (Kim et al., 2020; Pulvers et al., 2015), anxiety (Wang et al., 2018), and that depression significantly predicts dual use in current smokers (Wiernik et al., 2019). More broadly, results were contrary to expectations given the strong association between depression, anxiety, and difficulty in cigarette cessation (Fluharty et al., 2017; Leventhal & Zvolensky, 2015). However, this study is one of few examining negative affect constructs specifically as predictors of cigarette cessation in dual users of cigarettes and ENDS, and more work is needed to assess if potential vulnerability toward elevated negative affect states in dual users identified in other research applies to the likelihood of cigarette cessation in these users.

In the current sample, higher baseline nicotine dependence for cigarettes was predictive of less likelihood of quitting cigarettes 12 months later. Overall, cigarette consumption decreased from baseline to follow-up in the sample (see Table 1). Other research has found increased nicotine dependence in dual users as compared to cigarette only smokers (Kim et al., 2020), despite reduced number of cigarettes smoked in dual users (Martínez et al., 2019). Further research has reported associations between higher nicotine dependence and more reported

attempts to quit in the past year in dual users (Pulvers et al., 2015). Our longitudinal findings suggest that higher nicotine dependence for cigarettes is a risk factor for long-term dual use and may be a barrier to ENDS serving as a replacement for cigarettes in current smokers. These findings reinforce extant literature that nicotine dependence is central to quitting behavior in all tobacco consumption (Boden et al., 2010; Roys et al., 2016), and support concerns that long-term dual use may not lead to cigarette cessation in all smokers (Brose et al., 2015; Halpern et al., 2018; Kalkhoran & Glantz, 2016; Weaver et al., 2018).

Although depression, anxiety, and negative affect smoking expectancies were not associated with quitting, depression and anxiety were significantly associated with higher levels of nicotine dependence for cigarettes and ENDS at both baseline and follow-up in the overall sample. Associations between dual use, nicotine dependence, and depression have been reflected in other research, such that dual users report higher depression and nicotine dependence as compared to those only smoking cigarettes (Kim et al., 2020), and both nicotine dependence and depression are predictors of dual use in current smokers (Pulvers et al., 2015). Negative affect smoking expectancies were significantly associated with higher nicotine dependence for cigarettes at baseline and follow-up and higher ENDS nicotine dependence at baseline, but not with ENDS nicotine dependence at follow-up (See Table 2). Nicotine dependence for cigarettes was only modestly related to nicotine dependence for ENDS both at baseline and follow up in the overall sample (See Table 2), suggesting that although some features of nicotine dependence may overlap across products, there are also unique components to dependence for cigarettes and ENDS (Eaton et al., 2018). It may be that ENDS and cigarettes are not fully substitutable, and that characteristics of the devices, including nicotine level and satisfaction with use may play an important role in how well ENDS can serve as a substitute for cigarettes and help smokers

transition away from and eventually quit cigarettes (Kralikova et al., 2013; Pepper et al., 2014). Thus, nicotine dependence and negative affect should be further investigated in adult dual users, particularly in the context of whether negative affect impacts the subjective experience of ENDS as a substitute for cigarettes and how these relationships influence the likelihood of quitting in highly nicotine dependent smokers.

Gender was a strong predictor of cigarette cessation in the current sample of dual users, such that women were less likely to quit cigarettes than were men. Other researchers have noted gender differences in ENDS use patterns, such that women report using ENDS more for management of negative affect, mood, and weight than men (Piñeiro et al., 2016). Yet, our findings are contrary to Jorenby et al.'s (2017) findings showing highly nicotine dependent female dual users are more likely to effectively substitute ENDS for cigarettes during a cessation attempt than men, and that women use ENDS at a higher rate even despite experiencing higher spike in negative affect following attempted cigarette reduction (Jorenby et al., 2017). In the current sample, women reported significantly higher levels of anxiety and negative affect expectancies for smoking at baseline as compared to men and had significantly higher nicotine dependence for cigarettes, significantly higher rates of cigarette smoking, and significantly lower rates of ENDS use than men at follow-up. Elevated negative affect may be a risk factor for long-term dual use particularly in females, and more research is needed to investigate how gender influences the use of ENDS, responses to ENDS, and links to cigarette cessation in dual users.

Dual users who were Black and not of Hispanic origin were significantly less likely to quit cigarettes at follow-up as compared to dual users who were White and not of Hispanic origin. Hispanic, Asian American and Pacific Islander, or other races were not significantly related to the likelihood of quitting. Marked differences exist in rates of cigarette cessation

across Black smokers and White smokers in the United States, such that Black smokers have lower rates of quitting (Kulak et al., 2016; Trinidad et al., 2011), despite research showing lower rates of smoking in Black individuals than in White individuals (Trinidad et al., 2011), and that Black smokers consume fewer cigarettes than White smokers (Trinidad et al., 2015). Inadequate access to healthcare resources promoting cigarette cessation and cigarette cessation aids in underrepresented racial and ethnic groups have been cited as reasons for disparities in quit rates (Cokkinides et al., 2008; Soulakova & Crockett, 2018). Research has investigated racial and ethnic differences in smokers using ENDS and identified that Black smokers are more likely to report using ENDS to quit smoking than both White and Hispanic smokers (Webb Hooper & Kolar, 2016). However, research has identified that Black dual users, compared to White dual users, have lower odds of quitting cigarettes over a year-long period by substituting completely with ENDS (Harlow et al., 2019), and are more likely to report intentions to continue dual use long-term (Webb Hooper & Kolar, 2016). Black participants in the current study had significantly lower rates of ENDS use at both baseline and follow up and significantly higher baseline nicotine dependence as compared to White participants, factors both of which may explain lower likelihood of quitting cigarettes for Black participants over the course of the study. However, Black participants did not have significantly different cigarette rates at baseline as compared to White participants. This may suggest that patterns identified in other research of lower rates of successful cigarette cessation in Black smokers, despite not smoking at higher rates than White smokers (Trinidad et al., 2011, Trinidad et al., 2015), may also apply to the role of race/ethnicity in dual users' likelihood of quitting. Findings of the current study raise concerns that existing disparities in successful cigarette cessation across race/ethnicity may be applicable

in dual users' likelihood of quitting, and that research is needed to develop and target interventions that will be effective for aiding cigarette cessation in Black dual users.

When controlling for nicotine dependence, ENDS and cigarette rates, and negative affect variables, motivation to quit cigarettes was not significantly related to likelihood of quitting amongst dual users in the current sample. However, bivariate analyses revealed that higher motivation at baseline was related to lower overall cigarette rates and nicotine dependence for cigarettes at follow-up, as well as greater ENDS use at baseline. Some research has identified that dual users may be less motivated to quit (Jorenby et al., 2017), and may fail to quit completely despite increased reported attempts to quit (Brose et al. 2015). Still, some other research suggests that ENDS users may be more likely to express motivation to quit (Biener & Hargraves, 2015). Our work contributes to extant literature on motivation to quit in dual users by finding that higher motivation to quit early in ENDS initiation in current smokers is associated with higher use of ENDS and lower overall rates of cigarette smoking and dependence one year later. Given that this sample is one of convenience, we cannot estimate how motivation to quit may compare to that found in the overall population of dual users or to smokers in general, but do note that our sample was not recruited for any interest in quitting smoking. Although many smokers use ENDS as a quit aid (Pepper et al., 2014; Pulvers et al., 2015; Rutten et al., 2015), other important motives for ENDS use include ability to smoke in areas with combustible smoking restrictions, social inclusion, and reducing costs (Robertson et al., 2019), and research has identified that motives of reducing financial burden and stress reduction are associated with cigarette reduction in dual users (Rutten et. al, 2015). Further research attention is needed to assess how various dimensions of motivation for both cigarette reduction and ENDS use may contribute to cigarette cessation in dual users.

When controlling for covariates, age was not a statistically significant predictor of quitting at follow-up. However, modest trends emerged to suggest that younger dual users were more likely to quit at follow-up (see Table 3). Further, younger age in the current sample was associated with higher self-reported anxiety and depression (see Table 1). These patterns are consistent with findings from Piper et. al (2019) identifying that when compared to individuals who only smoke cigarettes, dual users tended to be younger and report greater mental health history. Trends toward younger dual users having higher odds of quitting (see Table 3) suggest that negative affect was not a barrier to transitioning away from cigarettes. Still, further research should investigate anxiety and depression in younger dual users to clarify the impact that elevated states of negative affect may have on cigarette cessation or overall patterns of dual use. Trends in our data suggest that older dual users had lower odds of quitting at follow-up, and older age in the current sample was associated with higher nicotine dependence for cigarettes at baseline and follow-up, and lower rates of ENDS use at both baseline and follow-up. These associations suggest that relatively lower odds of quitting in older dual users may have been related to higher nicotine dependence for cigarettes, which was a strong predictor of quitting in the current study. Associations between higher nicotine dependence for cigarettes in dual users of older age could be related to the association found between older age and lower rates of ENDS use at both baseline and follow-up, such that increased nicotine dependence for cigarettes would impact the substitutability of ENDS for cigarettes and impair attempts to use ENDS as a quit aid. Older age was also associated with a greater frequency of past reported quit attempts, reflecting a longer smoking history that could additionally impair quitting (see Table 2), or increase the difficulty of using ENDS as a quit aid. Evidence exists to suggest that the majority of dual use occurs in smokers over the age of 45 (National Health Interview Survey, 2015; Oakly

& Martin, 2019), and risk factors such as higher nicotine dependence for cigarettes and longer history of quit attempts could place older dual users at more risk for continued tobacco-related harms if quitting cigarettes is delayed through long-term dual use. Further research should assess older age, elevated negative affect in younger age groups, and other risk factors to determine best ways to evaluate and prevent long-term smoking across age groups of dual users.

Study Contributions and Limitations

The current study investigated the role of negative affect in a large, diverse sample of current smokers longitudinally beginning early in their use of ENDS. Although several studies have captured dual use and negative affect associations cross sectionally (Kim et al., 2020; Mayorga et al., 2019; Park et al., 2017; Piper et al., 2019; Pulvers et al., 2015; Spears et al., 2020; Wang et al., 2018) or have shown depression to predict dual use (Wiernik et al., 2019), no studies to date have investigated negative affect within the specific and critical period wherein smokers transition to dual use. Although no associations between negative affect and smoking cessation were identified, critical factors such as nicotine dependence, gender, and race/ethnicity, were identified as predictive of successful or unsuccessful smoking cessation over a one year period in smokers who recently initiated dual use.

Still, the current study has several limitations. We focused mainly on negative affect variables as predictors of smoking cessation, while there are a myriad of other factors that could be associated with motivation to substitute ENDS for cigarettes or to stop smoking. For example, reduced financial burden of ENDS as compared to cigarettes, management of stigma associated with cigarette smoking, and circumvention of smoke-free restrictions have been identified as prominent reasons for the uptake of ENDS in current smokers (Robertson et al., 2019). Further research should assess how negative affect may predict quitting in dual users when accounting

for these social and contextual factors. Additionally, our analyses omitted consideration of ENDS device type as it may relate to cigarette reduction and elevated negative affect and a majority of the participants were recruited prior to the upsurge in more popular pod ENDS devices. Differences in the type of device used can significantly impact nicotine absorption during vaping (Unger & Unger, 2018), which may have important implications for which devices are effective substitutions for cigarettes in dual users. Differences in device type and quitting likelihood as they vary across levels of elevated negative affect should be assessed further in dual users.

Conclusion

This study contributes to the relative minimal knowledge of individual factors that are predictive of changes in smoking among dual users over time. In particular, this study contributes knowledge related to longitudinal patterns of dual use and captures a diverse sample of smokers who have just recently begun to use ENDS and have intentions to continue ENDS use. As ENDS continues to be evaluated as a harm-reduction method for current smokers, our work has relevance in understanding which smokers who try ENDS are more or less likely to decrease their cigarette smoking and what factors may be viable intervention targets in aiding smokers in their transition away from conventional smoking or to stop all tobacco use. Our results suggest that factors such as nicotine dependence, gender, and race/ethnicity may be predictive of cigarette reduction over and above negative affect variables traditionally associated with quitting behavior in cigarette smoking. However, more work is needed to understand how elevated negative affect contributes to the likelihood of quitting across cigarette smokers who have begun to transition to dual use.

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Table 1*Baseline demographics and participant characteristics*

Characteristic	n (%) / M (SD)
Age	35.1 (12.9)
Race/Ethnicity	
White, not of Hispanic origin	139 (38.2)
Black, not of Hispanic origin	125 (34.3)
Hispanic	43 (11.8)
Asian or Pacific Islander	42 (11.5)
American Indian/Alaskan Native	3 (0.8)
Other or unknown	12 (3.3)
Gender	
Female	150 (41.2)
Male	214 (58.8)
Highest level of education	
Grades 9-11	24 (6.6)
Grade 12 or GED	70 (19.2)
College 1-3 years	179 (49.2)
College 4 years or more	91 (25.0)
ENDS type	
Disposable	69 (19.0)
Rechargeable, pre-filled cartridge	107 (29.4)
Rechargeable, refillable cartridge	184 (50.6)
Other	1 (0.28)
ENDS nicotine concentration	
0 mg or 0%	8 (2.2)
1-3 mg or 0.1-0.3%	60 (16.5)
4-6 mg or 0.4-0.6%	80 (22.0)
7-12 mg or 0.7-1.2%	54 (14.8)
13-18 mg or 1.3-1.8%	21 (5.8)
19-24 mg or 1.9-2.4%	14 (3.9)
25 mg+, or 2.5% or more	15 (4.1)
Do not know	108 (29.7)
Baseline depression (CES-D)	14.8 (11.0)
Baseline anxiety (MASQ)	25.1 (8.7)
Baseline negative affect smoking expectancies	3.1 (0.7)
Baseline cigarette NDSS	2.8 (0.7)
12-month cigarette NDSS	2.5 (0.8)
Baseline ENDS NDSS	2.4 (0.8)
12-month ENDS NDSS	2.2 (0.8)
Baseline motivation to quit	5.8 (2.7)
Frequency of past quit attempts	3.0 (1.6)
Baseline cigarette rate	8.4 (8.0)
12-month cigarette rate	5.7 (6.9)
Baseline ENDS rate	4.2 (7.1)
12-month ENDS rate	4.2 (7.9)

Table 2*Means, standard deviations, and correlations for key study variables*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	364	35.09	12.86														
2. BL Cigarette NDSS	364	2.82	0.70	.10*													
3. 12m Cigarette NDSS	364	2.48	0.84	.16**	.55**												
4. BL ENDS NDSS	359	2.37	0.76	-.03	.31**	.14**											
5. 12m ENDS NDSS	361	2.15	0.79	-.11*	.09	.21**	.40**										
6. BL ENDS Rate	364	4.16	7.14	-.13*	-.03	-.14**	.33**	.12*									
7. 12m ENDS Rate	364	4.19	7.85	-.22**	-.04	-.13*	.18**	.42**	.29**								
8. BL Cigarette Rate	364	8.44	7.95	.37**	.38**	.33**	.02	.00	-.05	-.01							
9. 12m Cigarette Rate	364	5.69	6.87	.36**	.29**	.50**	.01	-.00	-.05	-.19**	.55**						
10. Past Quit Attempts	364	3.07	1.61	.16**	.13*	.07	.02	-.01	.03	-.01	.02	.01					
11. BL Motivation to Quit	364	5.80	2.73	.10	-.12*	-.14**	.03	-.01	.13*	.09	-.08	-.13*	.17**				
12. BL NA Expectancies	364	3.13	0.72	.06	.48**	.34**	.16**	.02	-.03	-.04	.12*	.16**	.25**	-.07			
13. BL CES-D	360	14.82	11.02	-.17**	.26**	.18**	.22**	.16**	.04	-.02	.00	.03	-.02	-.02	.15**		
14. BL MASQ	360	25.11	8.70	-.26**	.20**	.13*	.22**	.17**	.07	.04	-.05	-.01	-.01	-.05	.14**	.82**	
15. Quit at 12m	364	0.24	0.43	-.26**	-.29**	-.53**	.05	.07	.13*	.21**	-.25**	-.46**	.01	.11*	-.22**	-.08	-.06

Note. *M* = mean; *SD* = standard deviation; BL = baseline; 12m = 12-month follow-up; NA = negative affect. * $p < .05$. ** $p < .001$.

Table 3*Logistic regression predicting self-reported abstinence from cigarettes at 12-month follow-up*

Predictor	Adjusted Odds Ratio	95% CI		<i>p</i>
		<i>LL</i>	<i>UL</i>	
Age	0.97	0.94	1.00	.075
Gender ^a	2.59	1.36	5.11	.005
Race/Ethnicity ^b				
Black, not of Hispanic origin	0.36	0.15	0.83	.018
Hispanic	0.67	0.26	1.63	.389
Asian or Pacific Islander	0.81	0.34	1.88	.623
Other or unknown	0.66	0.13	2.63	.585
Baseline motivation to quit	1.10	0.99	1.23	.091
Baseline cigarette NDSS	0.50	0.27	0.91	.024
Baseline cigarette rate	0.95	0.90	1.00	.082
Baseline ENDS rate	1.01	0.97	1.05	.488
12-month ENDS rate	1.03	1.00	1.07	.088
Baseline anxiety	0.97	0.91	1.03	.304
Baseline depression	1.00	0.96	1.05	.905
Baseline negative affect smoking expectancies	0.72	0.47	1.12	.145

Note. Total N = 360. CI = confidence interval; *LL* = lower limit; *UL* = upper limit

^a 1 = Female, 2 = Male. ^b White, not of Hispanic origin as the reference group

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EDUCATION

- | | |
|----------------|--|
| 2019 - Present | University of Illinois at Chicago , Chicago, IL Clinical Psychology Doctoral Program
Advisor: Robin Mermelstein, Ph.D
Expected Graduation: 2025 |
| 2013 - 2017 | Union College , Schenectady, NY
Majors: Psychology; Chinese Degree: B.S., <i>summa cum laude</i> |

PUBLICATIONS

- Walker, D.C., Donahue, J.M., Heiss, S., Gorrell, S., Anderson, L.M., **Brooks, J.**, Ehrlich, E.P., Morison, J.N. & Anderson, D.A. (2020). Rapid response is predictive of treatment outcomes in a transdiagnostic intensive outpatient eating disorder sample: a replication of prior research in a real-world setting. *Eating and Weight Disorders*.
- Walker, D. C., Heiss, S., Donahue, J. M., & **Brooks, J. M.** Practitioners' perspectives on ethical issues within the treatment of eating disorders: Results from a concept mapping study. *International Journal of Eating Disorders*.
- Cardinale, E. M., Kircanski, K., **Brooks, J.**, Gold, A. L., Towbin, K. E., Pine, D. S., Leibenluft, E., & Brotman, M. A. (2019). Parsing neurodevelopmental features of irritability and anxiety: Replication and validation of a latent variable approach. *Development and psychopathology*.
- Linke, J., Kircanski, K., **Brooks, J.**, Perhamus, G., Gold, A. L., & Brotman, M. A. (2019). Exposure-Based Cognitive- Behavioral Therapy for Disruptive Mood Dysregulation Disorder: An Evidence-Based Case Study. *Behavior Therapy*.
- *Brooks, J.**, *Cardenas, S. I., *Clayton, M., *Perhamus, G., Perlstein, S. C., *Ross, A.J., *Roule, A., & Vinograd, M. (2018). Breaking into open science: A primer on publicly available datasets for graduate students in clinical science. *The Behavior Therapist*, 41(6), 281-290. (*equal contribution)

POSTER PRESENTATIONS

- Brooks, J.** & Mermelstein, R. (May 2020). Anxiety and Negative Mood Regulation As Predictors Of Cigarette Cessation In Dual Cigarette/Ends Users Over 12 Months. Poster presented at the Association for Psychological Science (APS) 32nd annual virtual convention.
- Brooks, J.**, & Mermelstein, R. (March 2020). Negative Affect And Changes In Cigarette And Ends Use In Dual Cigarette/Ends Users Over 12 Months. Poster presented at the Society for Research on Nicotine and Tobacco (SRNT) 26th annual meeting, New Orleans, LA.
- Brooks, J.**, Cardinale, E., Kircanski, K., Pine, D., Leibenluft, E., & Brotman, M. A. (November 2018). Modeling dimensionally-assessed anxiety and irritability in youth. Poster presented at the Association for Behavioral and Cognitive Therapies (ABCT) 52nd annual convention, Washington, DC.
- Brooks, J.**, Agorsor, C., Kircanski, K., Smith, A. R., Gold, A. L., Tanofsky-Kraff, M., Engel, S. G., Crosby, R. D., Pine, D. S., Leibenluft, E., Brotman, M. A. (September 2018). Transdiagnostic assessment of pediatric irritability using smartphone-based ecological momentary assessment. Poster presented at the 20th Annual NIMH IRP Fellows' Scientific Training Day, Washington, DC.

- Brooks, J.,** Cardinale, E., Gold, A., Filippi, C., Pachecho, J., Kircanski, K., Pine, D., Leibenluft, E., & Brotman, M.A (May 2018). Mapping associations between cortical structure and unique versus shared variances of anxiety and irritability symptoms. Poster presented at the National Institutes of Health Post-baccalaureate Poster Day, Bethesda, MD.
- Brooks, J.,** Cardinale, E., Gold, A., Filippi, C., Sachs, J., Steuber, E., Pachecho, J., Pine, D., Leibenluft, E., & Brotman, M. A. (April 2018). An investigation of anxiety and irritability as predictors of cortical volume in youth. Poster presented at the Anxiety and Depression Association of America (ADAA) annual conference, Washington, DC.
- Brooks, J. & Walker, D. C.** (April 2018). What can my body do for me? Seeking to improve body-satisfaction with a guided functionality mirror exposure. Poster presented at the AED 2018 International Conference on Eating Disorders, Chicago, IL.
- Walker, D. C., Ehrlich, E., & **Brooks, J.** (March 2019). Initial results from In the Mirror: Functional Appreciated Bodies (IM FAB), a novel body functionality mirror exposure program. Poster presented at the Academy for Eating Disorders (AED) 2019 International Conference on Eating Disorders, New York, NY.
- Walker, D. C., **Brooks, J.** (June 2017). Ehrlich, E., Morison, J. N., & Anderson, D. A. Predictors of outcome in an evidence-based intensive outpatient program for the treatment of eating disorders support rapid response and treatment duration. Poster Presented at the AED 2017 International Conference on Eating Disorders, Prague, Czech Republic.
- Walker, D. C., **Brooks, J.**, Knauf, L. E., Anderson, L. M., Gorrell, S., Reilly, E. E., ... & Anderson, D. A. (October 2016). Rapid response predicts outcome in a community-based intensive outpatient program for eating disorders. Poster presented at the ABCT 50th annual convention, New York, NY.

RESEARCH EXPERIENCE

- | | |
|----------------|---|
| 2019 - Present | <p>Institute for Health Research and Policy, University of Illinois at Chicago
 <i>Graduate Research Assistant</i>
 <i>Mentor: Dr. Robin Mermelstein</i></p> <ul style="list-style-type: none"> • Conduct analyses large-scale longitudinal data sets of dual users of cigarettes and e-cigarettes using SPSS and R • Investigate negative affect as it relates to quitting in dual users of cigarettes and e-cigarettes |
| 2017 - 2019 | <p>Section on Mood Dysregulation and Neuroscience, National Institute of Mental Health
 <i>Postbaccalaureate Intramural Research Training Award (IRTA)</i>
 <i>Fellow Mentors: Ellen Leibenluft, M.D.; Melissa Brotman, Ph.D.</i></p> <ul style="list-style-type: none"> • Coordinate large-scale treatment and characterization studies targeting pediatric irritability • Co-manage administration of exposure-based cognitive-behavioral therapy (CBT) and computer-based interpretation bias training (IBT) • Pre-process and conduct individual-level analyses of functional Magnetic Resonance Imaging (fMRI) data collected during CBT (Analysis of Functional NeuroImages; AFNI) • Pre-process and conduct analyses of structural MRI and behavioral data • Manage smartphone-based ecological momentary assessment (EMA) protocol in CBT • Coordinate and run outpatient research visits: phone screening; fMRI scanning simulation training; behavioral tasks; questionnaires; neuropsychological testing • Manage recruitment and training of new IRTA fellows |
| 2015 - 2017 | <p>Body Image, Weight, and Eating Disorders (BIWED) Lab, Union College
 <i>Research Assistant</i>
 <i>Mentor: Catherine Walker, Ph.D.</i></p> <ul style="list-style-type: none"> • Conducted research on body image interventions and eating disorder treatment outcomes |

- Identified increased body appreciation following novel mirror exposure intervention
- Identified rapid response as a predictor of symptom reduction in an intensive outpatient (IOP) treatment center for eating disorders
- Administered exposure ratings during daily group meals in IOP
- Managed participant recruitment
- Oversaw training of undergraduate research assistants

CLINICAL EXPERIENCE

- 2019 – Present **Office of Applied Psychological Services, Chicago, IL**
Intake and Assessment Clinician
- Conduct diagnostic assessments
 - Administer neuropsychological assessments and interpret, document, and communicate results
- 2020 - Present **Students Understanding College Choices, Encouraging and Executing Decisions for Success (SUCCEEDS) Clinic, Chicago, IL**
Therapist
- Provide behavioral activation (BA) and organizational skills training (OST) treatments to college students with ADHD
- 2015 **New Choices Recovery Center, Schenectady, NY**
Clinical Intern
- Observed and co-facilitated group therapy and intakes for substance abuse treatment

TEACHING EXPERIENCE

- 2019 – Present **Graduate Teaching Assistant, University of Illinois at Chicago**
- Introduction to Psychology (Fall 2019)
 - Lab in Clinical Psychology (Spring and Fall 2020)
- 2016 - 2017 **Tutor, Union College Writing Center**
- Specialized in tutoring international students writing in English as a second language

