Smoking history, and not depression, is related to deficits in detection of happy and sad faces

K.K. Meyers\textsuperscript{a}, N.A. Crane\textsuperscript{b}, R. O’Day\textsuperscript{c}, J.K. Zubieta\textsuperscript{a}, B. Giordani\textsuperscript{a}, C.S. Pomerleau\textsuperscript{a,c}, J.C. Horowitz\textsuperscript{d}, S.A. Langenecker\textsuperscript{a,c,*}

\textsuperscript{a} Department of Psychiatry, University of Michigan, Ann Arbor, MI, USA
\textsuperscript{b} Department of Psychiatry, The University of Illinois at Chicago, USA
\textsuperscript{c} Nicotine Research Laboratory, University of Michigan Department of Psychiatry, Ann Arbor, MI, USA
\textsuperscript{d} Department of Medicine, University of Michigan, Ann Arbor, MI, USA

HIGHLIGHTS

- Impact of smoking history and depression on cognitive functions.
- History of smoking was associated with reduced emotion perception accuracy.
- Depression was associated with poorer executive functioning performance.
- No additive decrements in those with a history of smoking and depression observed.

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ABSTRACT

Introduction: Previous research has demonstrated that chronic cigarette smoking and major depressive disorder (MDD) are each associated with cognitive decrements. Further, these conditions co-occur commonly, though mechanisms in the comorbid condition are poorly understood. There may be distinct, additive, or overlapping factors underlying comorbid cigarette smoking and MDD. The present study investigated the impact of smoking and MDD on executive function and emotion processing.

Methods: Participants (N = 198) were grouped by diagnostic category (MDD and healthy controls, HC) and smoking status (ever-smokers, ES and never-smokers, NS). Participants completed the Facial Emotion Perception Test (FEPT), a measure of emotional processing, and the parametric Go/No-go task (PGNG), a measure of executive function.

Results: FEPT performance was analyzed using ANCOVA with accuracy and reaction time as separate dependent variables. Repeated measures MANCOVA was conducted for PGNG with performance measure and task level as dependent variables. Analyses for each task included diagnostic and smoking group as independent variables, and gender was controlled for. Results for FEPT reveal that lower overall accuracy was found for ES relative to NS, though MDD did not differ from HC. Post-hoc analyses revealed that ES were poorer at identifying happy and sad, but not fearful or angry, faces. For PGNG, poorer performance was observed in MDD relative to HC in response time to Go targets, but there were no differences for ES and NS. Interaction of diagnosis and smoking group was not observed for performance on either task.

Conclusions: The results of this study provide preliminary evidence for distinctive cognitive decrements in smokers and individuals with depression.

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1. Introduction

Chronic cigarette smoking is linked to several adverse health outcomes, including cerebrovascular disease, cardiovascular disease, respiratory disease, cancer and major depressive disorder (MDD). Such diseases accounted for two-thirds of deaths worldwide between the years 1990 and 2010 (Lozano et al., 2012). Previous research suggests that annual rates of morbidity and mortality are greater for cigarette smokers compared to nonsmokers (McGinnis & Foege, 1993), as well as for individuals with MDD compared to those without MDD (Wuslin, Vaillant, & Wells, 1999). Further, rates of smoking are higher among individuals with MDD (Dierker, Avenevoli, Stolar, &
Comorbid MD and smoking may have shared risk factors, such as dis-
may have limited ecological utility given high rates of comorbidity.
condition with cognition independently, the
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in MDD, yet this does not address the long-term effects of smoking
smoking. Existing studies of executive functions in temporarily absti-
whether executive dysfunction continues after individuals have quit
executive functioning appear to persist following the remission of
2006; Swan & Lessov-Schlaggar, 2007). Impairments in attention and
knew to detrimentally impact functioning in a variety of settings. For
instance, emotion perception, the ability to identify and respond to
facial expressions of emotion, is critical for successful social interactions.
Difficulties with emotion perception can result in interpersonal com-
munication problems that can impair an individual’s social and voca-
tional practices (Bourke et al., 2010; Carton, Kessler, & Fape, 1999;
Langenecker et al., 2005). Likewise, deficits in executive functions,
which include abilities to plan, make decisions, attend to stimuli, and
inhibit inappropriate responses, may hinder one’s ability to function op-
timally. Ultimately, emotion processing and executive function decre-
ments may interfere with recovery from depressive episodes (Porter,
Bourke, & Gallagher, 2007) or an individual’s ability to quit smoking
(Carmody et al., 2007; Mendrek et al., 2006). In MDD, executive dysfunc-
tion is associated with poor treatment response to standard de-
pression treatments (Kampf-Sherf et al., 2004). Thus, obtaining critical
information about the impact of smoking on executive functions and
emotional processing among individuals with and without MDD may
inform clinical care by guiding existing interventions for these condi-
tions, while also directing the development of novel treatments.
For example, if executive functioning deficits confer risk for smoking and
MDD together, but not MDD alone, then treatment decisions that target
executive functioning may be ineffective in MDD alone.

Despite the advantages of exploring affective and executive func-
tions in comorbid MDD and cigarette smoking, there is little research
on the topic. Typically, smoking precludes participation in neuropsy-
chological studies of MDD, and MDD is often an exclusionary, uncon-
trolled, or self-report variable in studies of smoking. While exclusion
as a methodology serves to elucidate the specific associations of each
condition with cognition independently, the findings from these studies
may have limited ecological utility given high rates of comorbidity.
Comorbid MD and smoking may have shared risk factors, such as dis-
ruption of executive functions and emotion perception.

Executive impairments are among the most common cognitive
symptoms associated with both MDD (Porter et al., 2007; Rogers et al.,
2004) and cigarette smoking (Jacobsen et al., 2005; Mendrek et al.,
2006; Swan & Lessov-Schlaggar, 2007). Impairments in attention and
executive functioning appear to persist following the remission of
depressive episodes and are thought to represent trait characteristics
or risk factors for depression (Langenecker, Lee, & Bielaiskas, 2009;
Paelcke-Habermann, Poll, & Leplow, 2005). It is less clear, however,
whether executive dysfunction continues after individuals have quit
smoking. Existing studies of executive functions in temporarily absti-
nent smokers reveal behavioral decrements similar to those observed
in MDD, yet this does not address the long-term effects of smoking
(Swan & Lessov-Schlaggar, 2007). Among chronic smokers, cognitive
decrements include reduced psychomotor speed, cognitive flexibility,
and visual search speed (Durazzo et al., 2010; Kalmijn, van Bokel,
Verschuren, Jolles, & Launer, 2002; Richards, Jarvis, Thompson, &
Wadsworth, 2003), though reports are inconsistent as samples and
methodology vary greatly across studies. Findings on executive func-
tions in former smokers relative to never smokers are also mixed,
although one study did report that those who were able to quit had better
executive functioning (Ernst, Heishman, Spurgeon, & London,
2001).

MDD often presents with emotional processing impairments
(Gollan, McCloskey, Hoxha, & Cocco, 2010; Versace et al., 2010). For
smoking, research suggests that negative affect is a motivation for
smoking in a larger percentage of smokers (Kassel, Stroud, & Paronis,
2003). Cognitive theories of psychiatric conditions such as depression
propose that biases in judgment of emotional processes are disease-
related. When such biases occur, individuals misinterpret situations
and may respond in a maladaptive manner, which further exacerbates
their conditions (Kahler et al., 2012). MDD has been associated with
impaired recognition of facial expressions (Bourke et al., 2010; Kohler,
Hoffman, Eastman, Healey, & Moberg, 2011; Wright et al., 2009).
It has been suggested that some of these impairments in emotion per-
ception resolve during remission and that increased bias of judging amb-
iguous faces as negative facial emotions may be predictive of persistent
depression at later time points (Bouhys, Geerts, & Gordijn, 1999; Hale,
1998). In smoking, it is unclear whether the pattern of poor emotion
identification observed for MDD is also present in smokers.

As a means of addressing limitations in the literature, the present
study will examine shared mechanisms and impact of MDD and
smoking upon emotion perception and executive functioning. It was ex-
pected that individuals with MDD and a history of cigarette smoking
would perform worse than non-depressed, non-smoking controls on
tests of executive function, examining attention and inhibitory control,
and emotion identification. Exploratory analyses addressed the impact
of comorbid smoking and MDD on measures of executive functioning
and emotion identification.

2. Method

2.1. Participants

This was a retrospective study of 194 participants (78 healthy con-
trols, HC, and 116 MDD). Depressed participants completed smoking
and cognitive measures as part of a standard intake battery prior to
their first psychiatric assessment for depression at the University of
Michigan Depression Center. HCs were recruited through projects at
the University of Michigan as part of a larger sample reported elsewhere
(Langenecker et al., 2007). Absence of psychiatric conditions in HC was
confirmed for 13 participants using the Structured Clinical Interview for
DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1995) non-patient
version and for 65 participants using the Diagnostic Interview for
Genetic Studies (DIGS; Nurnberger et al., 1994). Key demographic and
clinical variables relevant to diagnosis group and smoking status are
reported in Table 1.

2.1.1. Participant characteristics

MDD participants were diagnosed via clinical interview by board-
certified psychiatrists (n = 93), with the SCID-IV patient version
(n = 15), or with the DIGS (n = 8). Among MDD, most participants met
criteria for diagnosis of MDD alone (71%) or MDD comorbid with
an anxiety disorder (12%). The remaining MDD subjects had a diagnosis
within the broader spectrum of mood disorders (e.g., mood disorder
NOS (9%), dysthymia (0.2%) or no DSM-IV diagnosis (7.8%, yet with
significant depression symptoms)). There were 64% of MDD who
were currently taking psychotropic medications (mean number of
medications = 1.39, SD = 1.49). No HC participants met criteria for
any psychiatric disorder (current or past). Among MDD and HC, there

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