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A review of research on smoking behavior in three demographic groups of veterans: women, racial/ethnic minorities, and sexual orientation minorities

Andrea H. Weinberger, PhD, Hannah Esan, BA, Marcia G. Hunt, PhD, and Rani A. Hoff, MPH, PhD

ABSTRACT

Background: Veterans comprise a large segment of the U.S. population and smoke at high rates. One significant way to reduce healthcare costs and improve the health of veterans is to reduce smoking-related illnesses for smokers who have high smoking rates and/or face disproportionate smoking consequences (e.g., women, racial/ethnic minorities, sexual orientation minorities).

Objectives: We reviewed published studies of smoking behavior in three demographic subgroups of veterans—women, racial/ethnic minorities, and sexual orientation minorities—to synthesize current knowledge and identify areas in need of more research.

Methods: A MEDLINE search identified papers on smoking and veterans published through 31 December 2014. Results: Twenty-five studies were identified that focused on gender (n = 17), race/ethnicity (n = 6), or sexual orientation (n = 2). Female and sexual orientation minority veterans reported higher rates of smoking than non-veteran women and sexual orientation majority veterans, respectively. Veterans appeared to be offered VA smoking cessation services equally by gender and race. Few studies examined smoking behavior by race/ethnicity or sexual orientation. Little information was identified examining the outcomes of specific smoking treatments for any group.

Conclusion: There is a need for more research on all aspects of smoking and quit behavior for women, racial/ethnic minorities, and sexual orientation minority veterans. The high rates of smoking by these groups of veterans suggest that they may benefit from motivational interventions aimed at increasing quit attempts and longer and more intense treatments to maximize outcomes. Learning more about these veterans can help reduce costs for those who experience greater consequences of smoking.

Introduction

In the United States (US), approximately 480,000 adults die annually from tobacco-related causes every year (1). Smoking is associated with a long list of illnesses (e.g., cancer, cardiovascular disease, respiratory disease; [1]) and adults who smoke utilize greater healthcare resources than non-smokers (2). While smoking is harmful for all adults, certain demographic groups demonstrate higher smoking rates, lower smoking cessation rates, and/or increased consequences of smoking such as women (3,4), racial and ethnic minorities (5), and sexual orientation minorities (6).

There are currently approximately 22 million veterans in the US (7), a quarter of whom receive services through the Department of Veterans Affairs (VA) systems (8). Veterans report poor health and multiple chronic diseases more often than adults in the general population (9). Total VA expenditures, and expenditures specifically related to healthcare, have doubled over the past 10 years (10) and continue to increase (11). The VA healthcare system spent an estimated $2.7 billion on medical consequences of smoking in the year 2010 alone. Twice as much of the money spent on treating smoking-related illnesses in veterans was due to illnesses in current smokers compared to former smokers (12). Therefore, one meaningful way to reduce healthcare costs and improve health outcomes for the veteran population would be to reduce smoking-related illnesses especially for demographic groups who have higher rates of current smoking and face disproportionate negative consequences of smoking (e.g., women, racial/ethnic minorities, sexual orientation minorities).

Women constitute a growing proportion of the veteran population (13) and there has been increased attention on female veteran health (14); however, research on female veterans has primarily focused...
on a few specific topics (e.g. PTSD, sexual assault; 15). In the general US population, 16.5% of women report current smoking compared to 21.6% of men (16). While women smoke at lower rates than men, women experience unique consequences related to ovarian hormones (e.g. estrogen and progesterone), fertility, and pregnancy (1) and are more susceptible to some negative health-related consequences of smoking (17,18). For example, female smokers demonstrate a greater risk of cardiovascular disease and mortality due to cardiovascular disease than male smokers (19,20). In addition, there is evidence that women in the general population have a more difficult time quitting smoking (21–23; although see also 24), avoiding relapse after a period of abstinence (25), and achieving cessation using some common pharmacological treatments for smoking (e.g. transdermal nicotine patch; 26–28).

While it has been suggested that the overall number of veterans will decrease over the next 30 years, the percentage of veterans who identify themselves as being part of a minority racial or ethnic group will increase (29). Population-based data has shown differences by race and ethnicity in rates of smoking, motivation to quit smoking, and success at quitting smoking (5,30,31). For example, African-American adults tend to have lower or equal rates of smoking, greater motivation to quit smoking, and less success at quitting compared to Caucasian adults (5,30,31). Hispanic adults have been reported to have smoking rates that are lower than Caucasian adults (32) and greater success at quitting smoking (5,30). As the number of veterans who are racial and ethnic minorities increase over time, it will be important to understand patterns of smoking and treatment needs that are specific to these groups of smokers.

A third group of adults who are disproportionately impacted by smoking in the general population are adults who identify as a sexual or gender orientation minority. It has been estimated that 2.2% of adults in active military service identify as gay, lesbian, or bisexual (GLB; 33). In the general population, adults who identify as a sexual or gender orientation minority (GLB, transgender) smoke at higher rates than adults who identify as heterosexual or cisgender (i.e. whose biological sex matches the gender with which they identify) (6,34–36). Adults who are sexual or gender orientation minorities are an understudied group in smoking research in general and another important group to consider in research on veterans.

In order to move forward in reducing the rates of smoking and harmful smoking consequences for veterans who are women, racial/ethnic minorities, and sexual and gender orientation minorities, it is important to first understand the current state of research on the smoking and quit behavior of members of these demographic groups (e.g. smoking rates, exposure and utilization to VA smoking cessation services, quit rates). The purpose of this paper was to review the published research on smoking behavior and veterans by gender, race, and sexual orientation in order to synthesize current findings and identify areas in need of additional research.

Methods

A MEDLINE search was conducted in August 2014 to identify papers on smoking and veterans published through 31 December 2013. An identical search was conducted in January 2015 to identify additional papers published between 1 January 2014 and 31 December 2014. Papers were required to include at least one search term related to smoking (i.e. “Smoking,” “Tobacco,” “Cigarettes,” or “Nicotine”) and at least one search term related to veterans (“United States Department of Veterans Affairs”; “Veterans Health”; “Hospitals, Veterans”; or “Veterans”). After removing duplicate articles, the remaining articles were individually examined to determine whether they met the inclusion criteria, namely that (i) the study had at least one aspect of smoking behavior as a primary outcome (e.g. smoking rates, smoking cessation, smoking cessation services), (ii) at least part of the sample consisted of US veterans, and (iii) a primary focus of the study was on gender, racial/ethnic, or sexual/gender orientation differences in smoking behavior (e.g. reference to at least one of these demographic groups in the title or abstract). Papers that controlled or covaried their analyses by one of these demographic groups were not considered to have met the inclusion criteria.

Results

A total of 514 unique articles published through 2014 were identified through the MEDLINE search and were individually examined. Some 372 papers were excluded because they did not include veterans and/or an assessment of smoking behavior, had samples comprised of veterans from countries other than the US, or were focused on outcomes related to an illness or disease rather than smoking behavior (e.g. the rate of smoking in candidates versus non-candidates for bariatric surgery, the association of smoking status to post-hip replacement surgery complications). After excluding these papers, 142
pap-ers were identified that examined an aspect of smoking behavior in US veterans. These papers were then examined individually to determine whether they had a primary focus on gender, race/ethnicity, or sexual orientation. Of the 142 studies that examined some type of smoking behavior in US veterans, only 25 studies (17.6% of the total studies reviewed) were primarily focused on gender, race, or sexual orientation. Seventeen smoking-related studies were identified that had a primary focus of examining female veterans or gender differences, six studies were identified that focused on race/ethnicity, and two studies were identified that examined sexual orientation minority veterans. As a note, a separate review of the papers focused on illness or disease did not reveal studies that reported a primary focus on examining the interaction of one or more of the three demographic groups (gender, race/ethnicity, sexual orientation) and smoking behavior on disease or illness outcome.

Studies of women and smoking in veteran samples (Table 1)

Seventeen studies examined gender differences in some aspect of smoking behavior of veterans (37–53, see Table 1). The majority of these studies reported rates of smoking with most studies finding higher rates of smoking for female veterans compared to female non-veterans. In addition, one study (44) found that rates of current smoking were higher for female veterans who experienced sexual assault while in the military compared to female veterans who did not experience military-related sexual assault. A number of studies also examined gender differences in self-reported smoking cessation services through VA hospitals. Women and men were equally likely to report being offered smoking cessation services in several studies while one study found that women were more likely to be advised to quit smoking than men. While some studies asked about former smoking as a measure of smoking cessation and one study examined preferences for smoking programs, no study reported smoking treatment outcomes. A study by Katzburg and colleagues (49) conducted focus groups and a pilot study with female veterans who smoked to examine their preferences with regard to smoking cessation programs. Women in the pilot study were least likely to select the traditional VA-based smoking cessation program suggesting that female veterans may have unique preferences and needs for smoking programs; however, more research is needed.

Studies of racial/ethnic minorities and smoking in veteran samples (Table 1)

Six studies were identified that reported a primary focus of examining the smoking behavior of racial/ethnic minorities (54–59; Table 1). Four studies compared Caucasian and African-American veterans with regard to smoking rates (54), motivation to quit and interest in smoking cessation services from the VA (58), the report of receiving smoking cessation services at the VA (55), and smoking cessation outcomes (59). Smoking rates did not differ for Caucasian versus African-American women receiving bone density testing through the VA (54). Karvonen-Gutierrez and colleagues (58) found that motivation to stop smoking and interest in smoking cessation services differed for Caucasian versus non-Caucasian (primarily African-American) veterans receiving services at Michigan’s Battle Creek VA Medical Center (see Table 1 for details). In the third study (55), an equal number of Caucasian and African-American veterans who were patients at coronary artery disease clinics at five VA Medical Centers reported being current smokers and receiving VA-related smoking cessation services (see Table 1 for details). The fourth study, by Burgess et al. (59), was the only identified study that examined differences in the outcomes of a randomized clinical trial for a smoking cessation intervention by race. Participants in this study were randomized to receive proactive mail and telephone outreach, in-person or telephone smoking counseling, and increased access to smoking cessation medications through the VA or “usual care” (no proactive outreach or access to telephone smoking counseling). African-American participants were more likely to demonstrate 6-month continuous abstinence compared to Caucasian participants across treatment condition (Odds ratio = 1.57, 95% Confidence Interval = 1.14–2.15; see Table 1 for percentages). The odds of greater abstinence for African-American participants was no longer significant after adjusting for smoking history, self-efficacy to quit smoking, and motivation to quit smoking. African-American participants were more likely than Caucasian participants to report smoking menthol cigarettes, a shorter time to smoking the first cigarette of the day, being light smokers (i.e. smoking 10 or fewer cigarettes per day), attempting to quit smoking in the past year, having global self-efficacy and motivation to quit smoking.

One study was identified that included Hispanic participants in a comparison of race and smoking behaviors. Fu and colleagues (56) compared past-year quit attempts and use of nicotine replacement therapy
Table 1. Studies of veterans and smoking that included analyses of gender, race/ethnicity, or sexual orientation differences.

<table>
<thead>
<tr>
<th>Ref.</th>
<th>First author Year</th>
<th>Sample size</th>
<th>Type of sample</th>
<th>Gender</th>
<th>Race</th>
<th>Sexual orientation</th>
<th>Outcomes assessed</th>
<th>Primary results</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Whitlock 1997</td>
<td>409</td>
<td>Veterans at the Pettis VA Medical Center Preventive Medicine Women’s Clinic (Loma Linda, California)</td>
<td>100% female</td>
<td>79% Caucasian; 12% African-American; 7% Hispanic; 2% Other</td>
<td>—</td>
<td>Current smoking, Former smoking</td>
<td>Caucasian veteran women in California reported a lower rate of former smoking (37%) compared to Caucasian women in the general California population (56%; Data from the 1990 California Behavioral Risk Factor Surveillance). More female veterans reported ever smoking (58.8%) and current smoking (35.1%) compared to female non-veterans (44.6% and 26.2%). More male veterans reported ever smoking (74.8%) and current smoking (33.8%) compared to male non-veterans (54.8% and 30.2%). Both male and female veterans were more likely to start smoking before age 18 than male and female non-veterans (male OR = 1.4, 95% CI =1.4, 1.5; female OR = 1.4, 95% CI = 1.1, 1.7). Female veterans were more likely than female nonveterans to report ever smoking (63% vs. 46%). Female smokers were equally likely as female nonveterans to report current smoking (31% vs. 27%). There was no difference in age of initiation of smoking for female veterans vs. female nonveterans (18.4 years vs. 19.9 years). Female veteran ever smokers who were not currently smoking were younger when they stopped smoking than female nonveteran ever smokers who were not current smokers (35.7 years vs. 38.8 years). Current tobacco use was reported by 26% of male and 27% of female participants. The majority of male (78%) and female (88%) participants reported that they were offered smoking cessation counseling by the VA. Current smokers compared to non-smokers were younger (46.4 years vs. 48.8 years, ( p &lt; 0.05 )), less likely to reported that they were married (23% vs. 45%, ( p &lt; 0.01 )), less likely to have completed college (30% vs. 45%, ( p &lt; 0.05 )), and less likely to have a body mass index that fell in the obese range (32% vs. 48%, ( p = 0.01 )). More current smokers, compared to non-smokers, reported high work strain (65% vs. 48%, ( p &lt; 0.05 )).</td>
</tr>
<tr>
<td>38</td>
<td>Klevens 1995</td>
<td>84,872</td>
<td>National Health Interview Survey</td>
<td>41.8% male, 58.2% female</td>
<td>85.7% Caucasian; 11.4% African-American; 2.9% Other</td>
<td>—</td>
<td>Ever smoking, Current smoking, Age of smoking initiation</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>McKinney 1997</td>
<td>21,978</td>
<td>1987 National Medical Expenditure Survey</td>
<td>44.5% male, 55.5% female</td>
<td>—</td>
<td>—</td>
<td>Ever smoking, Current smoking, Age of smoking initiation; Cigarettes smoked per day</td>
<td>Female veterans were more likely than female nonveterans to report ever smoking (63% vs. 46%). Female smokers were equally likely as female nonveterans to report current smoking (31% vs. 27%). There was no difference in age of initiation of smoking for female veterans vs. female nonveterans (18.4 years vs. 19.9 years). Female veteran ever smokers who were not currently smoking were younger when they stopped smoking than female nonveteran ever smokers who were not current smokers (35.7 years vs. 38.8 years). Current tobacco use was reported by 26% of male and 27% of female participants. The majority of male (78%) and female (88%) participants reported that they were offered smoking cessation counseling by the VA. Current smokers compared to non-smokers were younger (46.4 years vs. 48.8 years, ( p &lt; 0.05 )), less likely to reported that they were married (23% vs. 45%, ( p &lt; 0.01 )), less likely to have completed college (30% vs. 45%, ( p &lt; 0.05 )), and less likely to have a body mass index that fell in the obese range (32% vs. 48%, ( p = 0.01 )). More current smokers, compared to non-smokers, reported high work strain (65% vs. 48%, ( p &lt; 0.05 )).</td>
</tr>
<tr>
<td>40</td>
<td>Branch 1998</td>
<td>1703</td>
<td>Patients at 6 VA Medical Centers (Durham, North Carolina; Fresno, Long Beach, and Loma Linda, California; New York, New York; Seattle, Washington)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Current smoking, Offer of smoking counseling</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Bastian 2001</td>
<td>275</td>
<td>Women, ages 36–85, in the Women Veterans Cohort (Veterans’ Affairs Medical Center in Durham, North Carolina)</td>
<td>100% female</td>
<td>34% African American; Other races not reported in the article</td>
<td>—</td>
<td>Demographics, Health Behaviors, Work Strain</td>
<td></td>
</tr>
</tbody>
</table>

(Continued)
### Table 1. (Continued)

<table>
<thead>
<tr>
<th>Ref.</th>
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<th>Sexual orientation</th>
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<th>Primary results</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Koepsell</td>
<td>2002</td>
<td>3608</td>
<td>The Washington State version of the 1999 Behavioral Risk Factor Survey</td>
<td>43.5% male, 56.5% female</td>
<td>93.8% Caucasian; 6.2% Non-Caucasian</td>
<td>—</td>
<td>Lifetime smoking, Current smoking</td>
<td>Male veterans, compared to male non-veterans, were more likely to be lifetime smokers (71% vs. 59%, ( p &lt; 0.001 )) and current smokers (24% vs. 18%, ( p &lt; 0.01 )). Among male veterans who did and did not use the VA system, there was no difference in the lifetime smoking (69% vs. 71%, ( p = 0.99 )) or current smoking (26% vs. 24%, ( p = 0.87 )). The rate of lifetime smoking for female veterans was 48% compared to a rate of 45% for female non-veterans. The rate of current smoking for female veterans was 11% compared to a rate of 18% for female non-veterans. Note: The statistics were not reported for the female veteran vs. female non-veteran comparisons due to the small number of female veterans in the sample (( n = 36 )).</td>
</tr>
<tr>
<td>43</td>
<td>Davis</td>
<td>2003</td>
<td>1257</td>
<td>Female veterans who received care from the VA Puget Sound Health Care System (Washington) between 1 October 1996, and 1 January 1998</td>
<td>100% female</td>
<td>73.9% Caucasian; 12.1% African-American; 2.4% Other; 11.6% Missing or Unknown</td>
<td>—</td>
<td>Current smoking</td>
<td>Current smoking was reported by 29.1% of the sample. Female veterans ages 35–49 reported a higher rate of smoking (34.5%) than women age 35 or younger (29.5%) and women age 50 and older (21.1%; ( p = 0.01 )). Rates of smoking were higher for women with any psychiatric disorder (37.5%) and specifically for those who had a positive screen for major depression (39.9%), panic disorder (49.4%), and PTSD (39.5%).</td>
</tr>
<tr>
<td>44</td>
<td>Frayne</td>
<td>2003</td>
<td>3543</td>
<td>Female veterans who received VA ambulatory care</td>
<td>100% female</td>
<td>76% Caucasian</td>
<td>—</td>
<td>Current smoking</td>
<td>Women who reported a history of sexual assault while in the military were more likely to report current smoking (44%) compared to women with no history of sexual assault (29%).</td>
</tr>
<tr>
<td>45</td>
<td>Dobie</td>
<td>2004</td>
<td>1206</td>
<td>Female veterans who received care from the VA Puget Sound Health Care System (Washington) between 1 October 1996, and 1 January 1998</td>
<td>100% female</td>
<td>73% Caucasian; 13% African-American; 10% Other</td>
<td>—</td>
<td>Past-year smoking</td>
<td>Women who were positive for PTSD were more likely to report past-year smoking (39.5%) than women without PTSD (22.9%; ( OR = 2.04, 95% CI = 1.52–2.75 )).</td>
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Table 1. (Continued).

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<th>Sexual orientation</th>
<th>Outcomes assessed</th>
<th>Primary results</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>Sherman</td>
<td>2005</td>
<td>1941</td>
<td>Veterans at 18 VA medical and ambulatory care centers in Arizona, California, Nevada, New Mexico, and Texas who were enrolled in the Quality Improvement Trial for Smoking Cessation and were current smokers</td>
<td>93.4% male; 6.6% female</td>
<td>64.5% Caucasian; 35.5% Non-Caucasian</td>
<td>—</td>
<td>Smoking Cessation Services</td>
<td>Female veterans were more likely than male veterans to report a smoking cessation attempt (55% vs. 49%; OR = 1.6, 95% CI = 1.01–2.6), less likely to report being prescribed transdermal nicotine patch (15% vs. 26%; OR = 0.6, 95% CI = 0.4–0.8). Although this difference did not reach statistical significance (OR = 0.3, 95% CI = 0.01–1.1), female veterans at VA medical centers were more likely to report that they had successfully quit smoking at a one year follow-up (2.7% vs. 9.5%). They were more likely to attend a smoking cessation program (30% vs. 27%), and less likely to report that they had successfully quit smoking (64% vs. 67%). They were less likely to report being prescribed transdermal nicotine patch (16% vs. 26%; OR = 0.5, 95% CI = 0.03–0.09). Female and male veterans did not differ in their report that in the past year a doctor or nurse talked to them about quitting smoking (64% vs. 67%); they were referred to a smoking cessation program (30% vs. 27%), they attended a smoking cessation program (30% vs. 27%), and they were prescribed nicotine gum (6.8% vs. 6.5%). Female VA patients reported current smoking (29.8%) at baseline had higher rates of smoking than female community patients (13.3%, p &lt; 0.0001). The rate of smoking for male VA patients vs. male community patients did not significantly differ (23.3% vs. 12.8%, p = 0.39). More female VA patients had higher current smoking rates at baseline had higher rates of smoking than female community patients (13.3%, p &lt; 0.0001). The rate of smoking for male VA patients vs. male community patients did not significantly differ (23.3% vs. 12.8%, p = 0.39). Women veterans in the pilot study were least likely to select a smoking cessation intervention that included a smoking cessation medication. The most popular interventions chosen were smoking cessation medication, support, and &quot;how to avoid reaching for the next cigarette.&quot;</td>
</tr>
<tr>
<td>47</td>
<td>Neumayer</td>
<td>2007</td>
<td>3823</td>
<td>Male and female patients from 128 VA Medical Centers and the community participating in the Patient Safety in Surgery Study and undergoing treatment for breast cancer</td>
<td>4.9% male; 95.1% female</td>
<td>82.7% Caucasian; 12.2% African-American; 2.2% Native American</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>48</td>
<td>Canter</td>
<td>2009</td>
<td>108</td>
<td>Female veterans ages 40 to 85 at moderate or high risk for cardiovascular disease at the Michael E. DeBakey VA Medical Center</td>
<td>100% female</td>
<td>95.1% Caucasian; 2.2% African-American; 0.4% Native American</td>
<td>—</td>
<td>Smoking Cessation Referrals</td>
<td>53.4% of current or former smokers reported that they had received a smoking cessation referral.</td>
</tr>
<tr>
<td>49</td>
<td>Katzberg</td>
<td>2009</td>
<td>158</td>
<td>Veterans Administration Greater Los Angeles Health Care System</td>
<td>100%</td>
<td>100%</td>
<td>—</td>
<td>—</td>
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<tbody>
<tr>
<td>50</td>
<td>Brown</td>
<td>2010</td>
<td>224,169</td>
<td>Data from the 2003–2007 Behavioral Risk Factor Surveillance System (BRFSS)</td>
<td>93% male; 7% female</td>
<td>—</td>
<td>—</td>
<td>Current smoking</td>
<td>The rate of smoking was higher for female veterans vs. female non-veterans (23% vs. 18%) and for male veterans vs. male non-veterans (27% vs. 21%). The prevalence of smoking decreased between 2003 and 2007 for female non-veterans (20% to 18%), male veterans (29–27%), and male non-veterans (23–21%) but not for female veterans (22–23%). Female veterans reported lower rates of smoking than male veterans in each birth cohort except for the youngest (1985–1989) where female veterans reported higher rates of smoking than male veterans (44% vs. 40%). Rates of smoking for participants were coronary heart disease were slightly higher for female veterans vs. female non-veterans (30% vs. 28%) and higher for male veterans vs. male non-veterans (43% vs. 31%).</td>
</tr>
<tr>
<td>51</td>
<td>Farmer</td>
<td>2011</td>
<td>Full sample: 65,627 Smokers: 15,033</td>
<td>The Primary Care Module of the VA Clinical Practice Organizational Survey (CPOS); the Senior Women’s Health Clinician Module of the VA Survey of Women Veterans Health Programs and Practices</td>
<td>95.6% male; 4.4% female</td>
<td>—</td>
<td>—</td>
<td>Full sample: Current smoking; Smokers: advice to quit smoking, recommendation for medication or other smoking treatment</td>
<td>Women smoked at higher rates than men (29% vs. 23%). Women were more likely to report being advised to quit smoking than men (87% vs. 83%; p &lt; 0.01). Women were equally likely to report receiving recommendations for medications for smoking cessation (63% vs. 62%) or other treatments for smoking cessation (61% vs. 60%). Rates of current smoking were higher for women (24.8%) than men (18.6%, p &lt; 0.01). A greater number of women than men reported being advised to quit by a physician (85.7% vs. 83.4%, p &lt; 0.05). An equal number of women and men reported that a physician recommended medication to quit smoking (63.9% vs. 63.0%) or discussed methods to quit smoking (60.9% vs. 59.7%). Rates of lifetime nicotine dependence was higher in men (20.5%) than women (11.7%, p &lt; 0.001). Among participants with lifetime major depressive disorder, rates of lifetime nicotine dependence were also higher in men (30.3%) than women (17.3%, p &lt; 0.01).</td>
</tr>
<tr>
<td>52</td>
<td>Duffy</td>
<td>2012</td>
<td>224,193</td>
<td>2007 Veterans Health Administration Outpatient Survey of Healthcare Experiences of Patients</td>
<td>96.5% male; 3.5% female</td>
<td>87.0% Caucasian; 6.3% African-American; 3.3% Latino; 3.4% Other</td>
<td>—</td>
<td>Current smoking; Smoking Cessation Services</td>
<td>Rates of lifetime nicotine dependence was higher in men (20.5%) than women (11.7%, p &lt; 0.001). Among participants with lifetime major depressive disorder, rates of lifetime nicotine dependence were also higher in men (30.3%) than women (17.3%, p &lt; 0.01).</td>
</tr>
<tr>
<td>53</td>
<td>Curry</td>
<td>2014</td>
<td>1700</td>
<td>Military veterans, active duty personnel, and reserve forces who served since 9/11/2001 who were part of the VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center (VISN 6 MIRECC) multi-site registry</td>
<td>80% male; 20% female</td>
<td>41.6% Caucasian; 48.4% African-American; 9.8% Other; 0.2% missing data</td>
<td>—</td>
<td>Nicotine dependence</td>
<td>(Continued)</td>
</tr>
<tr>
<td>Study</td>
<td>Reference</td>
<td>Year</td>
<td>Sample Size</td>
<td>Type of Sample</td>
<td>Gender</td>
<td>Race</td>
<td>Sexual Orientation</td>
<td>Outcomes Assessed</td>
<td>Primary Results</td>
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<tr>
<td>54</td>
<td>Wei</td>
<td>2003</td>
<td>75</td>
<td>Women who went through central dual-energy X-ray absorptiometry testing Washington, DC Veterans Affairs Medical Center</td>
<td>100% female</td>
<td>55% Caucasian, 45% African-American</td>
<td>—</td>
<td>Current smoking</td>
<td>African-American women and Caucasian women did not significantly differ in their rate of current smoking (27% vs. 24%; p = 0.82). An equal percentage of African-American and Caucasian veterans were ever smokers (63.8% vs. 62.9%, p = 0.81), were current smokers (33.2% vs. 30.9%, p = 0.51), and received smoking cessation interventions (55.8% vs. 56.1%, p = 0.97). There was no difference in readiness to quit smoking by race (p = 0.90). African-American veterans were more likely than Caucasian and Hispanic veterans to report a past-year quit attempt (55% vs. 43% and 43%, p = 0.001). African-American and Hispanic veterans were less likely than Caucasian veterans to report using nicotine replacement therapy to quit smoking ever (34% and 26% vs. 50%, p &lt; 0.001) and within the past 12 months (20% and 22% vs. 34%, p = 0.001). The rate of lifetime nicotine dependence was 23.3% and current nicotine dependence was 19%. Lifetime nicotine dependence was associated with lifetime alcohol use disorders, substance use disorders, affective disorder, anxiety disorders, PTSD, pathological gambling, and antisocial personality disorder. Current nicotine dependence was associated with current affective disorders and pathological gambling. While non-Caucasian and Caucasian participants reported smoking for 28 years, non-Caucasian participants smoked fewer cigarettes per day than Caucasian participants (16 cigarettes vs. 21 cigarettes, p &lt; 0.01). Non-Caucasian participants, compared to Caucasian participants, were more likely to report a desire to quit smoking within the next month (46% vs. 24%, p &lt; 0.05), that quitting smoking would be important to their health (68% vs. 64%, p &lt; 0.05), and that they would be interested in receiving smoking cessation services at the VA (68% vs. 40%, p &lt; 0.01).</td>
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<tr>
<td>55</td>
<td>Ambriz</td>
<td>2004</td>
<td>1045</td>
<td>Patients with coronary artery disease at 5 VA hospitals (Atlanta, Georgia; Durham, North Carolina; Houston, Texas; Pittsburgh, Pennsylvania; St. Louis, Missouri)</td>
<td>98% male; 2% female</td>
<td>77.4% Caucasian; 22.6% African-American</td>
<td>—</td>
<td>Chart review of smoking cessation services</td>
<td></td>
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<tr>
<td>56</td>
<td>Fu</td>
<td>2005</td>
<td>1606</td>
<td>Veterans at 18 VA medical and ambulatory care centers Arizona, California, Nevada, New Mexico, and Texas who were enrolled in the Quality Improvement Trial for Smoking Cessation</td>
<td>100% male</td>
<td>72% Caucasian; 19% African American; 9% Hispanic</td>
<td>—</td>
<td>Nicotine Replacement Therapy use</td>
<td></td>
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<tr>
<td>57</td>
<td>Dickerson</td>
<td>2009</td>
<td>480</td>
<td>Community sample of American Indian male veterans from the north central region of the United States (primarily Minnesota). The largest number of participants came from the Anishinabe (Ojibway/Chippewa) and Dakota Lakota (Sioux) tribes.</td>
<td>100% male</td>
<td>100% American Indian</td>
<td>—</td>
<td>Nicotine dependence</td>
<td></td>
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<tr>
<td>58</td>
<td>Kavvonen-Gutierrez</td>
<td>2012</td>
<td>146</td>
<td>Battle Creek Veterans Affairs Medical Center (Michigan)</td>
<td>95.6% male; 4.4% female</td>
<td>58% Caucasian; 42% Non-Caucasian (88% of Non-Caucasian participants were African-American)</td>
<td>—</td>
<td>Cigarettes per Day, Years of Smoking, Importance of Quitting Smoking to Health, Desire to Quit in the Next Month, Interest in Smoking Cessation Services</td>
<td></td>
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<tr>
<td>Ref.</td>
<td>First author</td>
<td>Year</td>
<td>Sample size</td>
<td>Type of sample</td>
<td>Gender</td>
<td>Race</td>
<td>Sexual orientation</td>
<td>Outcomes assessed</td>
<td>Primary results</td>
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<tr>
<td>59</td>
<td>Burgess</td>
<td>2014</td>
<td>2271</td>
<td>The Veterans Victory over Tobacco study at 4 VA Medical Centers (Jackson, Mississippi; Minneapolis, Minnesota; New York, New York; Tampa, Florida)</td>
<td>94.4% male; 5.6% female</td>
<td>69.1% Caucasian; 30.9% African-American</td>
<td>—</td>
<td>Smoking cessation for 6 months at the 1-year follow-up</td>
<td>More African-American veterans quit smoking than Caucasian veterans (13% vs. 9%, p &lt; 0.01). Differences were no longer significant after adjusting for smoking history, self-efficacy to quit, and motivation to quit.</td>
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<td>62</td>
<td>Blosnich</td>
<td>2013</td>
<td>11,665</td>
<td>Veterans who completed the 2010 Behavioral Risk Factor Surveillance System survey (from 10 states that assessed sexual orientation)</td>
<td>92.3% male; 7.7% female</td>
<td>86.7% Caucasian; 13.3% Non-Caucasian/Hispanic</td>
<td>2.0% LGB</td>
<td>Current smoking</td>
<td>The rate of current smoking was higher in LGB veterans (21.0%) than heterosexual veterans (14.6%; p &lt; 0.01).</td>
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<tr>
<td>63</td>
<td>Blosnich</td>
<td>2013</td>
<td>1908</td>
<td>Female veterans who completed the 2010 Behavioral Risk Factor Surveillance System survey (from 10 states that assessed sexual orientation)</td>
<td>100% female</td>
<td>83% Caucasian; 17% Non-Caucasian</td>
<td>2.0% LB</td>
<td>Current smoking</td>
<td>The rate of current smoking was higher in LB female veterans compared to heterosexual female veterans (34% vs. 17.2%; p &lt; 0.05) and LB female non-veterans (34% vs. 21.8%; p &lt; 0.05).</td>
</tr>
</tbody>
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---, information not available or n/a. B, bisexual; CI, confidence interval; G, gay; L, lesbian; LGB, lesbian, gay, bisexual; OR, odds ratio; PTSD, posttraumatic stress disorder; VA, Veterans Affairs.
in Caucasian, African-American, and Hispanic veterans at 18 VA Medical Centers. Differences by race were found with regard to smoking behavior, quit attempts, and use of nicotine replacement therapy (Table 1). Similar to the study by Burgess and colleagues (59) described above, African-American participants were more likely to report attempting to quit smoking in the past year compared to the other two groups. In contrast to the study by Burgess et al (59), Caucasian participants were more likely to report a short duration to smoke their first cigarette in the morning. Members of the three racial/ethnic groups reported equal motivation to quit smoking.

Finally, one study examined nicotine dependence in a sample of a 480 male veterans who identified as American Indian. Dickerson et al. (57) found that the sample reported a rate of current nicotine dependence (19.0%) that was higher than the rate found by other researchers in the general US population (12.8%; [58]) and a rate of lifetime nicotine dependence (23.3%) that was similar to the rate found in the US population (24%; [59]).

**Studies of sexual orientation minorities and smoking in veteran samples (Table 1)**

Two studies were identified that examined the smoking behavior of GLB veterans (62,63) and both studies identified higher rates of smoking in GLB veterans compared to GLB nonveterans or heterosexual veterans (see Table 1 for details). No study was identified that examined the smoking behavior of adult veterans who identified as transgender.

**Discussion**

Veterans smoke at high rates (50,64) and experience serious health-related consequences (2,65,66) resulting in extremely high personal and societal costs of smoking in this group. The VA system has engaged in efforts to increase smoking cessation services in order to reduce smoking and smoking-related consequences among veterans (67). In addition, many veterans who smoke express interest in quitting (68–70) and are willing to engage in treatment (70). Unfortunately, rates of smoking remain high and rates of VA cessation service utilization are low at VAs (71). The current study reviewed the literature on smoking behavior and veterans to determine how much research examined the smoking behavior of important subgroups of smokers and what content areas they examined. Overall, our review suggests the need for more studies that examine the smoking behavior of all three examined subgroups of veterans: women, racial/ethnic minorities, and sexual orientation minorities.

Gender differences in smoking behavior were examined by the largest number of studies that examined one of the three subgroups with most studies examining rates of smoking and provision of VA smoking cessation services. Studies reporting rates of smoking generally found that female veterans smoke at higher rates than female non-veterans suggesting the need to target female veterans with both prevention and intervention efforts. One study using population-based data in the US found that, while rates of smoking for female veterans were generally lower than male veterans, just as rates of smoking are lower in women in the general US population compared to men in the general US population (32), female veterans smoked at rates that were equal to male veterans in the youngest birth cohort (born between 1985–1989; female veterans, 44%; male veterans, 40%; 50). The equal rates of smoking among younger female veterans compared to younger male veterans is an important trend to follow as the number of women engaged in active duty, who will then become part of the veteran population, continues to increase over time.

Three studies examined the provision of VA smoking cessation services by gender (51,72,73) with mixed results. In two studies, women were more likely to report that they were advised to quit smoking than men (86–87% versus 83%; [51,72]) while a third study found that men and women were equally likely to report receiving advice to quit smoking (64% versus 67%; [73]). Across these studies, female and male veterans were equally likely to report receiving recommendations for medication to quit smoking (63–64% versus 62–63%) or referrals to a smoking cessation program (30% versus 27%; [51,72,73]). No study reported quit rates for a smoking cessation treatment suggesting an important area in need of more research. A study by Katzburg and colleagues (49) conducted focus groups and a pilot study to determine what preferences female veterans reported for smoking cessation programs. Women in the pilot study were least likely to select the traditional VA-based smoking cessation program suggesting that women may have unique preferences and needs for smoking programs; however, as stated above, more research is needed.

Female veterans, compared to male veterans, are less likely to have health insurance from any source and are more likely to be living in poverty (13). Further, reports from the US Department of Veterans Affairs suggest that while female veterans are less likely to use the VA healthcare system than male veterans, female veterans
who use the VA system are more likely than male veterans to obtain all of their healthcare through the VA (13). The VA can play an important role in treating smoking for all veterans, but especially women who may have fewer alternative medical settings through which to obtain pharmacological and behavioral treatments. In veteran populations, similar to the general adult population, it is important that efforts be made to encourage female veterans to use the VA healthcare system and to provide evidence-based smoking services that can help women to quit smoking and reduce their risks of negative health consequences.

Six studies examined race/ethnic differences in smoking behavior among veterans and the majority of those studies compared aspects of smoking in African-American veterans to Caucasian veterans. Only one study examined the outcomes of a smoking cessation intervention and this comparison was done between African-American and Caucasian adults. These findings are consistent with the general smoking literature within which a greater number of smoking cessation studies of minority races/ethnicities have focused on African-American smokers compared to other groups (74,75). As stated earlier, there are racial/ethnic differences in smoking rates and cessation outcomes in the general population (5,30,31) and there has been a call for more research that examines smoking outcomes by race (76,77). There is a need for more research on all aspects of smoking behavior among racial and ethnic minority adults in order to provide targeted treatments to veterans who smoke that will lead to the greatest smoking quit rates for diverse groups of smokers.

Only two studies examined sexual orientation and both looked at the smoking rate of GLB veterans compared to heterosexual veterans or GLB non-veterans. No study examined the smoking behavior of veterans who identify as transgender. It has been estimated that 2.2% of adults in active military service identify as GLB (33). Using the figure stated earlier that approximates 22 million current veterans in the US (7), there may be up to a half a million veterans who identify as a sexual or gender orientation minority although it is difficult to determine exact numbers due to the potential discomfort or hesitation in revealing a sexual or gender orientation minority status to healthcare providers. There is a need for more research on sexual and gender minority veterans in the VA healthcare system related to all areas of health (78), including smoking. Future research on smoking among sexual and gender orientation minority veterans should also start to extend to topics beyond rates of smoking in order to better understand the treatment needs for these groups of veterans.

Veterans in the subgroups examined reported smoking at high rates suggesting the need for clinically-based efforts to reduce the high rate of smoking. As mentioned above, many veterans are interested in quitting (68–70). Similarly, in the general population, most smokers want to quit smoking and more than half of adult smokers report making a past-year quit attempt (30). Unfortunately, most quit attempts end in relapse to smoking (30,79). It may be useful to augment effects across all clinical areas of the VA to work on increasing motivation of these veterans to quit smoking (e.g. motivational enhancement therapy, [80]) and increasing motivation to use VA cessation services since most quit attempts are made without the help of counseling or pharmacological aids (81). It may also be beneficial to provide treatments that are of higher intensity and longer duration than standard care, as needed. For example, combined behavioral counseling and pharmacotherapy for smoking has been shown to have better cessation outcomes than either type of treatment alone (79). In addition, continuing monitoring of smoking status after quit attempts would be important to prevent relapse or to encourage new quit attempts, by building motivation and making cessation aids available, as soon as possible after smoking relapse especially for subgroups of adults who report higher rates of smoking relapse (e.g. women, racial/ethnic minority adults; [25]).

Limitations of this study must be noted. The literature review was restricted to studies published in peer review journals. In addition, the identification of gender, racial, and sexual orientation analyses was also limited to those that were reported in the paper and, more specifically, in the title or abstract which allows research areas to be easily identified in topic searches. The authors of some papers that did not report results by demographic subgroups might have conducted these subgroup analyses and just not report them in their published results. Other studies might not have been able to appropriately power subgroup analyses due to low sample sizes; however, a review of gender-specific analyses in clinical trials for depression found that there were no differences in average sample sizes of studies that did and did not examine gender differences in outcomes (82). The 1993 Revitalization Act (Public Law 103-43; [83]), which requires that gender and race be considered in all National Institutes of Health-funded research, was created to increase the inclusion of women and racial/ethnic minorities in research studies and to encourage gender- and race-specific analyses of outcomes. However, the reporting of subgroup analyses remains low in a wide range of health research (82,84,85) including smoking research (76). It will be
important for additional studies in the future to consider gender, racial/ethnic, and sexual orientation differences in outcomes in order to learn more about the smoking behaviors of these groups of veterans. It should also be noted that the purpose of the review was to examine studies of smoking and quit behaviors in veterans. While the formal review did not include studies of the medical and health consequences of smoking, an examination of the excluded studies did not reveal data on the impact of demographics and smoking status on various illnesses or health conditions. Veterans who smoke demonstrate greater morality, medical costs, and productivity costs than veterans who do not smoke (86–87) and veterans who are current smokers demonstrate greater risk for specific smoking-related diseases including cardiovascular and respiratory diseases (88–90) and lung cancer (91). As described earlier, female smokers are at greater risk of cardiovascular disease, and greater risk of dying from cardiovascular disease, than male smokers in the general US population (19,20) and it would be expected that this discrepancy would also be seen in veteran samples. It would be important for future studies to examine the association of smoking by gender, race/ethnicity, and sexual orientation to illnesses and disease.

This review demonstrates that more research is needed to understand the specific smoking behavior and treatment needs for veterans who are women, members of diverse racial/ethnic groups, and sexual and gender orientation minorities. All three are critical smoking groups since they have been shown in the general population to exhibit greater smoking rates and/or lower quit rates in the general population yet have received little attention in the literature. Learning more about the smoking behavior of important subgroups of veterans can improve interventions with these smokers with the ultimate goal of reducing illness and the associated personal and societal costs for a large and important segment of the US adult population.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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