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Authors: McDaniel, Justin T., McDermott, Robert J., Henson, Harvey, Brown, Daniel, Albright, David L., et al.

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# Cigarette Use among Parents with Children in the Home: A Comparison of Civilian Parents and Parents with a Military Connection

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Justin T. McDaniel<sup>1</sup>, Robert J. McDermott<sup>1</sup>, Harvey Henson<sup>2</sup>, Daniel Brown<sup>2</sup>, David L. Albright<sup>3</sup>, Virginia Kreckman<sup>1</sup>, Elijah Lockhart<sup>1</sup> and Ramanjot Bains<sup>1</sup>

<sup>1</sup>School of Human Sciences, Southern Illinois University, Carbondale, IL, USA. <sup>2</sup>STEM Education Research Center, Southern Illinois University, Carbondale, IL, USA. <sup>3</sup>School of Social Work, University of Alabama, Tuscaloosa, AL, USA.

**ABSTRACT:** We tested the null hypothesis of equal likelihood of cigarette use among parents with a military connection and parents without a military connection, and independently compared risk factors for cigarette use. We obtained National Health Interview Survey (NHIS) data from 2015 to 2019 survey waves. We delimited analysis to 2-parent households who reported children aged <18 years living with them. After a 2:1 nonparametric age matching procedure, our sample included 1106 civilian parents and 553 parents with a military connection. Using the NHIS survey-design weights, we estimated a design-based F statistic for differences in cigarette use by military connection status. We also estimated population-stratified, survey-weighted multivariable logistic regression models to determine risk factors for parent cigarette use. Whereas 6.87% parents with a military connection used cigarettes, 16.64% of age-matched civilian parents reported cigarette use. This difference was significant even after adjustment for covariates (aOR = 0.49, 95% CI = 0.32, 0.74). Recommendations for programing and policy are provided.

**KEYWORDS:** Military family, cigarette smoking, secondhand smoke, child health, health status disparities, National Health Interview Survey

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**CORRESPONDING AUTHOR:** Justin T. McDaniel, School of Human Sciences, Southern Illinois University, 475 Clocktower Drive, Carbondale, IL 62901, USA Email: jtmcd@siu.edu

Parents who smoke cigarettes not only increase their odds of susceptibility to various adverse health outcomes, but also increase the risk that their children will be exposed to secondhand smoke. In adults and children, the effects of secondhand smoke exposure can lead to adverse health outcomes, including premature death.<sup>1</sup> Secondhand smoke exposure is causally related to the development of respiratory infections, asthma, sudden infant death syndrome, ear problems, and impeded lung growth in children.<sup>1</sup> Adults have an increased risk of developing lung cancer and coronary heart disease among other cardio-respiratory system complications when exposed to secondhand smoke.<sup>1</sup> It is estimated that 25% of the United States (US) general population (ie, regardless of military affiliation) was exposed to secondhand smoke during 2013–2014, including approximately 37 million adults ( $\geq 20$  years), 9 million adolescents (12–19 years), and 14 million children (3–11 years).<sup>2</sup>

The military, in particular, maintains a strong smoking culture. Smoking is viewed as a way to fit in, deal with stress, and avoid weight gain. For children in military families, some studies suggest that up to 43% are exposed to a form of household secondhand smoke.<sup>3</sup> Children and adolescents are at particular risk for secondhand smoke exposure when they live with a smoker or are exposed to environments that have a high prevalence of tobacco smoke.<sup>4,5</sup> Younger, less educated persons with lower salaries—a demographic that is typical of entry-level military families—are especially likely to initiate smoking.<sup>6</sup> Historically, tobacco has been sold at great discounts on

military bases.<sup>7</sup> Branches of the military have made attempts to lower cigarette use through restrictive policies such as the ban on smoking and drinking during Basic Military Training, as well as some types of Technical Training.<sup>6</sup> Additionally, many areas of military property have become tobacco-free, such as some rooms and all common areas of military housing, ships, and submarines.<sup>8</sup> These policies vary across military branches and even individual bases, and therefore, vary in their effectiveness as well.<sup>9</sup>

Eliminating health disparities is a key priority of the United States Department of Health and Human Services' *Healthy People 2030* initiative.<sup>10</sup> By identifying and defining groups that experience health inequities, health care interventions can be developed to address said inequities. Health disparities may reflect differences in socioeconomic status or access to certain resources; therefore, it is also important to not only identify health disparities but to also determine factors that are associated with the disparate outcome.

Health disparities research is often a first step in a complex process of taking efforts to ensure that health outcomes are equal across sub-populations in the United States. By identifying disparate health outcomes, such as cigarette use, in various populations, implementation scientists can examine factors associated with the behaviors/outcomes of the healthier sub-population to apply to the population experiencing the disparity. For example, individuals in the military experience different policies and regulations than the civilian population; thus, if it



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is learned the smoking prevalence among parents of young children is lower among those in the military, it would be possible to examine policies unique to the military that could be repurposed in the civilian population.

To the best of our knowledge, the current literature on smoking among parents with children aged <18 years by military connection status is limited. To amend this gap in the health disparities literature, we compared cigarette use among spouses of active duty service members who had children at home and age-matched civilian parents, along with accompanying demographic, socioeconomic, and geographic risk factors.

## Methods

### *Study design and sample*

We retrieved data for this cross-sectional study from the 2015 to 2019 files of the National Health Interview Survey (NHIS),<sup>11</sup> an annual household survey of health status and healthcare access conducted by the US Centers for Disease Control and Prevention. Although the NHIS does not collect information directly from persons who are active-duty military service members, surveys are completed by their spouses. Therefore, we ascertained the number of survey participants who were married to or partnered with an active-duty military service member by collecting affirmative responses to the following question: *Is [spouse name] now on full-time active duty with the Armed Forces (yes or no)?* We also delimited the dataset to survey participants who reported living in a 2-parent household and had at least one child under the age of 18 years living with them, as indicated by an NHIS-coded variable with the following categories: 0 children, 1 child, 2 children, or 3+ children.

Our delimiting sampling procedure produced 553 military families and 50 503 civilian families. Given the imbalance in military and civilian families, we employed a 2:1 parent and child age-matching procedure—taking into account survey year—using the nonparametric nearest neighbor algorithm in the “MatchIt” package in R Studio (Boston, MA).<sup>12</sup> The aforementioned procedure resulted in 1106 age-matched civilian families. Therefore, the final analytic sample included 553 military families and 1106 civilian families. Given that data for this study were publicly available and de-identified, this study was considered exempt from full review by an Institutional Review Board.

### *Measures*

Our dependent variable was cigarette use among parents. Given that our sample was delimited to individuals who reported children aged <18 years living in their household, we operationalized cigarette use as a parent’s response to the following question: *Do you now smoke cigarettes every day, some days, or not at all?* Parents who reported “every day” or “some days” were coded as a currently using cigarettes.

The independent variables in our analysis included a range of sociodemographic measures, including the parent’s age, parent’s race (ie, White, Black, or Other), the educational level of the parent with the highest educational attainment (ie, high school diploma or less, an associate or baccalaureate degree, and a master’s or doctoral degree), the family’s household annual income (ie, <\$35 000, \$35 000 to \$49 999, and \$50 000 or more), as well as a randomly selected child’s age (ie, in the case that the household had >1 child in the home), and the child’s sex (ie, male or female). We also obtained geographic information about each family’s residence in the United States (US), coded as residence in the Northeast, Midwest, South, or West. To the extent that a systematic review of >3000 studies showed that smoking varies by geography,<sup>13</sup> we felt that it would be important to control of United States region in this study. The primary independent variable in this study was each family’s connection to the military (ie, civilian or military).

### *Statistical analysis*

We analyzed our data using R Studio (Boston, MA) and Stata IC (College Station, TX). We first calculated univariate descriptive statistics for each independent variable (ie, means/standard errors or frequencies/percentages) stratified by military service connection. Second, using the NHIS survey design weights,<sup>14</sup> we calculated a design-based F statistic for a 2 × 2 matrix with the variables of military service connection (ie, military or civilian) and parental smoking status (ie, yes or no). Third, using the NHIS survey design weights, we estimated combined samples and stratified multivariable logistic regression models, where parent cigarette use was regressed on the independent variables of parent age, parent race, child age, child sex, parental educational attainment, parental household income, survey year (ie, 2015–2019), and region of the US, as well as military affiliation (ie, for the combined samples model). Our third data analytic technique permitted the separate evaluation of risk factors for cigarette use among parents.

## Results

Table 1 presents the sample characteristics stratified by military service connection. Because of our non-parametric age-matching procedure during the sampling stage of the study, the mean age of the parents and children included in the civilian and military families are similar. While child sex and parent race were relatively equally balanced between the civilian and military samples, military families had slightly higher educational attainment ( $P < .001$ ) and income ( $P < .001$ ). The smallest regional samples were evident in the Northeast for both civilian and military families ( $P < .001$ ).

Table 2 shows prevalence rates of parental cigarette use among civilian and military families. Whereas 6.87% military spouses reported current cigarette use, 16.64% of age-matched civilian parents reported current cigarette use. Our estimation of a survey-design based F statistic revealed that prevalence

**Table 1.** Sociodemographic characteristics of the parents and children in the present study by military service connection.

VARIABLE	CIVILIAN FAMILIES (N = 1106)	MILITARY FAMILIES (N = 553)	P
	M (SE)	M (SE)	
Parent age	34.85 (0.26)	34.88 (0.37)	.96 <sup>a</sup>
Child age	6.72 (0.16)	6.75 (0.22)	.91 <sup>a</sup>
	N (%)	N (%)	
Child sex (Male)	583 (52.70)	289 (52.30)	.90 <sup>b</sup>
Parent race			
White	874 (79.00)	419 (75.80)	.26 <sup>b</sup>
Black	100 (9.00)	53 (9.60)	
Other	132 (11.90)	81 (14.60)	
Parent educational attainment			
≤HS Diploma	260 (23.50)	45 (8.10)	<.001 <sup>b</sup>
Associate or Baccalaureate Degree	670 (60.60)	390 (70.50)	
Master's or Doctoral Degree	176 (15.90)	118 (21.30)	
Household annual income			
<\$35 000	210 (19.00)	47 (8.50)	<.001 <sup>b</sup>
\$35 000-\$49 999	161 (14.60)	77 (13.90)	
≥\$50 000	735 (66.50)	429 (77.60)	
Survey year			
2015	202 (18.30)	100 (18.10)	1.00 <sup>b</sup>
2016	246 (22.20)	123 (22.20)	
2017	214 (19.30)	107 (6.40)	
2018	216 (19.50)	108 (19.50)	
2019	228 (20.60)	115 (20.80)	
United States region			
Northeast	150 (13.60)	41 (7.40)	<.001 <sup>b</sup>
Midwest	265 (24.00)	71 (12.80)	
South	392 (24.00)	250 (45.20)	
West	299 (27.00)	191 (34.50)	

Means and percentages are weighted according to the NHIS survey design.

<sup>a</sup>P-value for an independent samples t-test.

<sup>b</sup>P-value for a chi-square test.

**Table 2.** Prevalence of parent cigarette use by military connection.

POPULATION	N	% (95% CI)
Civilian parent (n = 1106)	184	16.64 (14.49-18.96)
Parent with a military connection (n = 553)	38	6.87 (4.91-9.31)
Total sample	222	13.38 (11.78-15.11)

Design-based F statistic for 2 × 2 matrix = 30.31,  $P < .001$

rates for cigarette use in civilian and military families were significantly different ( $F = 30.31$ ,  $P < .001$ ).

Table 3 presents combined samples and civilian-military stratified multivariable logistic regression model results. After controlling for relevant confounding factors (ie, parent age, child age, child sex, parent race, parent education, parent income, survey year, and region of the United States), parents with a military connection were less likely than civilian parents to smoke cigarettes [Combined Sample Design-Based F

**Table 3.** Survey-weighted multivariable logistic regression results for factors associated with parent cigarette use by military connection.

VARIABLE	COMBINED (ENTIRE SAMPLE)	CIVILIAN PARENT	PARENT WITH A MILITARY CONNECTION
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Parent age	0.99 (0.97, 1.01)	0.97 (0.94, 1.01)	1.05 (1.01, 1.10)*
Child age	1.02 (0.98, 1.06)	1.04 (0.99, 1.09)	0.99 (0.92, 1.06)
Child sex (Male)	1.10 (0.80, 1.51)	1.17 (0.77, 1.75)	0.99 (0.92, 1.06)
Parent race			
White	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Black	0.83 (0.46, 1.47)	0.64 (0.30, 1.40)	1.77 (0.64, 4.83)
Other	1.02 (0.61, 1.71)	1.18 (0.77, 1.75)	0.68 (0.22, 2.14)
Parent educational attainment			
≤HS Diploma	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Associate or Baccalaureate Degree	0.38 (0.27, 0.55)***	0.35 (0.22, 0.55)***	0.70 (0.24, 2.06)
Master's or Doctoral Degree	0.07 (0.03, 0.16)***	0.01 (0.001, 0.14)***	0.35 (0.08, 1.50)
Household annual income			
<\$35 000	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
\$35 000-\$49 999	1.43 (0.87, 2.32)	1.56 (0.85, 2.86)	0.84 (0.24, 2.86)
≥\$50 000	0.91 (0.59, 1.41)	1.02 (0.60, 1.73)	0.36 (0.11, 1.14)
Survey year	0.96 (0.86, 1.07)	0.97 (0.84, 1.12)	0.96 (0.75, 1.24)
United States region			
Northeast	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Midwest	1.51 (0.86, 2.64)	1.38 (0.70, 2.72)	5.13 (0.55, 47.36)
South	1.03 (0.60, 1.77)	0.89 (0.45, 1.73)	4.27 (0.51, 35.39)
West	0.74 (0.41, 1.31)	0.64 (0.32, 1.29)	2.75 (0.31, 24.19)
Parent with military connection	0.49 (0.32, 0.74)***		

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; HS, high school.

Civilian parent design-based F statistic=4.91 (df=13, 1093),  $P<.001$ ; Parent with a military connection design-based F statistic=1.25 (df=13, 540),  $P<.24$ ; Combined sample design-based F statistic=7.36 (df=14, 1645),  $P<.001$ .

\* $P<.05$ . \*\*\* $P<.001$ .

Statistic=7.36 (df=14, 1645),  $P<.001$ ]. Parent cigarette use served as the dependent variable in both models. For civilian families, risk factors for parent cigarette use included lower parental educational attainment. For military families, risk factors for parent cigarette use included older parent age.

## Discussion

Using nationally representative data on civilian and military parents in the US, we showed that parent cigarette use was less likely for military spouses than age-matched civilian parents. Specifically, rates of parent cigarette use in civilian families were 142% higher than in military families. Although cigarette use rates were lower in military families, a notable sub-sample

of the population used cigarettes (6.87%). Our analysis showed that a risk factor for cigarette use among military parents was older age. Parent age was not associated with cigarette use in civilian families, although educational attainment was.

A study published in 2018 compared smoking rates in adults from 1980 to 2012 who were in the military and who were civilians. The authors, Drope et al,<sup>15</sup> showed that “in 1980, more than one-half of military personnel reported smoking [and], by 2011, smoking prevalence had dropped to less than one-quarter, although unadjusted prevalence [was] still significantly higher than that in the general population” (p. 111). Following policy efforts by the Department of Defense centered on smoking prevention, many of which are explained



momentarily, more recent data<sup>16</sup> show that smoking prevalence in the military and civilian populations were near similar in 2015, 14% (military) and 15% (civilian).

The above studies, however, have not considered cigarette use among military parents, and to our knowledge, this is the first study to make a direct comparison of cigarette use among civilian and military parents. This population may reasonably, due to the existence of children in the home, be less inclined to use cigarettes than the general population, in the aggregate. Our analysis revealed that cigarette use may be less prevalent among military parents than in previous reports, potentially due to the implementation of military smoke-free policies<sup>8,9</sup> and other local-related factors, such as locally influenced differences.<sup>17</sup> Furthermore, our findings align with existing literature in that older age<sup>18–20</sup> may be associated with increased risk for cigarette use.

The following discussion may serve as a brief survey of evidence-based policy recommendations to reconcile the health disparities noted in this study. Raghueer et al<sup>21</sup> recommended increasing tobacco taxes and cigarette prices to help reduce cigarette use. The idea behind the recommendation is that raising the prices will make it more formidable for lower-income families to purchase tobacco products; therefore, parental use will decrease, and thus decrease the likelihood of childhood secondhand smoke exposure. Bauer et al<sup>22</sup> meta-analysis concluded with the recommendation that pediatric healthcare providers should disseminate more information on the health/behavioral risks<sup>23,24</sup> of secondhand smoke exposure to children and parents during annual checkups.<sup>25</sup> Given that civilian parents were more likely to use cigarettes than military families in this study, efforts should be made to encourage civilian pediatricians to provide information material to parents about the effects of secondhand smoke exposure in children, particularly in the southern United States.

Existing policy in the military ensures access to classes and free nicotine-replacement therapy that can lead to successful smoking cessation<sup>26</sup>; however, these opportunities could be scaled for greater opportunity. For example, access to free nicotine replacement therapy—perhaps covered by private insurance companies—for civilians could potentially address the inequity in cigarette use among civilian parents.

## Limitations

Some limitations accompany the interpretation of findings in this report. First, the data used in this study were cross-sectional; thus, we were unable to make any causal claims about the relationships studied. Second, the data were based on self-report survey items, which are subject to recall and social desirability bias. As such, the estimates of cigarette use may be underestimated. Third, our measure of cigarette use was based on a single-item regarding whether the parent smoked, which may not necessarily represent actual secondhand smoke exposure, the magnitude or accumulation of exposure, nor whether parents smoked when children were present in the same room.

Fourth, we were unable to ascertain whether the spouse/partner of the survey respondent engaged in cigarette use. Fifth, because data for children in the study were based on one randomly selected child, we were unable to determine if the child was the youngest in the family or the oldest. Sixth, comparing the effects of household income on smoking behavior in military families and civilian families is difficult due to differences in non-taxable income and housing allowances, details which were not available in the NHIS. Not accounting for these financial differences may have impacted our results, especially given the strong association between income and smoking in the health economics literature.<sup>27</sup>

## Conclusions

Ultimately, our analysis showed that a connection to the military may be protective against cigarette use among parents, although older military parents may still be at risk of cigarette use. Future research should examine culturally appropriate (ie, civilian vs military) interventions and policies that aim to reduce childhood secondhand smoke exposure and parental cigarette use, especially among older families, as well as examine particular military experiences (ie, deployment) that are strongly associated with cigarette use.

This study provides important data in the health disparities research literature, particularly about military service members and their spouses, as well as civilian families, albeit only regarding families with 2-parent households. Health disparities research provides important data upon which public health practitioners and policy makers can base decisions that benefit the population experiencing the disparity. In this study, we showed that military involvement is protective against cigarette smoking among parents with children at home. Military-specific policies, such as tobacco bans and enforcement procedures, as well as the wide availability of tobacco prevention and cessation programs, could benefit civilian parents. Although more research and various data elements are needed in the comparison of these 2 important populations, this paper represents a first step toward eliminating disparities in tobacco use among civilian and military parents.

## Author Contributions

All authors contributed equally to the manuscript and approved the final version submitted. Data used in this study are publicly available at <https://www.cdc.gov/nchs/nhis/index.htm>. Data for this study were de-identified and publicly available; therefore, this study was considered exempt from IRB review.

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