Short Communication

The relationship of anxiety and smoking behaviors to medication adherence among cigarette smokers living with HIV

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HIGHLIGHTS

- Examined anxiety and medication adherence among smokers with HIV
- Higher anxiety was associated with lower medication adherence among PLWH who smoke.
- Medication adherence did not differ by frequency and quantity of cigarette smoking.
- PLWH who smoke may benefit from assessment and management of anxiety.

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ABSTRACT

Introduction: People living with HIV/AIDS [PLWH] who smoke cigarettes report lower medication adherence. The purpose of the current study was to examine the relationship between anxiety and smoking behaviors (e.g., smoking quantity and frequency) and medication adherence in a sample of PLWH who smoke.

Methods: PLWH who reported current cigarette smoking and use of antiretroviral medication were recruited from Center for Positive Living at Montefiore Medical Center (New York, US). Participants completed questions about their current smoking behavior, anxiety symptoms, and medication adherence.

Results: The analytic sample included sixty-eight PLWH who smoked cigarettes (female 48.5%, mean age = 49.1 ± 8.8 years, 52.2% Latino/a). The participants smoked an average of 10.53 (SD = 8.6) cigarettes daily and just over half of participants (55.9%) reported high medication adherence. There was a significant association between greater anxiety symptoms and poorer medication adherence (OR = 1.09, CI = 1.04–1.15, \( p = .001 \)). Participants with higher anxiety symptoms were more likely to report forgetting to take their medication, forgetting to take medication when leaving on a trip, stopping medication when feeling symptoms are under control, and when feeling hassled about sticking to the treatment plan. Within this sample of current smokers, there were no significant associations between smoking quantity or frequency and medication adherence and no interactive effects of these smoking behaviors and anxiety on medication adherence.

Discussion: Current cigarette smoking PLWH who reported greater anxiety symptoms were less likely to adhere to their medication than current smoking PLWH who reported fewer anxiety symptoms. PLWH who smoke may benefit from assessment and management of anxiety.

1. Introduction

More than 1.2 million people the United States [US] are living with HIV (CDC, 2015). Proper medication adherence to antiretroviral therapy [ART] is crucial for the most effective management of HIV (CDC, 2015). Physicians recommend a 95% or greater adherence rate to ART in order to suppress the HIV virus, prevent virus mutation, and for overall better prevention of the HIV’s progression into AIDS (CDC, 2015; Shuter & Bernstein, 2008).

Cigarette smoking is a highly prevalent behavior among persons living with HIV [PLWH]. PLWH smoke at two to three times the prevalence of the general US population (CDC, 2009; Park, Hernandez-Ramirez, Silverberg, Crothers, & Dubrow, 2016; USDHHS, 2014; Weinberger, Smith, Funk, Rabin, & Shuter, 2017). PLWH who smoke are more likely than PLWH who do not smoke to contract serious illnesses such as heart disease, lung cancer, and stroke (CDC, 2015).
Additionally, smoking can increase the severity of HIV symptoms and the rate of HIV-disease progression (CDC, 2015).

There is an association between smoking and poorer ART adherence (Feldman et al., 2006; Shuter & Bernstein, 2008; Webb, Vanable, Carey, & Blair, 2009; Yuan, L’Italien, Mukherjee, & Iloeje, 2006). The overall medication adherence rate for PLWH in the US is 70% to 80%; however, PLWH who smoke report lower adherence rates (~65%) compared to PLWH who do not smoke (80–85%; Bangsberg et al., 2000; Karpia, 2014; Shuter & Bernstein, 2008).

Anxiety disorders are common among individuals with chronic diseases including PLWH (Kessler et al., 2005). PLWH report levels of anxiety that are up to twice that of the general US population (Kessler, Chiu, Demler, & Walters, 2005; Nel & Kagge, 2011). Like smoking, anxiety is associated with medication nonadherence. PLWH with moderate or severe anxiety were 1.66 times more likely than PLWH with low or no anxiety to report < 95% medication adherence (95% CI = 1.17–2.37; Shacham, Morgan, Onen, Taniguchi, & Overton, 2012). Similarly, people currently reporting anxiety had a higher likelihood of ART nonadherence than people currently not reporting anxiety (OR = 1.6, 95% CI = 1.2–2.1; Nguyen et al., 2016). There is a link between anxiety and smoking (Moylan, Jacka, Pasco, & Berk, 2012) and individuals with anxiety may smoke cigarettes as a way to manage their anxiety (Kassel, Stroud, & Paronis, 2003).

To the authors’ knowledge, there has been no research published to date that examines the relationships between smoking behaviors, anxiety, and antiretroviral medication adherence among PLWH who smoke cigarettes. The aims of the current study were to examine the relationship between anxiety and smoking behaviors (e.g., smoking quantity and frequency) in relation to medication adherence in a sample of PLWH who smoke.

2. Materials and methods

2.1. Participants

Participants were adults with a diagnosis of HIV receiving care at the Montefiore Medical Center’s Center for Positive Living (CPL; Bronx, New York, US). Inclusion criteria were: (1) self-reported diagnosis of HIV and/or AIDS (2) capacity to give informed consent, (3) age 18 years or older, (4) English-speaking, and (5) current cigarette smoker (i.e., reported smoking one or more cigarettes in the past day). All aspects of the study were reviewed and approved with oral consent procedures by the Montefiore Medical Center Institutional Review Board.

2.2. Procedure

Researchers generated a list of patients who had appointments at the CPL during time slots when investigators were present and every patient was assigned a random rank number. Patients were approached in the waiting area in number order and invited to participate in the study. If the participant was unable to read English or was visually impaired, a research assistant read the questions aloud for the participant in a private area. Upon completion of the survey, participants received a twenty-dollar gift card to Target and, if interested, information about smoking cessation services.

3. Measures

3.1. Demographics

Demographic questions included age, gender, race, ethnicity, sexual orientation, education, and year of HIV diagnosis.

3.2. Smoking

Smoking questions included smoking frequency (analyzed as days per week and as daily versus non-daily smoking), smoking quantity (number of cigarettes smoked per day; CPD), use of non-cigarette tobacco products, number of past quit attempts, and length of quit attempts.

3.3. Anxiety

The Patient-Reported Outcomes Measurement Information System (PROMIS) for Anxiety Short Form-8A was administered to assess anxiety. This 8-item questionnaire assesses anxiety symptoms over the past week and is scored using a 5-point Likert scale (1 = never to 5 = always). For the analyses, the anxiety total scores were converted into T-scores (Cella, Riley, Stone, et al., 2010). The anxiety items demonstrated excellent internal consistency reliability in previous research (α = 0.96; Cella et al., 2010) and in this sample (α = 0.95).

3.4. Medication adherence

The 8-item Morisky Medication Adherence Scale1 (MMAS-8; Morisky, Ang, Krousel-Wood, & Ward, 2008; Morisky & DiMatteo, 2011; Berlowitz et al., 2017) was administered to assess medication adherence. Seven out of eight of the items are scored on a yes or no scale. The eighth item has a five-point response scale about the frequency of the difficulty of taking medication. The total score on the MMAS-8 ranges from 0 to 8. The MMAS-8 has excellent internal consistency reliability (α = 0.68–0.83; de Oliveira-Filho, Morisky, Neves, Costa, & de Lyra Jr, 2014; Morisky et al., 2008; current sample, α = 0.67) and excellent test–retest reliability (Spearman’s r = 0.93; Dias de Oliveira-Filho et al., 2014). The MMAS-8 has high sensitivity (83%) and high predicative validity (Morisky, Ang, Krousel-Wood, & Ward, 2008).

3.5. Statistical analysis

All statistics were performed using the Statistical Package for the Social Sciences-22.0 (SPSS). Similar to past research (e.g., Shalansky, Levy, & Ignaszewski, 2004; Wong et al., 2015), medication adherence was analyzed as a categorical variable with scores of 0 to 5 indicating lower adherence and scores of 6 to 8 indicating higher adherence. Results did not differ when analyses were repeated with medication adherence as a continuous variable.

3.5.1. Anxiety and medication adherence

Logistic regressions were run to examine the association between the independent variable of anxiety and the dependent variable of medication adherence (total MMAS-8 score and each MMAS-8 item).

3.5.2. Smoking behaviors and medication adherence

Logistic regressions were run to examine the relationship between each of the smoking behavior independent variables (i.e., smoking days per week, CPD, smoking frequency) and the dependent variable of medication adherence.

3.5.3. Smoking, anxiety, and medication adherence

Three sets of logistic regressions were run with anxiety and a smoking behavior (CPD, smoking days per a week, frequency of smoking) entered in the first block and the interaction of anxiety and that smoking behavior entered in the second block. Medication adherence was entered as the dependent variable.

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4. Results

Approximately 220 potential participants were approached during the four-month study. The major reason for exclusion from the study was the report of no current cigarette smoking. One hundred fourteen participants met the inclusion criteria and completed informed consent procedures. Four participants did not complete the survey after the consent procedures because of other commitments. Four participants did not report current use of ARTs were excluded from the current analyses leaving a final analytic sample of 68 participants.

4.1. Demographics

See Table for demographic and smoking information for the full analytic sample. The participants were split almost equally between men and women and Latino and non-Latino ethnicity. The majority of the participants reported daily cigarette use (76.5%) and smoked an average of 10.5 cigarettes per day. Approximately 56% of participants reported higher medication adherence while 44% reported lower medication adherence. There were no demographic differences between participants with higher versus lower medication adherence (see Table 1).

4.2. Anxiety and medication adherence

There was a significant association between greater anxiety and poorer medication adherence (OR = 1.09, 95% CI = 1.04–1.15, p = .001). Upon examining each item of the adherence scale, participants with higher anxiety symptoms, compared to participants with lower anxiety symptoms, were more likely to report forgetting to take their medication (OR = 1.05, 95% CI = 1.01–1.10, p = .02), forgetting to take medication in the last two weeks (OR = 1.05, 95% CI = 1.01–1.10, p = .02), forgetting to take medication when leaving on a trip (OR = 1.08, 95% CI = 1.02–1.12, p = .006), stopping medication when feeling symptoms are under control (OR = 1.09 95% CI = 1.01–1.16, p = .04), and feeling hassled about sticking to the treatment plan (OR = 1.08, 95% CI = 1.02–1.14, p = .004).

4.3. Smoking behaviors and medication adherence

There were no significant relationships between medication adherence and smoking days per week (Wald = 0.65, df = 1, p = .65), CPD (Wald = 0.01, df = 1, p = .94), or frequency of smoking (Wald = 0.76, df = 1, p = .38).

4.4. Smoking, anxiety, and medication adherence

There were no significant interactions of anxiety and smoking behaviors (CPD (B = 0.002, p = .52); smoking days per week (B = 0.004, p = .68); frequency of smoking (B = 0.048, p = .38)) on medication adherence.

5. Discussion

Current smoking PLWH who reported higher levels of anxiety were less likely to adhere to their medication than current smoking PLWH who reported lower levels of anxiety. Specifically, PLWH who reported higher levels of anxiety were more likely to report forgetting to take medication, forgetting to take medication in past two weeks, forgetting to bring their medication when they leave home or travel, feeling that medication is a hassle, and having greater difficulty remembering to take all medication. Within the sample of current smoking PLWH, specific smoking behaviors (i.e., smoking days per week, CPD, smoking frequency) were not associated with medication adherence. Further, there were no significant interactions between anxiety and smoking behaviors on medication adherence.

The current finding linking self-reported anxiety to medication adherence is consistent with previous findings reported by Shacham et al. (2012) and Nguyen et al. (2016) who examined general samples of PLWH and extends these studies by examining the relationship within a sample of smokers. Understanding the association between anxiety and medication adherence among smokers with HIV may provide physicians with a better understanding of how to promote better medication adherence in this population. For example, it may be beneficial for health care workers who care for PLWH to assess levels of anxiety in their patients and/or work to target and treat the anxiety among their patients.

Previous studies found a relationship between smoking or nicotine dependence and medication adherence (Marks King et al., 2012; Nguyen et al., 2016; Shuter & Bernstein, 2008). While these studies examined smokers versus non-smokers, the current study looked solely at smoking behaviors within a sample of smokers living with HIV and did not find that medication adherence was associated with a greater frequency or quantity of smoking. Overall smoking status (i.e., smoker versus non-smoker) may have a greater association to medication adherence than specific smoking behaviors (e.g., number of cigarettes smoked per day) within current smokers.

This study had a number of limitations. First, this study had a small sample size and future studies should examine the relationship of smoking, anxiety, and medication adherence with larger samples. Second, variables were collected by self-report and future research would benefit from incorporating other methods to confirm smoking behavior (e.g., carbon monoxide levels) and medication adherence (e.g., pharmacy logs). Third, participants were not asked to provide information about their use of substances other than tobacco (e.g., alcohol, illicit drugs) which may play a role in medication adherence (Hinkin et al., 2004; Palepu, Horton, Tibbetts, Meli, & Samet, 2004). Fourth, the sample was predominantly English-speaking Hispanic and African American persons, and white homosexual men were underrepresented relative to the demographics of the general US HIV population (CDC, 2018a, 2018b). Fifth, the criterion for current smoking was broad and future research should examine other smoking groups (e.g., persons with nicotine dependence). Additional research should examine whether these patterns are replicated in other demographic groups and other geographic locations including countries with lower average adherence rates than the US (Ortego et al., 2011). Sixth, the MMAS was not validated for analysis of individual items and use of the scale should occur within relevant Trademark and Copyright laws. Finally, future research should examine anxiety and medication adherence in PLWH who smoke versus PLWH who do not smoke.

6. Conclusions

In a sample of PLWH who smoke cigarettes, greater symptoms of anxiety were related to lower medication adherence. It may be beneficial for physicians to assess and treat anxiety in their HIV+ patients who smoke to increase medication adherence.

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Contributors

Dr. Weinberger designed the parent study and wrote the protocol. Ms. Esan developed the research questions for the current analyses, conducted the data analyses, and wrote the first draft of the manuscript. Drs. Shuter and Weinberger contributed to data interpretation and manuscript writing. All authors contributed to and have approved the final manuscript.

Conflicts of interest

The authors have no conflicts of interest to report.

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Table 1
Demographic, smoking, and medication adherence variables for the full sample of persons living with HIV/AIDS (n = 68) and by medication adherence group.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Full Sample (n = 68)</th>
<th>Medication Adherence Group</th>
<th>Lower Medication Adherence (n = 30)</th>
<th>Higher Medication Adherence (n = 38)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, M (SD)</td>
<td>49.1 (8.5)</td>
<td>48.4 (10.1)</td>
<td>49.6 (7.03)</td>
<td>0.56</td>
<td></td>
</tr>
<tr>
<td>Male, % (n)</td>
<td>51.5 (35)</td>
<td>60.0 (18)</td>
<td>44.7 (17)</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Ethnicity, % (n)</td>
<td>Latino/a 52.2 (35)</td>
<td>57.1 (16)</td>
<td>59.4 (19)</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Race, % (n)</td>
<td>White 12.5 (6)</td>
<td>11.1 (3)</td>
<td>13.5 (5)</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Sexual Orientation, % (n)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
</tr>
<tr>
<td>Education, % (n)</td>
<td>1-8th Grade 4.6 (3)</td>
<td>6.9 (2)</td>
<td>2.8 (1)</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Years Since HIV Diagnosis, M (SD)</td>
<td>18.1 (7.50)</td>
<td>16.6 (6.40)</td>
<td>19.4 (8.15)</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Current Non-Cigarette Tobacco Use, % (n)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigar 8.8 (6)</td>
<td>13.3 (4)</td>
<td>5.3 (2)</td>
<td></td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>E-cigarettes 4.4 (3)</td>
<td>6.7 (2)</td>
<td>2.6 (1)</td>
<td></td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>Pipe 0 (0)</td>
<td></td>
<td>--</td>
<td></td>
<td></td>
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<tr>
<td>Chew 0 (0)</td>
<td></td>
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<tr>
<td>Snuff 0 (0)</td>
<td></td>
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<tr>
<td>Other products 10.3 (7)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking Behavior</td>
<td>Smoked more than 100 lifetime cigarettes, % (n)</td>
<td>95.5 (63)</td>
<td>100 (29)</td>
<td>91.9 (34)</td>
<td>0.12</td>
</tr>
<tr>
<td>Cigarettes per day, M (SD)</td>
<td>10.53 (8.6)</td>
<td>9.63 (8.82)</td>
<td>11.22 (8.51)</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Smoking days per week, M (SD)</td>
<td>6.21 (2.00)</td>
<td>5.75 (1.81)</td>
<td>6.58 (2.09)</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>Number of lifetime smoking quit attempts, M (SD)</td>
<td>29.85 (144.35)</td>
<td>10.94 (26.8)</td>
<td>2.59 (2.97)</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Longest Quit (years), M (SD)</td>
<td>1.10 (1.96)</td>
<td>1.50 (2.45)</td>
<td>0.78 (1.42)</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Frequency of Cigarette Use, % (n)</td>
<td>Non-Daily 23.5 (16)</td>
<td>33.3 (10)</td>
<td>15.8 (6)</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>Daily 76.5 (52)</td>
<td>66.7 (20)</td>
<td>84.2 (32)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety, M (SD)</td>
<td>56.6 (12.85)</td>
<td>63.0 (14.01)</td>
<td>51.5 (9.24)</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>Medication Adherence</td>
<td>High Adherence, % (n)</td>
<td>55.9 (38)</td>
<td>0 (0)</td>
<td>100 (38)</td>
<td>--</td>
</tr>
<tr>
<td>Low Adherence, % (n)</td>
<td>44.1 (30)</td>
<td>100 (30)</td>
<td>0 (0)</td>
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<td></td>
</tr>
</tbody>
</table>

Key: M, mean; SD, standard deviation.

Notes: The total number of individuals reporting data for each characteristic differs from the N = 68. Total response for each characteristic are as follows: Age, N = 68; Gender, N = 68; Ethnicity, N = 67; Sexual Orientation, N = 64; Education, N = 65; Years of HIV diagnosis, N = 67; Current tobacco non-cigarette use, N = 68; Smoking more 100 cigarettes, N = 66; Cigarettes per day, N = 65; Smoking Days per a week, N = 66; Lifetime Smoking quit, N = 59; Longest Quit, N = 68; Frequency of Cigarette Use, N = 68; Medication Adherence, N = 68.

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2 Due to the variability in the responses to the number of times that a person attempted to quit, three outliers who reported 100 or more quit attempts were removed from the analysis. Seven additional participants who did not answer the question were also removed from the analysis. Overall n = 58 for the number of lifetime quit attempts.

3 Anxiety was measured using the Patient-Reported Outcomes Measurement Information System (PROMIS) for Anxiety Short Form-8A; total anxiety scores were converted to T-scores.