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Cross-Sectional Analysis of the Association between Perceived Barriers to Behavioral Health Care and Intentions to Leave the U.S. Army

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The attrition of service members is a costly concern for the U.S. military and can lead to reduced readiness. While there have been studies identifying reasons for attrition, little is known about the relationship between perceived barriers to behavioral health care and attrition. A cross-sectional survey was conducted as part of a behavioral health epidemiological consultation at a U.S. Army division (n=5,842) during the COVID-19 pandemic in 2020. Odds of intending to leave the Army increased by 6% for each additional perceived barrier to behavioral health care. Soldiers' concerns about the potential negative impacts on their careers or work environments were the most frequently cited barriers to behavioral health care.

WHAT ARE THE NEW FINDINGS?

This study found that 55% of surveyed soldiers intended to leave the Army at the end of their contract, and each additional perceived barrier to behavioral health care was associated with 6% higher odds of intentions to attrite. Soldiers who screened positive for depression or anxiety were also more likely to report intentions to leave the Army.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

High levels of attrition result in high costs and lowered readiness. Soldiers with behavioral health conditions may intend to leave service for numerous reasons. To sustain readiness, the Army should dedicate resources to ensure soldiers have adequate access to behavioral health care and are not subject to stigma for accessing care for behavioral health concerns.

Service member attrition within the first term of service ranges from 18.5% in the U.S. Marine Corps to 29.7% in the U.S. Army.[1] First term attrition is a costly occurrence in the U.S. military with each instance costing from $15,000 to $25,000 to include training and equipment costs in the case of enlisted soldiers.[1] Attrition is of particular concern to the military because of its negative impact on readiness and its potential to increase training costs. Although the costs of first term attrition have been quantified[1], little is known about the factors that impact career attrition beyond the first term and before 20 years of service.

There is extensive knowledge about the impact of injuries and chronic diseases on military careers, but the knowledge about the behavioral health aspects of attrition is limited in comparison.[2–6] One possible reason for early career attrition related to behavioral health concerns is insufficient access to, or perceived barriers to use of, behavioral health care resources. The Army has the highest reported burden of behavioral health conditions of all military branches.[7–8] In 2016, 26% of active duty Army soldiers had a behavioral health diagnosis, such as a mood disorder or adjustment disorder, which is 6% higher than the average for service members across the 4 branches.[7–8]

Similar to civilians, soldiers may encounter barriers to accessing behavioral health care. Soldiers may perceive that seeking care for behavioral health needs will lead to career stagnation or will result in occupational stressors, such as being seen as weak, being treated differently, and difficulty getting time off for appointments. There is extensive literature demonstrating that seeking behavioral health care does not affect career trajectory, unless the behavioral health issue has already led to duty-limiting recommendations, the service member intends to commit a crime, or engages in conduct unbecoming.[9–13]

While there are previous studies of the relationship between stigma, help-seeking, and treatment outcomes, there is limited evidence on what impact service members' perceived barriers to behavioral health care may have on early career attrition.[4] Several studies have shown that the service members who report the highest perceived barriers to behavioral health care are also the ones who have the highest utilization of such services, presumably indicating a more severe condition or inability to get the treatment that they desire.[7,14–16] A study published using data from a U.S Marine Corps sample found that Marines who sought treatment for behavioral health conditions were more likely to be separated from the military and have shorter lengths of service than Marines who did not seek such treatment.[10,17] However, Marines who sought treatment for behavioral health conditions were not significantly more likely to be separated involuntarily, which indicates that most of the Marines in the study sample could have left of their own volition.[10] Further investigation is warranted; therefore, the objective of this analysis was to examine the association between perceived barriers to behavioral health care and intentions to leave the Army after contract completion.

METHODS

Study Population

This secondary analysis used survey data from a behavioral health epidemiological consultation conducted in 2020 by the U.S. Army Public Health Center's

Division of Behavioral and Social Health Outcomes Practice. The purpose of this behavioral health epidemiological consultation was to assess adverse behavioral and social health outcomes among soldiers following a perceived increase in suicide in an Army division, in addition to the potential exacerbating factors introduced by the COVID-19 pandemic. The survey included questions pertaining to demographics, Army career characteristics, COVID-19 health behaviors, food security, physical fitness, sleep, behavioral health, substance use, operational tempo, leadership, social support, behavioral health access and perceived barriers to care, and suicide ideation. Soldiers completed the survey in the summer of 2020. For the purpose of this secondary analysis, survey data (n=5,842 soldiers) on sociodemographic characteristics, Army career characteristics, and behavioral health characteristics were examined.

TABLE 1. Perceived barriers to behavioral health care from the 12-item questionnaire[a] (adapted from Hoge et al.[14])

Perceived barriers to behavioral health care
I don't know where to get help.
I don't have adequate transportation.
It is difficult to schedule an appointment.
There would be difficulty getting time off work for an appointment.
It would harm my career.
My coworkers might have less confidence in me.
My leadership might treat me differently.
I would be seen as weak.
My visit would not remain confidential.
My leaders discourage the use of behavioral health services.
Behavioral health care doesn't work.
Behavioral health care providers do not seem to care.

[a]Respondents were asked to "Rate each of the possible concerns that might affect your decision to seek behavioral health services." Response options for each item ranged from "strongly disagree" to "strongly agree" with a decline to answer option for each concern.

Main predictor and outcome

The main predictor was based on soldiers' responses to the question, "Rate each of the possible concerns that might affect your decision to seek behavioral health services." Twelve possible concerns were listed (adapted from Hoge et al. 2004; **Table 1**).[18] The response options for each concern ranged from "strongly disagree" to "strongly agree" with a decline to answer option for each concern. Responses to each concern were dichotomized (strongly agree or agree=1; neutral, disagree, or strongly disagree=0; decline to answer was coded as missing) and then summed to create a total behavioral health care barrier concerns score (range: 0–12).

The main outcome was soldiers' intent to leave the Army after the current service period. Soldiers were asked their intentions to leave the Army after contract completion based on a 5-point Likert scale (very unlikely, somewhat unlikely, neither likely nor unlikely, somewhat likely, very likely, and decline to answer). Responses to this question were collapsed into 2 categories: yes (somewhat likely, very likely) and no (very unlikely, somewhat unlikely, neither likely nor unlikely). Decline to answer responses were coded as missing.

Sociodemographic and Army career characteristics

To assess the association between perceived barriers to behavioral health care and intentions to leave the Army, the analysis controlled for sociodemographic characteristics including sex; Hispanic origin (Hispanic and non-Hispanic); racial group (White/Caucasian, Black/African American, Asian/Pacific Islander, other/multiracial and unspecified race with Hispanic origin). Racial group was based on responses to the question, "What is your race/ethnicity? Select all that apply." The response options included 1) White, 2) Black or African American, 3) Asian/Pacific Islander, 4) Hispanic, Latino, or Spanish Origin, or 5) other race, ethnicity, or origin. Soldiers who only selected "other race, ethnicity or origin" were classified as "other". Soldiers who selected more than one racial group were classified as "multiracial." "Multiracial" and "other" categories were combined because of small cell sizes. Soldiers who selected "Hispanic, Latino, or Spanish origin" without indicating whether they were White, Black, Asian/Pacific Islander, or other were classified as "Unspecified race with Hispanic origin." This was done to distinguish this group from soldiers who did not provide a response to this question. Soldiers who selected "Hispanic, Latino, or Spanish Origin," regardless whether they were White, Black, Asian/Pacific Islander, or other, were classified as "Hispanic." Soldiers who did not select "Hispanic, Latino, or Spanish Origin," but indicated that they were White, Black, Asian/Pacific Islander, or other, were classified as "non-Hispanic."

Also included was marital status (married/in a relationship, separated/divorced/widowed, and single, never married); and parental status (children or no children). Army career characteristics included rank (junior enlisted [E1–E4], junior noncommissioned officer [E5–E6], senior noncommissioned officer [E7–E9], junior commissioned officer [O1–O3], senior commissioned officer [O4 or above], and warrant officer [WO1–CW5]) and job satisfaction. Although E4s are classified as junior enlisted, certain E4s (corporals) are also considered junior non-commissioned officers. For the purposes of this study, no distinction was made between specialists and corporals. Job satisfaction was assessed using the survey question, "How satisfied are you with your job overall?" with a 5-point Likert scale ranging from very satisfied to very dissatisfied. For this analysis, job satisfaction was collapsed into 3 categories including satisfied, neutral, or dissatisfied.

Behavioral health characteristics

Depression and anxiety were assessed using the 4-item Patient Health Questionnaire (PHQ-4).[19] The first 2 questions of this tool measure anxiety and the last 2 questions measure depression. Composite scores of negative (0–2) and positive (3–6) were used for each condition. Post-traumatic stress disorder (PTSD) was assessed using the PTSD Checklist Civilian Version 2 (PCL-C2) with composite scores of 0–3 coded as negative and 4–8 as positive.[20] Resilience (low [1.00–2.99], normal [3.00–4.30], and high [4.31–5.00]) was measured using the average score of 6 questions from the Brief Resilience Scale.[21] The analysis also controlled for current access to behavioral health services (e.g., unit or garrison chaplain, behavioral health officer, Substance Use Disorder Clinical Care program, psychologist, psychiatrist, and licensed counselor) (yes/no). On the survey, this question was asked immediately before asking about perceived behavioral health care barriers.

Statistical analysis

Soldiers with missing responses on any covariate were excluded from the analysis. To descriptively compare the overall study population and the analytic sample, both sets of demographics and military characteristics were analyzed. Due to the analytic sample nesting within the overall study population (i.e., not mutually exclusive), no statistical tests were performed. Multivariable logistic regression was used to determine the association between the perceived behavioral health care barriers score and intentions to leave the Army after contract completion, adjusting for sociodemographic, Army career, and behavioral health characteristics. Adjusted odd ratios (AORs) and their 95% confidence intervals (CIs) were calculated for each variable. The regression model was built in 1 step, and all predictors were selected a priori based on existing literature. All analyses were completed using SAS, version 9.4 (SAS Institute, Cary, NC). The alpha to determine statistical significance was set at $p<.05$.

TABLE 2. Sociodemographic, Army career, and behavioral health characteristics among survey respondents

Characteristic	Overall		Intent to leave the Army[a,b]			
			Yes		No	
	No.	%	No.	%	No.	%
Total	5,842	100.0	3,004	54.8	2,480	45.2
Sex[a,b]						
Male	5,120	89.1	2,650	89.5	2,174	89.2
Female	629	10.9	312	10.5	262	10.8
Racial group[a,b]						
White	3,520	60.5	1,858	62.1	1,476	59.7
Asian/Pacific Islander	283	4.9	146	4.9	110	4.4
Black	737	12.7	346	11.6	340	13.7
Multiracial/other	372	6.4	191	6.4	146	5.9
Unspecified race with Hispanic origin	909	15.6	449	15.0	401	16.2
Hispanic origin[a,b]						
Hispanic	1,147	19.7	580	19.4	487	19.7
Non-Hispanic	4,674	80.3	2,410	80.6	1,986	80.3
Marital Status[b]						
Separated/divorced/widowed	465	8.0	257	8.6	178	7.2
Married/in a relationship	2,885	49.4	1,315	43.8	1,361	54.9
Single, never married	2,492	42.7	1,432	47.7	941	37.9
Parental status[a,b]						
Children	2,070	36.0	878	29.7	1,035	42.2
No children	3,684	64.0	2,077	70.3	1,415	57.8
Rank[a,b]						
E1–E4	3,093	53.1	1,827	61.0	1,103	44.6
E5–E6	1,517	26.0	698	23.3	708	28.6
E7–E9	356	6.1	183	6.1	139	5.6
O1–O3	592	10.2	216	7.2	351	14.2
O4 or above	135	2.3	14	0.5	105	4.2
WO1–CW5	133	2.3	59	2.0	66	2.7
Job satisfaction[a,b]						
Satisfied	2,758	47.4	978	32.7	1,607	65.0
Neutral	1,146	19.7	577	19.3	469	19.0
Dissatisfied	1,909	32.8	1,437	48.0	397	16.1
Behavioral health care access[a,b]						
Yes	1,523	29.6	835	32.0	606	26.8
No	3,624	70.4	1,778	68.0	1,658	73.2
Resilience[a,b]						
Low	455	8.4	337	12.1	100	4.3
Normal	3,465	63.7	1,820	65.2	1,436	61.3
High	1,522	28.0	635	22.7	807	34.4
Anxiety[a,b]						
Positive	1,293	23.2	882	30.9	341	14.3
Negative	4,271	76.8	1,976	69.1	2,045	85.7
Depression[a,b]						
Positive	1,168	21.2	839	29.7	275	11.6
Negative	4,349	78.8	1,984	70.3	2,104	88.4
PTSD[a,b]						
Positive	856	15.4	565	19.8	242	10.1
Negative	4,716	84.6	2,287	80.2	2,155	89.9

[a]Missing data: intent to leave the Army=358, sex=93, race/ethnicity group=21, Hispanic origin=21, parental status=88, rank=16, job satisfaction=29, behavioral health care access=695, resilience=400, anxiety=278, depression=325, and PTSD=270. Soldiers who did not specify a sociodemographic characteristic, or an Army career and behavioral health characteristic were not included in the percent calculation.
[b]Percentages may not add to 100% due to rounding.

RESULTS

A total of 5,842 soldiers were surveyed (5,120 men, 629 women, 93 sex unspecified) **(Table 2)**. Of the 5,484 respondents with data on the main outcome, approximately 55% had intentions to leave the Army after contract completion. Of those with intent to leave, the majority were White (62%), non-Hispanic (81%), junior enlisted (61%), and without children (70%); had normal resilience (65%), and were not accessing behavioral health services at the time of the survey (68%). Nearly half of respondents with intentions to leave the Army were single, never married (48%) or dissatisfied with their jobs (48%). The most commonly perceived barriers to behavioral health care were related to stigma **(data not shown)**. On average, soldiers reported 2 out of 12 behavioral health care concerns (median=1.0; standard deviation=2.8) **(data not shown)**. The majority of soldiers with an intent to leave the Army screened negative for anxiety (69%), depression (70%), or PTSD (80%) **(Table 2)**.

A total of 3,854 respondents (66% of the full sample) with complete information on the covariates were included in the logistic regression analysis **(Table 3)**. The analytic sample was descriptively similar to the overall study population in terms of demographic and military characteristics. The odds of a soldier intending to leave the Army increased by 6% for each additional perceived barrier to behavioral health care, after adjusting for covariates. Soldiers with a rank of major (O4) and above (AOR=0.28; 95% CI: 0.14–0.56) were less likely to intend to leave the Army compared to soldiers in other rank groups. Soldiers who reported they were dissatisfied with their jobs (AOR=4.40; 95% CI: 3.67–5.27) had odds of intention to leave the Army that were 4.4 times that of those who reported being satisfied with their jobs **(Table 3)**. For soldiers who screened positive for anxiety or depression, odds of leaving the Army were 36% and 39% higher, respectively, than those who screened negative for these conditions (AOR=1.36; 95% CI: 1.08–1.72 and AOR=1.39; 95% CI: 1.08–1.79, respectively). There was no association between behavioral health care access at the time of the survey and soldiers' intentions to leave the Army (p=.07).

TABLE 3. Multivariable logistic regression of sociodemographic, Army career, and behavioral health characteristics and the intention to leave the Army (n=3,854)

	No.	%	AOR	95% CI	p-value
Sex					
Male	3,453	89.6	ref		
Female	401	10.4	1.02	(0.80–1.29)	.894
Racial group					
White	2,456	63.7	ref		
Asian/Pacific Islander	159	4.1	0.85	(0.59–1.21)	.366
Black	454	11.8	0.82	(0.65–1.04)	.096
Multiracial/other	234	6.1	0.95	(0.70–1.29)	.750
Unspecified race with Hispanic origin	551	14.3	0.65	(0.43–0.98)	.040
Hispanic origin					
Hispanic	702	18.2	1.27	(0.88–1.83)	.208
Non-Hispanic	3,152	81.8	ref		
Marital status					
Separated/divorced/widowed	294	7.6	ref		
Married/in a relationship	1,942	50.4	1.18	(0.87–1.60)	.277
Single, never married	1,618	42.0	0.81	(0.68–0.97)	.024
Parental status					
Children	1,407	36.5	0.73	(0.60–0.88)	.001
No children	2,447	63.5	ref		
Rank					
E1–E4	1,915	49.7	2.12	(1.68–2.68)	<.001
E5–E6	1,021	26.5	1.26	(0.97–1.62)	.082
E7–E9	266	6.9	3.10	(2.18–4.41)	<.001
O1–O3	450	11.7	ref		
O4 or above	103	2.7	0.28	(0.14–0.56)	<.001
WO1–CW5	99	2.6	1.74	(1.07–2.84)	.027
Job satisfaction					
Dissatisfied	1,199	31.1	4.40	(3.67–5.27)	<.001
Neutral	696	18.1	1.89	(1.57–2.28)	<.001
Satisfied	1,959	50.8	ref		
Perceived barriers to behavioral health care					
Number of perceived barriers			1.06	(1.03–1.09)	<.001
Behavioral health care access					
Yes	1,122	29.1	ref		
No	2,732	70.9	0.86	(0.74–1.01)	.071
Resilience					
Low	307	8.0	1.63	(1.17–2.27)	.004
Normal	2,359	61.2	ref		
High	1,188	30.8	0.84	(0.72–0.99)	.038
Anxiety					
Positive	803	20.8	1.36	(1.08–1.72)	.009
Negative	3,051	79.2	ref		
Depression					
Positive	729	18.9	1.39	(1.08–1.79)	.010
Negative	3,125	81.1	ref		
PTSD					
Positive	522	13.5	1.07	(0.82–1.38)	.623
Negative	3,332	86.5	ref		

AOR, adjusted odds ratio; CI, confidence interval; ref, reference group; PTSD, post-traumatic stress disorder.

Attrition in the military is a multifaceted issue that can have wide-ranging, long-lasting effects. High levels of attrition result in high costs and lowered readiness. The factors that influence decisions to leave the military prior to 20 years of service are not well understood. Survey results demonstrated that 55% of the surveyed soldiers intended to leave the Army at the end of their current contract. Additionally, each additional reported perceived barrier to behavioral health care was associated with 6% higher odds of intentions to leave. Soldiers who screened positive for depression or anxiety were also more likely to report intentions to leave compared to those who screened negative for these conditions. The findings also indicate that job satisfaction and being a senior officer are both potential protective factors for attrition.

This study had notable limitations. The sample used in this study was from 1 Army division and may not have been representative of the entire Army. Second, this sample did not distinguish between the 2 E4 pay grades (specialist and corporal). As a result, the findings did not capture potential differences between these 2 groups. Third, although no identifying information was collected, social desirability bias (i.e., the tendency to underreport socially undesirable attitudes/behaviors) could have been present leading to an attenuation of reporting barriers to behavioral health care. Fourth, it is also possible that the healthy warrior effect resulted in selection bias for the sample. The healthy warrior effect states that there is a disproportionate loss of psychologically unfit personnel early in training, which is amplified by numerous efforts to screen out as many individuals as possible prior to enlistment or commissioning.[22] Fifth, it is also possible that the results are skewed due to an already existing issue in this specific population since behavioral health epidemiological consultations are only requested by units who have a perceived increase in social or behavioral health conditions. The pre-existing social, behavioral health, or organizational environment concerns within this division that were not measured by this study, including from the COVID-19 pandemic, could have contributed to intentions to leave the Army. Sixth, the analytic sample included individuals who may intend to leave the Army after the current service contract primarily because they are eligible for retirement (e.g., 20 years of service). However, results of the bivariate analyses indicated that respondents who were senior in ranks (i.e., O4 and above, E7 and above) were less likely to intend to attrite than other rank groups. Lastly, given that this was a cross-sectional study, no conclusions about causality can be drawn. The strengths of this study included a large sample within the Army and the minimization of social desirability bias since the survey was self-directed and anonymous.

The findings of the current study point to numerous potential areas for future investigation. The COVID-19 pandemic has had a significant impact on behavioral health and continues to affect the psychological well-being of individuals worldwide.[23–26] Previous studies have shown the pandemic exacerbated already existing racial disparities, loneliness, and strained social support systems, especially as a result of the restrictions put in place to reduce the spread of COVID-19.[23–29] While the effects of the pandemic on the results of this study are unknown, it is likely that the results were biased away from the null due to COVID-19.

One of the most commonly reported barriers to seeking or receiving behavioral health care in military populations is stigma. In this study, 6 stigma specific questions were incorporated into the 12-item questionnaire on barriers to behavioral health care. Although race and ethnicity did not significantly impact the intention to leave the Army (except for unspecified race with Hispanic origin), elucidating racial disparities in perceived stigma could be a future direction for research.[30] Another important area to address is the number of behavioral health care providers in the military.[31,32] A 2010 report by the Department of Defense found that a dearth of providers made it difficult for service members to seek care and led to negative outcomes, such as suicidal behavior.[33] Subsequent studies found that the number of providers has not increased in the years since.[34–37] The most persistent barriers continue to be the stigma associated with seeking behavioral health care.[9,14,38,39] To ensure that readiness is maintained and soldiers maintain holistic health, additional resources need to be dedicated to making sure soldiers have adequate access to, and perceive little stigma when seeking, behavioral health care resources.

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Is Suicide a Social Phenomenon during the COVID-19 Pandemic? Differences by Birth Cohort on Suicide Among Active Component Army soldiers, 1 January 2000–4 June 2021

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This study explored rates of death by suicide by birth cohort including Baby Boomers (1946–1964), Generation X (1965–1980), Millennials (1981–1996), and Generation Z (1997–2012), among active component U.S. Army soldiers during 1 January 2000–4 June 2021. From 1 January 2008 through 4 June 2021, the most likely cluster of suicides, although not statistically significant, was identified between March 2020 and June 2021, which coincided with the coronavirus disease 2019 (COVID-19) pandemic. Since the onset of the COVID-19 pandemic, the Army has observed 55%–82% increases in suicide rates among Millennials, Generation Z, and Generation X compared to 1 year before the pandemic. The largest proportional increase in rates affected the members of Generation X, but the highest rates both before and after the onset of the pandemic affected those in Generation Z. Discussion of the findings introduces theories that have been used to explain psychological states that may predispose to suicidal behavior and posits ways in which Army leaders and organizations may be able to reduce suicide risk among soldiers. The limitations of the study and possible additional inquiries are described.

WHAT ARE THE NEW FINDINGS?

From 2008 through 2021, the most likely cluster of deaths by suicide was identified from March 2020 to June 2021, which coincided with the COVID-19 pandemic. Since the onset of the pandemic, the Army has observed 55%–82% increases in suicide rates among Millennials, Generation Z, and Generation X compared to 1 year before the pandemic.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

Assuming a soldier reaches the age range for being eligible for retirement based on at least 20 years of service (between 38 and 62 years), the deaths by suicide between 2000 and 2021 constitute 25,454–82,766 years of life lost to the Army. Findings from the current study suggest the need for additional inquiries to better understand the implications of the pandemic, during which restriction of movement, isolation, and physical distancing necessary to minimize COVID-19 transmission have magnified social health issues among Army soldiers.

The U.S. Army suicide rate has surpassed 20 per 100,000 soldiers since 2008 and reached 30 per 100,000 soldiers in 2018.[1] Although the Army suicide rate has been higher in the 17–24 age group in recent years,[1] it has not always been the case.[2,3] Prior to 2016, Army suicide rates were highest among those aged 25–34;[2,3] rates since 2017 have been highest among those 17–24 years.[1,4]

Because optimal physical, mental, and behavioral health are key to ensure readiness, Army suicide prevention strategies have traditionally focused on individual-level factors (e.g., mental and behavioral health diagnoses, mandatory suicide prevention training). Studies have shown that interventions focused on such factors have been of limited effectiveness in reducing the risk of suicide rates.[5] The Army has taken the community-level approach to identify factors associated with suicidal behaviors.[6] While common community-level factors emerged from over 10 years of the Army's behavioral health epidemiological consultations[6], recommendations accompanying each individual consultation report are not always acted upon or followed through. Suicide shares many community-level risk and protective factors with other harmful behaviors (e.g., intimate partner violence). Shifting the focus from individual harmful outcomes to community-level root causes[5], such as social determinants of health[7], could allow Army leaders to address suicide and other harmful behaviors using an integrated approach and potentially have a greater impact.

There is a dearth of information on how birth cohorts impact suicidal behavior in the Army, especially during the coronavirus disease 2019 (COVID-19) pandemic. This study summarized data on the demographic and military characteristics of active component Army soldiers who died by suicide from 1 January 2000 through 4 June 2021. Additionally, a commonly applied method to detect temporal suicide clusters, the scan statistic, was applied to these data in an attempt to identify differences by birth cohort.

METHODS

Study population, time frame, and data sources

This study was a population-based retrospective analysis of active component Army soldiers who died by suicide from

1 January 2000 through 4 June 2021, as documented by the Armed Forces Medical Examiner System (AFMES). Monthly population counts of all active component Army soldiers were obtained from the Defense Medical Surveillance System. Demographic data (date of death, date of birth, age, pay grade, rank, sex, racial group, and marital status) for soldiers who died by suicide came from the Defense Civilian Intelligence Personnel System (DCIPS). Soldiers who died by suicide but did not have a date of birth and age at death in DCIPS were excluded from the study (n=6). A total of 2,388 Army soldiers were included in the final analysis.

Descriptive statistics and cluster analyses

The following 4 successive birth cohorts were included in this analysis: Baby Boomers (1946–1964), Generation X (1965–1980), Millennials (1981–1996), and Generation Z (1997–2012). Demographic characteristics were stratified by birth cohort and differences were assessed using chi-square tests. Crude suicide rates were calculated by birth cohort before (1 March 2019–29 February 2020) and during (1 March 2020–4 June 2021) the COVID-19 pandemic. These analyses were performed using R, version 4.0.2 (2020, R Core Team).

In general, suicide clusters can be identified by location (spatial) and/or by time (temporal). This study identified temporal-only suicide clusters using a discrete Poisson temporal model available in SaTScan, version 9.6 (2018, M. Kulldorff). The most likely suicide cluster was identified using temporal scan statistics and was calculated for the periods from 2000 through 2021 (with all available data) and 2008 through 2021 (2008 was the first year the adjusted Army suicide rate surpassed the civilian rate[8]). The discrete scan statistics applied scanning windows over the study period to test whether the number of suicides occurred closer together in time than would normally be expected through random processes. Given the availability of the suicide event date, the time precision for suicide counts was set to day. Suicide counts and population sizes were aggregated by month. The minimum and maximum temporal cluster sizes were set to 1 month and 15 months, respectively. A sensitivity analysis was carried out using the same minimum temporal cluster size and a maximum temporal cluster size extending to half of the study period (software default). A minimum of 2 suicides were required in a cluster. To account for suicide trend, the analysis also incorporated an automatic log-linear adjustment. Statistical significance was determined using a p value generated by a sequential Monte Carlo procedure (software default maximum replications=999).

RESULTS

From 1 January 2000 through 4 June 2021, 2,388 soldiers died by suicide; the majority were male (94%), White (77%), married (56%), junior enlisted (E1–E4; 54%), and Millennials (63%) **(data not shown)**. There were no statistically significant differences in birth cohorts by sex or racial group. However, Generation Z soldiers included significantly higher proportions of soldiers who were single and junior enlisted than the 3 other cohorts **(data not shown)**.

From 2000 though 2021, a statistically significant cluster of suicides was identified from April 2008 to April 2009, resulting in an Army suicide rate that surpassed the rate for civilians for the first time.[9] From 1 January 2008 through 4 June 2021, the most likely cluster of suicides, although not statistically significant, was identified from March 2020 through June 2021, which coincided with the COVID-19 pandemic **(Figure)**. The sensitivity analysis revealed the same result. Since the onset of the COVID-19 pandemic, the Army has observed 55%–82% increases in suicide rates among Millennials, Generation Z, and Generation X soldiers compared to 1 year before the pandemic **(Table)**. While Generation Z had the highest absolute increase in the rate of death by suicide (from 39.5 to 60.8 per 100,000) when compared to the year of the pandemic, Generation X soldiers had the highest relative increase in rates during the COVID-19 period rising from 17.4 to 30.8 per 100,000. This represented an 82% increase in the relative rate of death by suicide among Generation X soldiers. Comparatively, there was only a 56% increase in the suicide death rate for Generation Z soldiers **(Table)**.

EDITORIAL COMMENT

The current study demonstrated pronounced increases in U.S. suicide rates from 1 year before the COVID-19 pandemic to the period from 1 March 2020 to 4 June 2021 during the pandemic among soldiers across 3 of the 4 successive birth cohorts. When comparing the 2 time periods, members of Generation Z soldiers had the highest absolute increase in suicide rates; Generation X soldiers had the highest relative increase in rates. Assuming a soldier reaches the age range of being eligible for retirement based on at least 20 years of service (between 38 and 62 years), these deaths from 2000 through 2021 constitute 25,454–82,766 years of life lost to the Army. Of note, this is likely an overestimate given that not all soldiers pursue a military career to retirement.

The reasons behind suicidal behavior at various stages in life and potential birth cohort differences may affect soldiers' receptiveness to prevention and intervention efforts. Findings from this study suggest that Generation Z soldiers are at a greater risk for suicide (from 39.5 to 60.8 per 100,000) and Generation X soldiers may have been more impacted by the pandemic (82% increase in suicide rate during pandemic). While Generation Z soldiers born in the digital age could value extrinsic factors (e.g., image, fame) more than intrinsic factors (e.g., self-acceptance, community)[10], Generation X soldiers could face deepened despair. A study among Generation Xers in the civilian population demonstrated increased levels of suicidal ideation, depressive symptoms, marijuana use, and heavy drinking—compared to previous birth cohorts of the same age.[11] This suggests tailoring suicide prevention strategies by birth cohort and having a leader who could provide purpose could have greater impact.

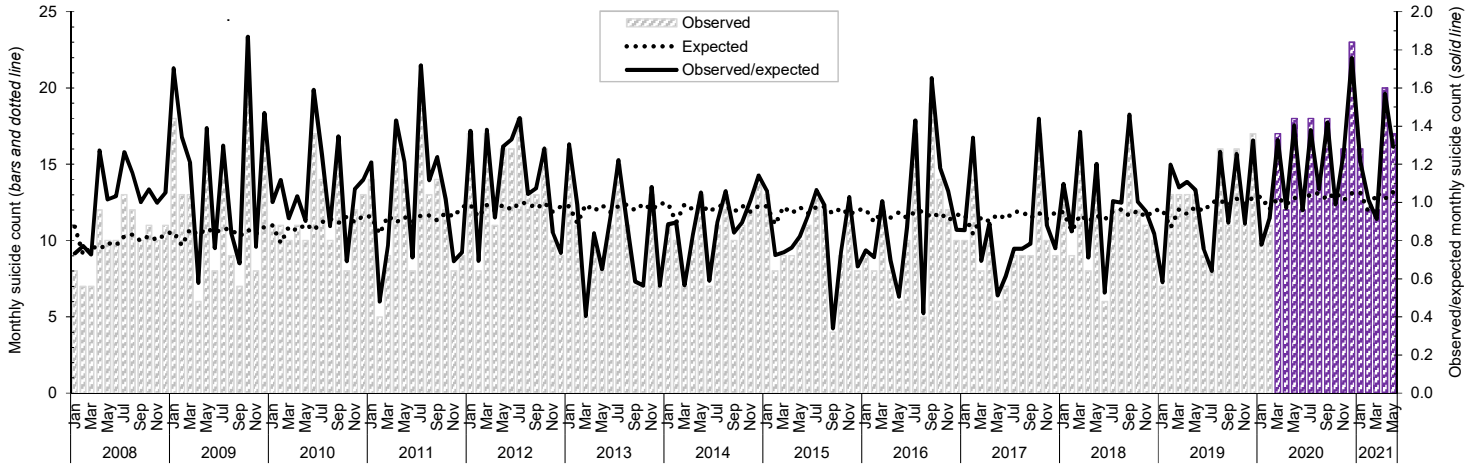
Joiner's Interpersonal Theory of Suicide describes thwarted belongingness,

TABLE. Crude suicide rates from before (1 March 2019–29 February 2020) and during (1 March 2020–4 June 2021) COVID-19 pandemic, by birth cohort, active component, U.S. Army

	Baby boomers[a]		Generation X[b]		Millennials[c]		Generation Z[d]	
Overall time frame (1 January 2000–4 June 2021)	n	%	n	%	n	%	n	%
Overall case count[e]	50	2.1	661	27.7	1,497	62.7	180	7.5
Before COVID-19 pandemic (1 March 2019–29 February 2020)								
Case count[e]	0	0.0	11	7.5	90	61.2	46	31.3
Population count[f]	1,450	0.3	63,135	13.3	292,054	61.7	116,519	24.6
Crude suicide rate per 100,000 soldiers	0	-	17	-	31	-	39	-
During COVID-19 pandemic (1 March 2020–4 June 2021)								
Case count[e]	0	0.0	17	7.1	134	56.1	88	36.8
Population count[f]	1,095	0.2	54,293	11.4	278,036	58.2	144,682	30.3
Crude suicide rate per 100,000 soldiers	0	-	31	-	48	-	61	-
Comparing before and during COVID-19 pandemic								
Difference in crude suicide rates	0	-	14	-	17	-	22	-
Crude suicide rate ratio	-	-	1.82	-	1.55	-	1.56	-

[a]Baby Boomers, born 1946–1964.
[b]Generation X, born 1965–1980.
[c]Millennials, born 1981–1996.
[d]Generation Z, born 1997–2012.
[e]Suicide data came from the Armed Forces Medical Examiner System, and are current as of 4 June 21.
[f]Population data came from the Defense Medical Surveillance System and were provided by the Armed Forces Health Surveillance Division on 4 June 21.
COVID-19, coronavirus disease 2019.

FIGURE. Suicides, as reported by the Armed Forces Medical Examiner System,[a] by month, active component Army soldiers, 1 January 2008–4 June 2021[b]



[a]Suicide data are current as of 4 June 2021.
[b]The cluster of suicide analysis included monthly population counts provided by the Armed Forces Health Surveillance Division.

perceived burdensomeness, and acquired capabilities as potential triggers for suicide[12] and can be used to explain soldier death by suicide. This theory of suicidal behavior posits that the desire to die by suicide arises as a result of an individual holding 2 specific psychological states in their mind simultaneously for a period of time: "perceived burdensomeness" and "low belongingness".[12] Perceived burdensomeness is a feeling that one's existence is a burden to family, friends, society, or other social groups. A low sense of belongingness corresponds to a sense of alienation or a lack of integration with family, friends, or other social groups.

Thwarted belongingness and perceived burdensomeness may be compounded by the COVID-19 pandemic. The lack of social connectedness due to the pandemic may have intensified feelings of thwarted belongingness, as loneliness has been identified as a public health epidemic in younger populations[13] and a risk factor for suicidal

ideation.[14] With regard to perceived burdensomeness, soldiers place value on their ability to support their unit and accomplish the Army mission. Meaning salience (understanding of one's meaning in life) is important for maintaining and promoting behavioral and social health in times of crisis.[15] Trachik et al. found that having leaders who remind soldiers of the purpose of military service amidst stressful experiences can indirectly lower the odds of soldiers having suicidal ideation through unit cohesion that counters thwarted belongingness and perceived burdensomeness.[16] Moreover, a sense of meaning and purpose is a protective factor under extreme stress[17] and having that purpose articulated from a military leader may enhance resilience and reduce risk for suicidal ideation.[16,18]

With acquired capability, soldiers may have an intensified degree of fearlessness and develop an insensitivity to the pain associated with death by suicide. Previous research demonstrates that service members are more likely to have a greater capability for suicide[19], which may be due to exposure to combat violence, death, and pain.[20,21] From 2001 through 2021, the most prevalent method of death by suicide was gunshot wound as documented by the Department of Defense Suicide Event Report[22,23], DCIPS[24,25], and AFMES.[24,25] Dempsey et al. found that storing a loaded firearm at home quadrupled the risk of death by suicide among soldiers.[26] Hoffmann et al. also found that impulsivity was the strongest predictor of suicide attempt in a sample of 38,507 soldiers.[27] Minimizing soldiers' access to firearms/lethal means is an evidenced-based practice in suicide prevention[28] and mechanisms to promote lethal means safety[29]—especially at a time of crisis (e.g., COVID-19 pandemic)—are crucial.

The U. S. Army Public Health Center and other U.S. Government organizations have routinely identified social determinants of health impacting preventable deaths and soldier and family readiness.[6] These factors include conditions of military housing[30-33], food quality and availability[32], quantity and quality of gyms and other recreational areas[32], spouse employment opportunities[32-34], economic stress and financial literacy[32], education and training[31,32], family/community support services[31,32], racial and ethnic discrimination[35,36], health care availability and accessibility[14,31,32,37], behavioral health stigma[14,31,32], and social isolation.[14,32] Focusing on these root causes brings an upstream approach to suicide prevention, where programs, practice, and policies could best synergize and have shown evidence in reducing suicide risk.[38]

This study has several limitations. Because demographic data came from a single source, there was no additional validation of this information. The study period was based on calendar year and covered various years in service for each birth cohort. Because all 4 birth cohorts of soldiers could not be followed equally for 20 years, the differences by marital status and rank could be an artifact of Generation Z soldiers being in the Army for a shorter period of time. The scan statistics accounted for suicide trend but did not adjust for covariates. The suicide rates from this study were based on preliminary data and were not adjusted for age or sex. Further analyses with adjusted scan statistics and adjusted suicides rates should be considered upon receipt of the annual data in 2021. The study's strengths include over 20 calendar years of suicide records and synchronization of the AFMES data from the latest years with the Army Resilience Directorate to ensure accuracy.

Findings from the current study suggest the need for additional inquiries to better understand the implications of the pandemic, during which restriction of movement, isolation, and physical distancing necessary to minimize COVID-19 transmission have magnified social health issues among Army soldiers.

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Brief Report

Relationships Between Self-reported Psychological Conditions and Aggressive Behaviors Among Crew Members of a U.S. Navy Aircraft Carrier, January 2021

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Aggression is defined as behavior intended to inflict physical or psychological harm, and can be verbal or physical.[1,2] Aggressive behavior is common among active component service members, with approximately half reporting that they engaged in aggressive behavior within the past month.[3,4] Further studies show that rates of aggression are increasing.[3,4] Although well-regulated aggression (e.g., toward an enemy; in a response to an attack) may be necessary for combat engagement, uncontrolled aggression (e.g., domestic violence, physical fights with other service members) can have significant negative psychological, social, and occupational ramifications. Aggression is associated with poorer occupational productivity and retention,[5] and increased risk of legal problems.[6–8] Research also suggests that aggression may be a form of non-suicidal self-injury,[9] and that it may predict increased suicide risk;[10] approximately 43% of service members who attempted suicide reported they acted to "stop feeling angry, frustrated, or enraged."[11] Additional research on aggression is needed to identify service members at high risk of these behaviors in order facilitate prevention, mitigation, assessment, and intervention.

Another area that warrants further examination is the relationship between aggression and mental health among service members. Approximately 14% of service members have a diagnosed psychological condition,[12] with post-traumatic stress disorder (PTSD), major depressive disorder (MDD), and anxiety disorders being among the most prevalent.[12–13] The relationship between PTSD and aggression is well-established; service members with PTSD report higher levels of aggression compared to those without PTSD.[14–16] Recent evidence suggests that service members with symptoms of depression and anxiety are more likely to report anger problems.[17–18] However, only 1 study has examined associations between depression or anxiety and aggression among service members, finding that aggression was associated with a self-reported history of depression and anxiety "problems" among soldiers.[14] Given the gap in knowledge, additional studies are needed. This study examines associations between 3 mental health conditions—probable MDD, generalized anxiety disorder (GAD), and PTSD—and aggression among active component sailors.

METHODS

In January 2021, all crew members from a docked Naval aircraft carrier were invited to complete an anonymous questionnaire that assessed demographic characteristics, aggressive behaviors, and symptoms of mental health disorders. The questionnaire was completed on computer tablets provided by the research team and was administered as part of a larger, mixed-methods study designed to assess stress and health among shipboard sailors. Participation was voluntary and all crew members were eligible to participate. Study procedures were approved by the Naval Health Research Center Institutional Review Board.

Aggressive behavior was assessed using 4 items adapted from previous research; however, the version of the scale employed in the current study has not been previously validated.[19–20] Participants reported how often during the past month they yelled or shouted at someone, kicked or smashed something, threatened someone with physical violence, or got into a fight or harmed someone. Responses ranged from 0 (never) to 4 (5 or more times). Respondents who had engaged in each behavior 1 or more times in the past month were classified as positive for that behavior. Items were also examined as a summed scale score, which assesses frequency of aggressive behaviors over the past month (range 0–16; Cronbach's alpha=0.68).

Clinically validated screening tools were used to assess mental health symptoms; each tool has been widely used in military populations.[21–23] Responses to the Patient Health Questionnaire-9[24] were used to assess depression symptoms over the previous 2 weeks. Per clinical guidelines, participants were categorized as having probable MDD if they answered "more than half the days" or "nearly every day" on 5 or more of the items, including either item 1 (diminished pleasure or interest) or item 2 (depressed mood) or if they endorsed item 9 [suicidal ideation]).[25]

Responses to the 7-item GAD-7 scale were used to assess anxiety symptoms over the previous 2 weeks; participants with summed scale scores ≥10 were categorized as having probable GAD.[26]

Post-traumatic stress symptoms were assessed using the abbreviated 8-item PTSD Checklist for DSM-5 (PCL-5).[27] Participants were categorized as having probable PTSD if they had a summed scale score of ≥19 and if they reported prior experience of a Criterion A trauma (i.e., exposed to actual or threatened death, serious injury, or sexual violence).[27]

Descriptive statistics were computed for all variables. One-way analysis of variance (ANOVA) and chi-square tests of association were conducted to examine the relationship between participant characteristics, probable mental health disorders, and aggressive behaviors. To control risk of Type I error, all statistical tests were conducted using Bonferroni adjustments. All analyses were conducted using SPSS Statistics, version 25.0 (IBM Corp., Armonk, NY).

RESULTS

Nine-hundred fifty-three sailors (72.1% male) completed the survey **(Table 1)**; approximately 30% of the crew participated in the study. Over three-quarters (76.4%) of participants reported engaging in at least 1 aggressive behavior in the past month, with less extreme forms of aggression being most common **(data not shown)**. Yelling/shouting was more common among women (X^2=8.2, p<.005), whereas kicking/smashing something was more common among men (X^2=4.8, p<.05) **(data not shown)**. Gender differences in the other aggressive behaviors were not statistically significant.

Approximately half of participants (50.5%) screened positive for at least 1 mental health disorder **(Table 1)**. Overall frequency of aggressive behavior increased with increasing number of positive screens for mental health disorders. More specifically, sailors who screened positive for MDD or GAD (i.e., probable MDD/GAD) were more likely to engage in each of the 4 aggressive behaviors and reported greater frequency of aggressive behaviors overall (as measured by the summed scale score) when compared to individuals who screened negative **(Tables 1, 2; Figure)**. Similarly, individuals with more than one positive screen for mental health disorder comorbidities reported more frequent aggressive behaviors than those with 1 or no probable mental health disorder diagnoses. Finally, those with probable MDD, GAD, and PTSD were more likely to get in a fight or harm someone, and had the highest frequency of aggressive acts, when compared to any other group **(Table 2)**. The small number of participants with singular PTSD symptoms (n=6) precluded comparisons between PTSD and the other singular conditions.

EDITORIAL COMMENT

This study documents associations between aggressive behaviors, demographic characteristics, and mental health conditions. In the current sample, female sailors reported initiating more verbal aggression whereas male sailors reported initiating more physical aggression. These findings are in line with prior research on gender differences in aggression among civilians.[28–29] Individuals with probable MDD or GAD reported more frequent physical and verbal aggression than those without probable diagnoses and frequency of aggression rose with the number of probable mental health disorder diagnoses.

These findings may have clinical implications. Although aggression has previously been associated with PTSD, the current results indicate that military providers should regularly assess verbal and physical aggression among individuals with other mental health conditions as well, and in both male and female service members. Providers should also be aware that risk of aggression increases in the presence of comorbid mental health conditions. Clinically, this implies increased importance of assessing aggression among patients with comorbid mental health conditions and of incorporating elements to address aggression in treatment of patients with many types of common mental health disorders.

TABLE 1. Engagement in aggressive behaviors by survey participant characteristics and mental health screening results (n=953)

	Total[a] (n=953)		Yelled or shouted at someone		Kicked or smashed something		Threatened someone with physical violence		Got into a fight or harmed someone	
	n	%	n	%[b]	n	%[b]	n	%[b]	n	%[b]
Gender										
Male	682	72.1	476	70.2	211	31.1	125	18.5	75	11.1
Female	264	27.9	206	79.5	62	23.8	39	15.0	23	8.9
Age group (years)										
18–24	534	56.0	379	71.9	169	31.9	100	19.0	64	12.1
25–29	206	21.6	143	70.1	61	29.9	37	18.1	19	9.4
30+	213	16.4	164	77.0	45	21.1	29	13.6	16	7.5
Mental health screening results										
No MH disorders	459	49.5	285	62.1	80	17.4	40	8.8	18	3.9
One disorder (GAD, MDD, or PTSD[c])	169	17.9	131	78.9	75	34.3	35	21.1	19	11.5
GAD only	85	9.2	71	83.5	26	30.6	16	18.8	12	15.6
MDD only	78	8.4	58	74.4	31	39.7	18	23.1	7	8.2
Comorbid disorders (any 2: GAD, MDD, PTSD)	190	20.5	158	84.9	75	39.9	50	26.7	28	15.0
Tri-morbid disorders (GAD, MDD, and PTSD)	113	12.2	96	85.7	55	49.1	39	34.8	31	27.7

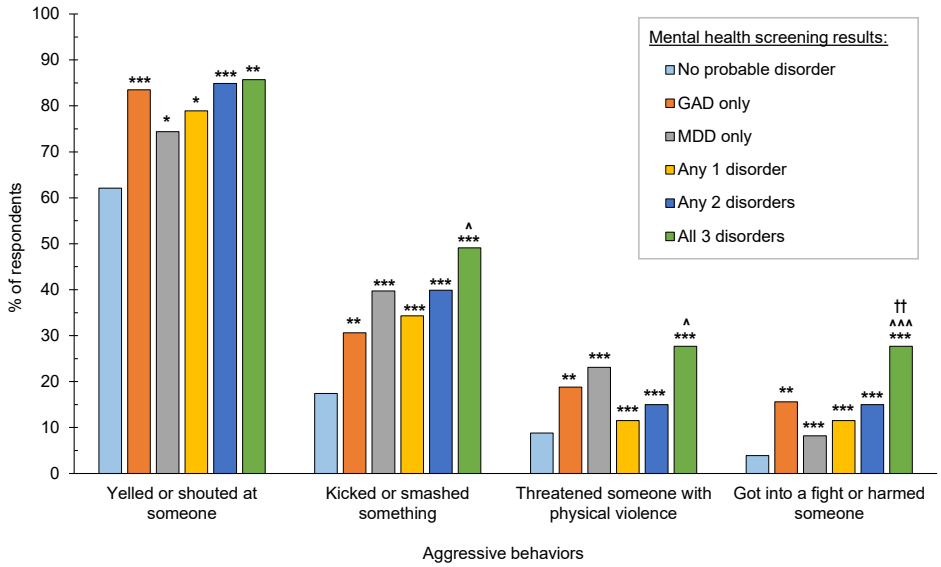
[a]Some variables had missing values.
[b]Values reflect the number and percent of individuals within groups (rows) that endorsed engaging in a given behavior 1 or more times in the past month; thus, column totals do not sum to 100%.
[c]Respondents with a diagnosis of PTSD only could not be examined as an independent group, as only 6 active component service members fell into this category.
MH, mental health; GAD, generalized anxiety disorder; MDD, major depressive disorder; PTSD, post-traumatic stress disorder.

TABLE 2. Frequency of aggressive behavior, by survey participant characteristics and screened positive for mental health disorders among shipboard sailors (n=946)

	Aggressive behavior score, mean[a]	SD	F(df)	p-value	Eta-squared
Gender					
Male	2.8	3.08	0.37 (1,936)	.54	0.00
Female	3.0	2.76			
Age group (years)					
18–24	3.1	3.23	2.19 (2,940)	.11	0.01
25–29	2.8	2.79			
30+	2.6	2.55			
Positive screen for MH disorder					
None	1.8_a	2.18	16.68 (2,618)	<.001	0.05
GAD only	3.0_b	2.64			
MDD only	3.0_b	2.73			
Number of MH disorders[b]					
0	1.8_p	2.18	66.08 (3,919)	<.001	0.18
1	3.0_q	2.69			
2	4.0_r	2.95			
3	5.4_s	4.11			

[a]Mean of the summed scale score from the aggressive behavior measure. For each predictor examined, means sharing a common subscripted letter did not differ significantly from one another.
[b]Frequency of aggressive behavior was compared as a function of type of probable MH condition (none, GAD only, MDD only) and as a function of number of probable conditions (0–3) using 1-way ANOVA. Post hoc tests used the Bonferroni adjustment.
SD, standard deviation; F, F statistic; df, degrees of freedom; MH, mental health; GAD, generalized anxiety disorder; MDD, major depressive disorder; PTSD, post-traumatic stress disorder; ANOVA, analysis of variance.
MH, mental health.

FIGURE. Associations between mental health screening results and aggressive behaviors among surveyed sailors (n=946)



*,^,†Asterisks (*) represent statistically significant differences compared to the group with no probable mental health disorders. Carets (^) indicate significant differences compared to the any 1 disorder group, and crosses (†) indicate significant differences compared to the comorbid disorders group (any 2 disorders). A single symbol indicates p<.05, two symbols indicate p<.01, and 3 symbols indicate p<.001.
GAD, generalized anxiety disorder; MDD, major depressive disorder.

Although this study provides new information regarding aggression among service members, it is limited by a lack of prospective data, use of a non-validated aggression measure, lack of specificity regarding the target of their aggression, and a higher than expected rate of screening positive for mental health disorders (potentially confounded by the effects of the coronavirus disease 2019 [COVID-19] pandemic), preventing the examination of aggression among sailors with probable PTSD alone. Nonetheless, this research can guide improvements in mental health care provider training, as well as prevention, assessment, and intervention efforts.

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Surveillance Snapshot: A Simple Model Estimating the Impact of COVID-19 on Lost Duty Days Among U.S. Service Members

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TABLE. Impact of quarantine length (7 versus 14 days) on military readiness, by lost duty days after a COVID-19 infection, as of 25 Aug 2021

	Quarantine	No. of cases[a]	Days in isolation	Lost duty days		
				No. of close contacts per case		
				2	4	7
Single case impact	7-day	1	10	24	38	59
	14-day	1	10	38	66	108
Total DOD impact	7-day	226,510	2,265,100	5,436,240	8,607,380	13,364,090
	14-day	226,510	2,265,100	8,607,380	14,949,660	24,463,080

COVID-19, coronavirus disease 2019; No., number; DOD, Department of Defense.
[a]The number of cases used to estimate total DOD impact includes active duty reserve and National Guard members; however, it is unclear if the total number includes inactivated reserve/Guard.

Since the start of the coronavirus disease 2019 (COVID-19) pandemic, the Department of Defense (DoD) has reported 226,510 cases of COVID-19 among military members as of 25 August 2021.[1] Managing COVID-19 infections and implementing quarantines of their contacts could alter the training and mission plans for most, if not all, military units. Although there was robust prognostication regarding the impact of COVID-19 on lost duty days in the early months of the pandemic,[2,3] little has been published in this area since then.

Simple modeling can provide an important estimate of the impact of COVID-19 on lost duty days among U.S. service members. The model used in this analysis assumes that each reported case undergoes 10 days of isolation and allows for variation in the number of close contacts (e.g., low [2], medium [4] and high [7]) and the length of quarantine (7 or 14 days). This model estimates the impact of a single COVID-19 case for each of the possible values of close contacts and quarantine length and also extrapolates the DOD-wide impact in terms of number of lost duty days **(Table)**.

The model is a gross approximation of lost duty days and may both underestimate and overestimate lost duty days due to several factors. The model ignores the lost duty days of the 34 deaths and 2,036 hospitalizations among military service members reported by DoD since the start of the pandemic.[1] This model also does not take into account the indirect lost duty days affecting service members charged with special duties in tracking, caring for, and administratively handling service members in isolation and quarantine. It also ignores the lost duty days of cases diagnosed in family members and the impact of lost duty days on non-military close contacts, including family members and DoD civilian employees. Furthermore, this model does not estimate the cumulative impact on unit readiness of multiple simultaneous or consecutive COVID-19 infections within a command. Finally, this model may overestimate lost duty days by including weekend days and it is unclear if the military members included in the DoD case report[1] includes inactivated reserve/Guard members who may not be on duty.

The COVID-19 pandemic has adversely impacted the availability of service members to unit Commanders. Using this model, one can estimate a best-case scenario of the loss of 0.71% of all duty days, with a worst-case scenario of the loss of around 3.2% of all duty days in the DoD during the period of 1 March 2020 to 25 Aug 2021. When this loss is placed in the context of 3 to 8 members of a unit being unavailable for a mission, deployment, or training event due to a single infection, the impact on unit readiness is easily seen. Preventing a single case has a far-reaching impact on readiness, conserving 24–98 duty days of availability to Commanders. Although some service members were able to recover a portion of these lost days by teleworking, they represent the minority and were primarily among higher ranks.

Prevention of COVID-19 infections can have a significant positive impact on service member availability for missions and training. Ongoing efforts using all available infection prevention tools, including immunization, non-pharmaceutical interventions, and policies designed to prevent new infections should be pursued by Commanders and leaders at all levels of the DoD in order to optimize training tempo and readiness activities.

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Update: Routine Screening for Antibodies to Human Immunodeficiency Virus, Civilian Applicants for U.S. Military Service and U.S. Armed Forces, Active and Reserve Components, January 2016–June 2021

This report provides an update through June 2021 of the results of routine screening for antibodies to the human immunodeficiency virus (HIV) among members of the active and reserve components of the U.S. Armed Forces and through December 2020 among civilian applicants for military service. During the surveillance period, seroprevalences among applicants for service were highest in 2019 (0.36 per 1,000 tested) and then decreased in 2020 (0.32 per 1,000 tested). Full-year seroprevalence peaked in 2019 for active component service members of the Army, in 2017 for the Navy, 2018 for the Marine Corps, and 2016 for the Air Force. Among reserve and National Guard members, seroprevalence peaked in 2019 for the Air Force National Guard, 2016 for the Air Force reserve, in 2017 for the Marine Corps reserve, 2018 for the Navy reserve, and in 2016 for the Army National Guard and reserve. Overall (January 2016–June 2021) HIV antibody seroprevalences were highest among Army reservists, Army National Guard members, and Navy reservists and lowest among Air National Guard members, Marine Corps active component members, and Air Force active component members. Across active and reserve components of all services, HIV antibody seroprevalences continued to be higher among men than women.

WHAT ARE THE NEW FINDINGS?

From January 2016 through December 2020, the rates of HIV test positivity among civilian applicants for military service were stable at 0.33 per 1,000 tested. Among uniformed personnel (active component, Guard, and reserve), rates between January 2016 and June 2021 remained relatively stable. Rates among female applicants and female service members have remained very low compared to those of male applicants and service members.

WHAT IS THE IMPACT ON READINESS AND FORCE HEALTH PROTECTION?

The routine screening for antibodies to HIV for over 30 years has enabled the U.S. military to provide adequate and timely medical care to infected service members, counseling to prevent unwitting transmission, and protection of the battlefield blood supply.

Since acquired immune deficiency syndrome (AIDS) was first recognized as a distinct clinical entity in 1981,[1] its spread has had major impacts on the health of populations and on health care systems worldwide. Human immunodeficiency virus type 1 (HIV-1) was identified as the cause of AIDS in 1983. For more than 30 years, the U.S. military has conducted routine screening for antibodies to HIV-1 to enable adequate and timely medical evaluations, treatment, and counseling; to prevent unwitting transmission; and to protect the battlefield blood supply.[2,3]

As part of the U.S. military's total-force HIV screening program, civilian applicants for military service are screened for antibodies to HIV during pre-accession medical examinations. Infection with HIV is medically disqualifying for entry into U.S. military service.[4] Since 1986, all members of the active and reserve components of the U.S. Armed Forces have been periodically screened to detect newly acquired HIV infections. In 2004, the Department of Defense (DoD) set a standard testing interval of 2 years for all service members.[5,6] In addition, all military personnel are supposed to be screened for HIV infection before deployment, upon return from deployment, and after having received a diagnosis of various other conditions, such as a sexually transmitted infection.[6] Routine HIV screenings are usually performed during the periodic health assessment, an annual evaluation of a service member's medical readiness status. Service members who are infected with HIV receive clinical assessments, treatments, and counseling; they may remain in service as long as they are able to fully perform their military duties.[2,3] HIV positive service members are eligible for certain non-combat or non-contingency deployments and, as such, must meet the DoD's retention policy for non-deployable service members. The latest policy on retention determinations for non-deployable service members was implemented in October 2018 and requires service members who are in a non-deployable status for more than 12 consecutive months to be evaluated for a retention determination by their respective military departments or, as appropriate, be referred into the Disability Evaluation System, or processed for administrative separation from the military.[7]

Before 2009, all of the aforementioned screening programs used laboratory techniques that detected only HIV-1–type infections. Starting in 2009, all programs adopted methods that allowed the detection of antibodies to both major HIV types (i.e., HIV-1 and HIV-2). Although HIV-2 infection is rare in the U.S. and no instances of HIV-2 infection have thus far been detected in civilian applicants or service members since 2009, HIV-2 is much more prevalent in other parts of the world where service members may be required to serve. To provide for the change in

laboratory methods in the past and for the prospect of future detections of HIV-2 infection in the services' screening programs, this report will hereafter refer to the target of the screening programs as simply "HIV" without specifying the types.

This report summarizes numbers, seroprevalences, and trends of newly identified HIV antibody positivity among civilian applicants for military service and members of the active and reserve components of the U.S. Armed Forces from 1 January 2016 through 30 June 2021. Summaries of the results of routine screening for antibodies to HIV among civilian applicants and active and reserve component members of the U.S. military since 1990 are available at www.health.mil/MSMRArchives.

METHODS

The surveillance period was 1 January 2016 through 30 June 2021 for service members, and 1 January 2016 through 31 December 2020 for civilian applicants for U.S. military service. The surveillance population included all civilian applicants for U.S. military service and all individuals who were screened for antibodies to HIV while serving in the active or reserve component of the Army, Navy, Air Force, or Marine Corps during the surveillance period.

All individuals who were tested and all first-time detections of antibodies to HIV through U.S. military medical testing programs were ascertained by matching specimen numbers and serologic test results to the personal identifiers of providers of the specimens. All results were accessed from records routinely maintained in the Defense Medical Surveillance System (DMSS). The surveillance period was truncated to 31 December 2020 for civilian applicants for U.S. military service because, at the time of analysis, the U.S. Military Entrance Processing Command (MEPCOM) had stopped providing data into the DMSS.

An incident case of HIV antibody seropositivity was defined as 2 positive results from serologic testing of 2 different specimens from the same individual or 1 positive result from serologic testing of the most recent specimen provided by an individual.

Annual prevalences of HIV seropositivity among civilian applicants for service were calculated by dividing the number of applicants identified as HIV-antibody seropositive during each calendar year by the number of applicants tested during the corresponding year. For annual summaries of routine screening among U.S. service members, denominators were the numbers of individuals in each component of each service branch who were tested at least once during the relevant calendar year.

RESULTS

Civilian applicants

In 2020, a total of 267,602 civilian applicants for U.S. military service were tested for antibodies to HIV, and 86 applicants were identified as HIV antibody positive (seroprevalence: 0.32 per 1,000 applicants tested) **(Table 1)**. During the surveillance period, seroprevalences among applicants for service were highest in 2019 (0.36 per 1,000 tested) and then decreased to 0.32 per 1,000 tested in 2020 **(Table 1, Figure 1).**

Throughout the surveillance period, annual HIV antibody seroprevalences among male applicants were consistently higher than among female applicants **(Table 1, Figure 1)**. Seroprevalences were much higher among non-Hispanic Blacks, compared with other race/ethnicity groups **(Table 2, Figure 2)**. During 2020, on average, 1 civilian applicant for service was detected with antibodies to HIV per 3,244 screening tests **(Table 1).**

U.S. Army

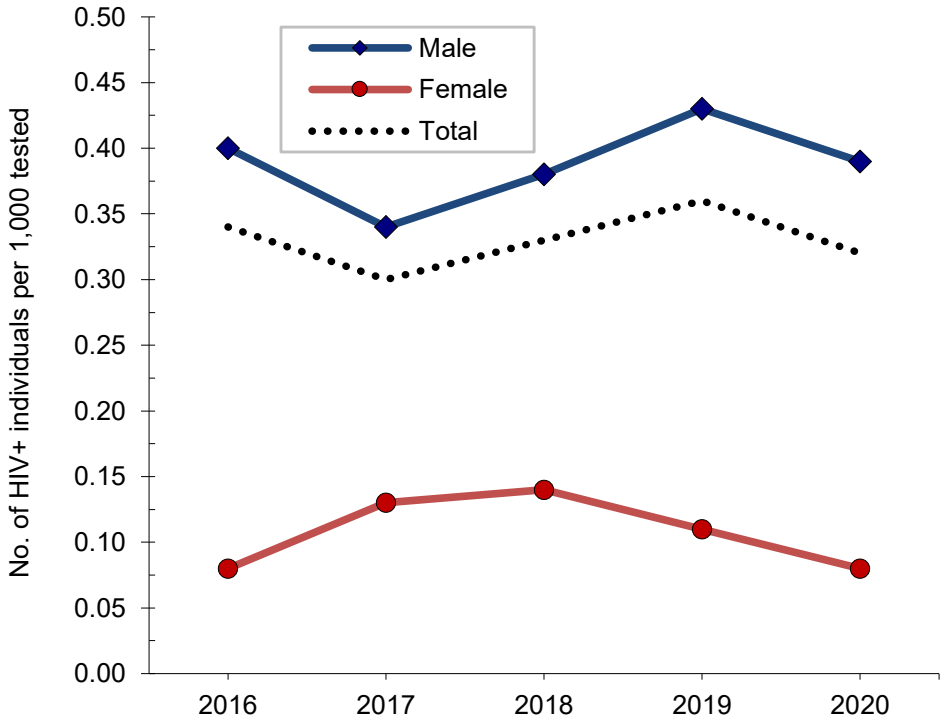
Active component: From January 2020 through June 2021, a total of 496,166 soldiers in the active component of the U.S. Army were tested for antibodies to HIV, and 108 soldiers were identified as HIV antibody positive (seroprevalence: 0.22 per 1,000 soldiers tested) **(Table 3)**. During the

TABLE 1. Diagnoses of HIV infections, by sex, civilian applicants for U.S. military service, January 2016–December 2020

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total HIV(+)	HIV(+) male	HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2016	250,223	244,124	193,343	50,781	**82**	78	4	**0.34**	0.40	0.08
2017	267,762	261,069	206,494	54,575	**78**	71	7	**0.30**	0.34	0.13
2018	266,750	258,592	201,611	56,981	**85**	77	8	**0.33**	0.38	0.14
2019	290,060	281,883	216,871	65,012	**101**	94	7	**0.36**	0.43	0.11
2020	279,002	267,602	208,279	59,323	**86**	81	5	**0.32**	0.39	0.08
Total	1,353,797	1,313,270	1,026,598	286,672	**432**	401	31	**0.33**	0.39	0.11

HIV, human immunodeficiency virus.

FIGURE 1. Diagnoses of HIV infection by sex, civilian applicants for U.S. military service, January 2016–December 2020



HIV, human immunodeficiency virus; No., number.

surveillance period, annual seroprevalences fluctuated between a low of 0.17 per 1,000 tested in 2017 and a high of 0.25 per 1,000 tested in 2021 **(Table 3, Figure 3)**. Annual seroprevalences for male active component soldiers were considerably higher than those of female active component soldiers **(Figure 3)**. During 2020, on average, 1 new HIV infection was detected among active component soldiers per 6,127 screening tests **(Table 3)**. Of the 386 active component soldiers diagnosed with HIV infections since 2016, a total of 241 (62.4%) were still in military service in 2021.

Army National Guard: From January 2020 through June 2021, a total of 288,231 members of the U.S. Army National Guard were tested for antibodies to HIV, and 84 soldiers were identified as HIV antibody positive (seroprevalence: 0.29 per 1,000 soldiers tested) **(Table 4)**. Among Army National Guard soldiers, annual seroprevalences decreased markedly from 2016 through 2018 (seroprevalences: 0.38 and 0.24 per 1,000 soldiers tested, respectively), increased in 2019 (0.30 per 1,000 tested) and 2020 (0.32 per 1,000 tested), and then decreased in the first 6 months of 2021 (0.23 per 1,000 tested). On average, during 2020, 1 new HIV infection was detected among Army National Guard soldiers per 3,535 screening tests. Of the 339 National Guard soldiers who tested positive for HIV since 2016, a total of 187 (55.2%) were still in military service in 2021.

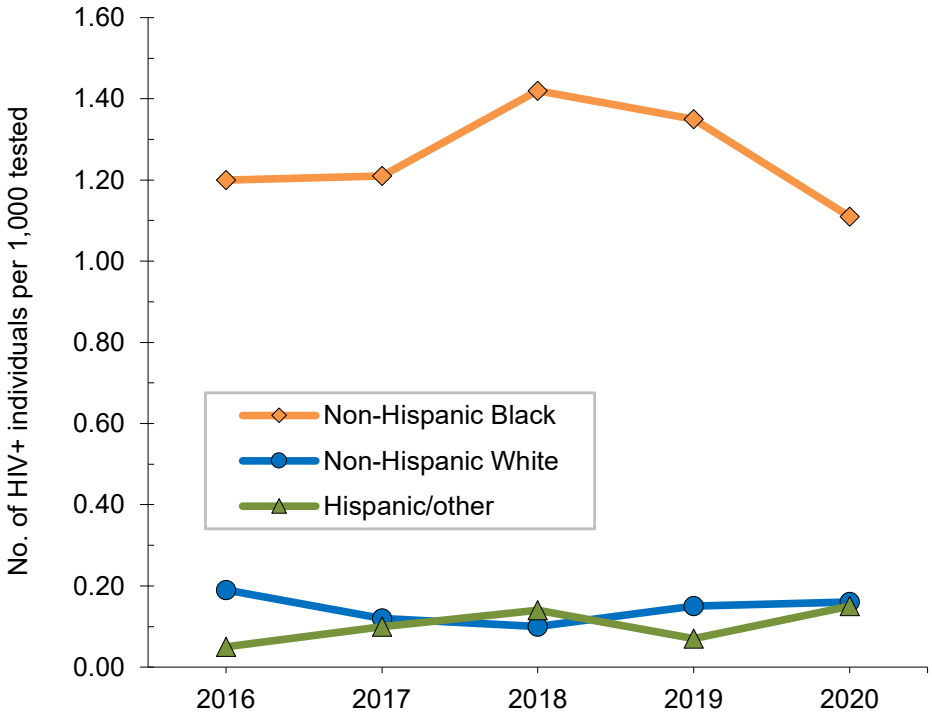
Army Reserve: From January 2020 through June 2021, a total of 155,752 members of the U.S. Army Reserve were tested for antibodies to HIV, and 42 soldiers were identified as HIV antibody positive (seroprevalence: 0.27 per 1,000 soldiers tested) **(Table 5)**. Among Army reservists during the surveillance period, seroprevalence was highest in 2016 at 0.40 per 1,000 tested, decreased slightly in 2017 to 0.38 per 1,000 tested, and then remained relatively stable through 2019. This pattern was followed by a considerable decrease in seroprevalence in 2020 (0.24 tested per 1,000), and an increase in seroprevalence in the first 6

TABLE 2. Diagnoses of HIV infections, by race/ethnicity, civilian applicants for U.S. military service, January 2016–December 2020

Year	Total HIV tests	Total persons tested	Non-Hispanic white tested	Non-Hispanic black tested	Hispanic/ others tested	Total HIV(+)	Non-Hispanic white HIV(+)	Non-Hispanic black HIV(+)	Hispanic/ others HIV(+)	Overall rate per 1,000 tested	Non-Hispanic white rate per 1,000 tested	Non-Hispanic black rate per 1,000 tested	Hispanic/ others rate per 1,000 tested
2016	250,223	244,124	141,357	43,198	59,569	**82**	27	52	3	**0.34**	0.19	1.20	0.05
2017	267,762	261,070	155,063	43,633	62,374	**78**	19	53	6	**0.30**	0.12	1.21	0.10
2018	266,750	258,595	153,151	43,102	62,342	**85**	15	61	9	**0.33**	0.10	1.42	0.14
2019	290,060	281,886	160,038	53,409	68,439	**101**	24	72	5	**0.36**	0.15	1.35	0.07
2020	279,002	267,603	160,589	46,883	60,131	**86**	25	52	9	**0.32**	0.16	1.11	0.15
Total	1,353,797	1,313,278	770,198	230,225	312,855	**432**	110	290	32	**0.33**	0.14	1.26	0.10

HIV, human immunodeficiency virus.

FIGURE 2. Diagnoses of HIV infections by race/ethnicity group, civilian applicants for U.S. military service, January 2016–December 2020



HIV, human immunodeficiency virus; No., number.

months of 2021 (0.33 per 1,000). During 2020, on average, 1 new HIV infection was detected among Army reservists per 4,815 screening tests **(Table 5)**. Of the 208 Army reservists diagnosed with HIV infections since 2016, a total of 125 (60.1%) were still in military service in 2021.

U.S. Navy

Active component: From January 2020 through June 2021, a total of 315,765 active component members of the U.S. Navy were tested for antibodies to HIV, and 59 sailors were identified as HIV antibody positive (seroprevalence: 0.19 per 1,000 sailors tested) **(Table 6)**. Among tested male active component sailors, full-year annual HIV antibody seroprevalences decreased 33.3% between 2016 and 2020 **(Figure 4)**. Annual seroprevalences remained relatively low and stable among female sailors between 2016 and 2020, with an uptick in the first 6 months of 2021. However, during each year of the surveillance period, only 1 to 2 female sailors tested positive. During 2020, on average, 1 new HIV infection was detected among active component sailors per 7,237 screening tests **(Table 6)**. Of the 282 active component sailors who tested positive for HIV since 2016, a total of 189 (67.0%) were still in military service in 2021.

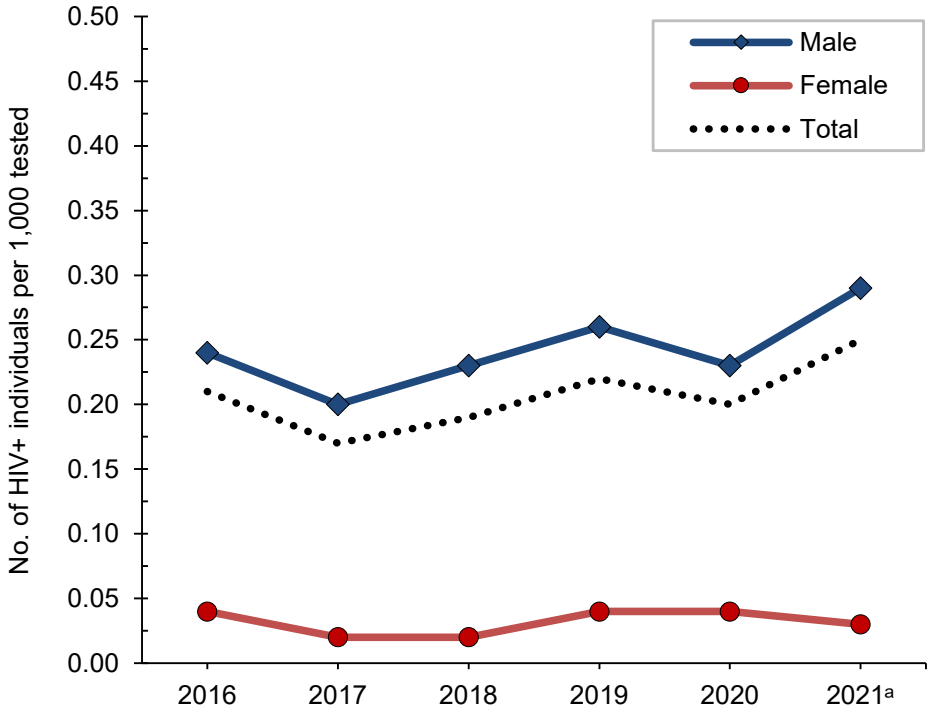
Navy Reserve: From January 2020 through June 2021, a total of 46,295 members of the U.S. Navy Reserve were tested for antibodies to HIV, and 13 sailors were identified as HIV antibody positive (seroprevalence: 0.28 per 1,000 sailors tested) **(Table 7)**. The HIV antibody seroprevalence among Navy reservists since 2016 peaked in the first 6 months of 2021 (seroprevalences: 0.38 per 1,000 sailors tested). Between 2008 and 2020, no female Navy reservist was detected with antibodies to HIV during routine testing **(data not shown)**. However, 1 female Navy reservist tested positive in the first 6 months of 2021. On average, during 2020, 1 new

TABLE 3. New diagnoses of HIV infections, by sex, active component, U.S. Army, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	428,275	349,748	297,395	52,353	**72**	70	2	**0.21**	0.24	0.04	31
2017	435,663	351,106	297,039	54,067	**61**	60	1	**0.17**	0.20	0.02	29
2018	450,608	351,344	296,747	54,597	**68**	67	1	**0.19**	0.23	0.02	35
2019	439,663	345,697	289,768	55,929	**77**	75	2	**0.22**	0.26	0.04	50
2020	398,272	322,275	269,932	52,343	**65**	63	2	**0.20**	0.23	0.04	53
2021[a]	187,263	173,891	144,803	29,088	**43**	42	1	**0.25**	0.29	0.03	43
Total	2,339,744	1,894,061	1,595,684	298,377	**386**	377	9	**0.20**	0.24	0.03	241

[a]Through 30 June 2021.

FIGURE 3. New diagnoses of HIV infections by sex, active component, U.S. Army, January 2016–June 2021



[a]Through 30 June 2021.
HIV, human immunodeficiency virus; No., number.

HIV infection was detected among Navy reservists per 5,047 screening tests **(Table 7)**. Of the 48 reserve component sailors diagnosed with HIV infections since 2016, a total of 38 (79.2%) were still in military service in 2021.

U.S. Marine Corps

Active component: From January 2020 through June 2021, a total of 188,391 members of the active component of the U.S. Marine Corps were tested for antibodies to HIV, and 29 Marines were identified as HIV antibody positive (seroprevalence: 0.15 per 1,000 Marines tested) **(Table 8)**. From January 2016 through June 2021, seroprevalences of antibodies to HIV remained relatively low and stable among routinely tested Marines **(Figure 5)**. During 2020, on average, 1 new HIV infection was detected among active component Marines per 7,389 screening tests **(Table 8)**. Of the 114 active component Marines diagnosed with HIV infections since 2016, a total of 58 (50.9%) were still in military service in 2021.

Marine Corps Reserve: From January 2020 through June 2021, a total of 29,776 members of the U.S. Marine Corps Reserve were tested for antibodies to HIV, and 6 Marine Corps reservists were identified as HIV antibody positive (seroprevalence: 0.20 per 1,000 Marines tested) **(Table 9)**. During the surveillance period, seroprevalences among Marine Corps reservists peaked at 0.33 per 1,000 tested in the first 6 months of 2021 and at 0.32 per 1,000 tested in 2017. Seroprevalence reached a low in 2020 at 0.11 per 1,000 tested. Of note, only 1 female Marine Corps reservist was detected with antibodies to HIV during routine screening in 2015; none were detected during 1990–2014 or during 2016–2021 (through June) **(data not shown)**. During 2020, on average, 1 new HIV infection was detected among Marine Corps reservists per 9,666 screening tests

TABLE 4. New diagnoses of HIV infections, by sex, U.S. Army National Guard, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	232,930	209,973	174,065	35,908	**80**	78	2	**0.38**	0.45	0.06	25
2017	235,671	205,401	170,175	35,226	**65**	63	2	**0.32**	0.37	0.06	24
2018	235,505	205,455	168,552	36,903	**50**	49	1	**0.24**	0.29	0.03	29
2019	235,066	202,964	165,330	37,634	**60**	60	0	**0.30**	0.36	0.00	36
2020	215,637	189,867	153,350	36,517	**61**	58	3	**0.32**	0.38	0.08	50
2021[a]	103,369	98,364	79,835	18,529	**23**	21	2	**0.23**	0.26	0.11	23
Total	1,258,178	1,112,024	911,307	200,717	**339**	329	10	**0.30**	0.36	0.05	187

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

TABLE 5. New diagnoses of HIV infections, by sex, U.S. Army Reserve, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	121,454	110,370	84,147	26,223	**44**	44	0	**0.40**	0.52	0.00	16
2017	119,373	108,249	82,686	25,563	**41**	40	1	**0.38**	0.48	0.04	16
2018	122,472	106,001	79,885	26,116	**39**	37	2	**0.37**	0.46	0.08	24
2019	125,894	109,318	81,950	27,368	**42**	40	2	**0.38**	0.49	0.07	31
2020	115,554	101,252	75,327	25,925	**24**	23	1	**0.24**	0.31	0.04	20
2021[a]	57,736	54,500	40,902	13,598	**18**	18	0	**0.33**	0.44	0.00	18
Total	662,483	589,690	444,897	144,793	**208**	202	6	**0.35**	0.45	0.04	125

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

TABLE 6. New diagnoses of HIV infections, by sex, active component, U.S. Navy, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	241,585	214,825	173,079	41,746	**54**	52	2	**0.25**	0.30	0.05	32
2017	249,270	219,408	174,722	44,686	**67**	66	1	**0.31**	0.38	0.02	31
2018	252,551	216,850	172,711	44,139	**47**	45	2	**0.22**	0.26	0.05	32
2019	258,388	223,012	176,065	46,947	**55**	54	1	**0.25**	0.31	0.02	39
2020	224,340	199,215	155,881	43,334	**31**	31	0	**0.16**	0.20	0.00	27
2021[a]	121,613	116,550	91,332	25,218	**28**	26	2	**0.24**	0.28	0.08	28
Total	1,347,747	1,189,860	943,790	246,070	**282**	274	8	**0.24**	0.29	0.03	189

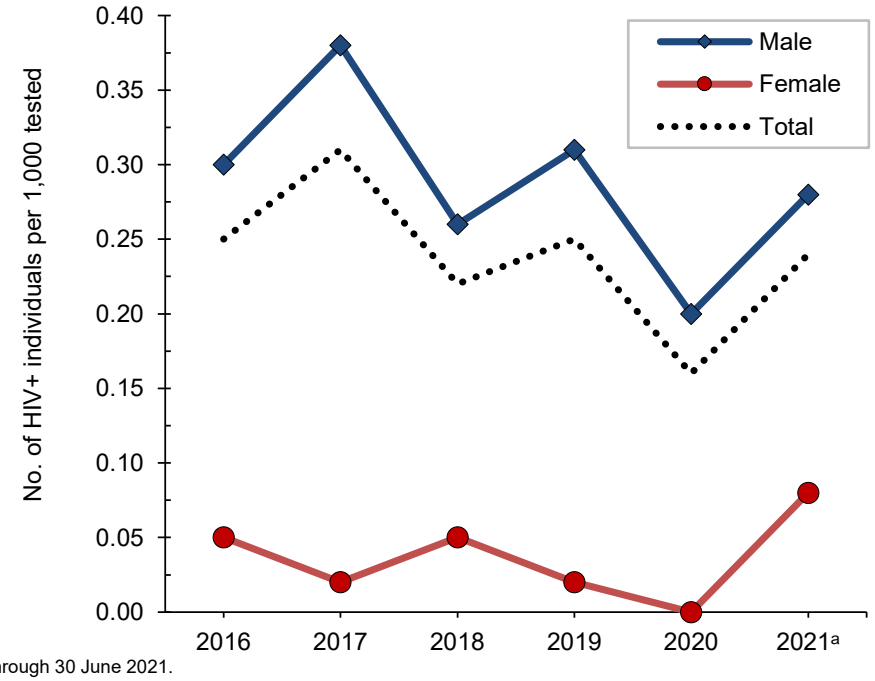
[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

(Table 9). Of the 27 Marine Corps reservists diagnosed with HIV infection since 2016, a total of 11 (40.7%) were still in military service in 2021.

U.S. Air Force

Active component: From January 2020 through June 2021, a total of 312,055 active component members of the U.S. Air Force were tested for antibodies to HIV, and 34 Air Force members were diagnosed with HIV infections (seroprevalence: 0.11 per 1,000 Air Force members tested) **(Table 10)**. During the surveillance period, seroprevalences among male members ranged from a high of 0.25 per 1,000 tested in 2016 to a low of 0.11 per 1,000 tested in 2020. **(Figure 6)**. Among female Air Force members during the surveillance period, annual seroprevalences remained relatively low

FIGURE 4. New diagnoses of HIV infections by sex, active component, U.S. Navy, January 2016–June 2021



[a]Through 30 June 2021.
HIV, human immunodeficiency virus; No., number.

TABLE 7. New diagnoses of HIV infections, by sex, U.S. Navy Reserve, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	41,693	35,990	28,173	7,817	**8**	8	0	**0.22**	0.28	0.00	6
2017	40,532	34,769	27,267	7,502	**8**	8	0	**0.23**	0.29	0.00	4
2018	37,855	33,385	25,751	7,634	**10**	10	0	**0.30**	0.39	0.00	9
2019	38,728	34,390	26,486	7,904	**9**	9	0	**0.26**	0.34	0.00	7
2020	30,281	27,846	21,155	6,691	**6**	6	0	**0.22**	0.28	0.00	5
2021[a]	19,385	18,449	14,058	4,391	**7**	6	1	**0.38**	0.43	0.23	7
Total	208,474	184,829	142,890	41,939	**48**	47	1	**0.26**	0.33	0.02	38

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

TABLE 8. New diagnoses of HIV infections, by sex, active component, U.S. Marine Corps, January 2016–June 2021

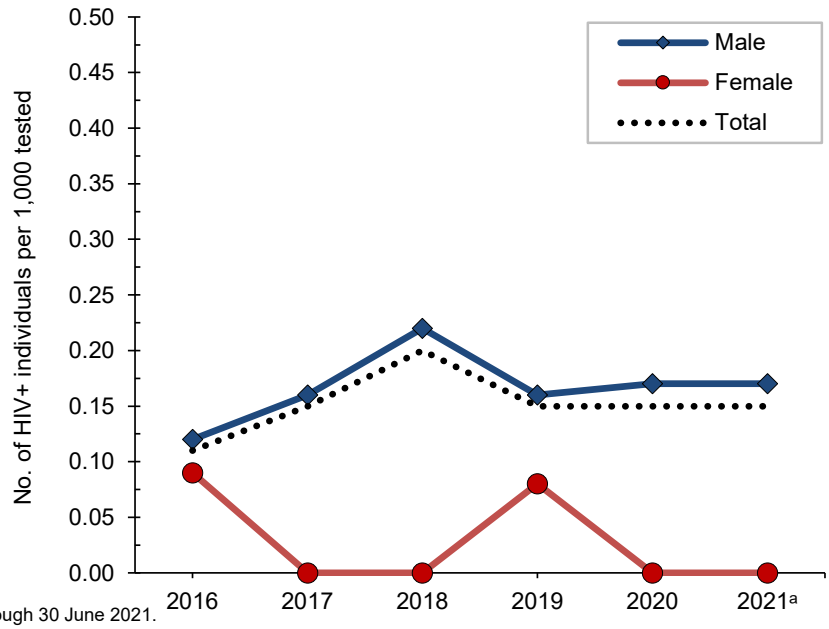
Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	159,466	139,677	128,126	11,551	**16**	15	1	**0.11**	0.12	0.09	4
2017	164,599	140,973	129,138	11,835	**21**	21	0	**0.15**	0.16	0.00	4
2018	157,613	135,989	123,702	12,287	**27**	27	0	**0.20**	0.22	0.00	11
2019	160,073	138,215	125,686	12,529	**21**	20	1	**0.15**	0.16	0.08	12
2020	140,392	123,485	112,373	11,112	**19**	19	0	**0.15**	0.17	0.00	17
2021[a]	68,132	64,906	58,508	6,398	**10**	10	0	**0.15**	0.17	0.00	10
Total	850,275	743,245	677,533	65,712	**114**	112	2	**0.15**	0.17	0.03	58

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

and stable. During 2020, on average, 1 new HIV infection was detected among active component Air Force members per 15,211 screening tests **(Table 10)**. Of the 170 active component Air Force members diagnosed with HIV infections since 2016, 101 (59.4%) were still in military service in 2021.

Air National Guard: From January 2020 through June 2021, a total of 92,632 members of the Air National Guard were tested for antibodies to HIV, and 11 Air National Guard members were diagnosed with HIV infections (seroprevalence: 0.12 per 1,000 Air National Guard members tested) **(Table 11)**. In 2020, 1 female Air National Guard member was detected with antibodies to HIV, the first since 2010 **(data not shown)**. During 2020, on average, 1 new HIV infection

FIGURE 5. New diagnoses of HIV infections by sex, active component, U.S. Marine Corps, January 2016–June 2021



[a]Through 30 June 2021.
HIV, human immunodeficiency virus; No., number.

TABLE 9. New diagnoses of HIV infections, by sex, U.S. Marine Corps Reserve, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	26,760	23,505	22,652	853	**6**	6	0	**0.26**	0.26	0.00	1
2017	28,809	25,364	24,470	894	**8**	8	0	**0.32**	0.33	0.00	0
2018	27,009	22,987	22,215	772	**4**	4	0	**0.17**	0.18	0.00	2
2019	28,200	24,835	23,936	899	**3**	3	0	**0.12**	0.13	0.00	2
2020	19,332	17,833	17,100	733	**2**	2	0	**0.11**	0.12	0.00	2
2021[a]	12,236	11,943	11,448	495	**4**	4	0	**0.33**	0.35	0.00	4
Total	142,346	126,467	121,821	4,646	**27**	27	0	**0.21**	0.22	0.00	11

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

TABLE 10. New diagnoses of HIV infections, by sex, active component, U.S. Air Force, January 2016–June 2021

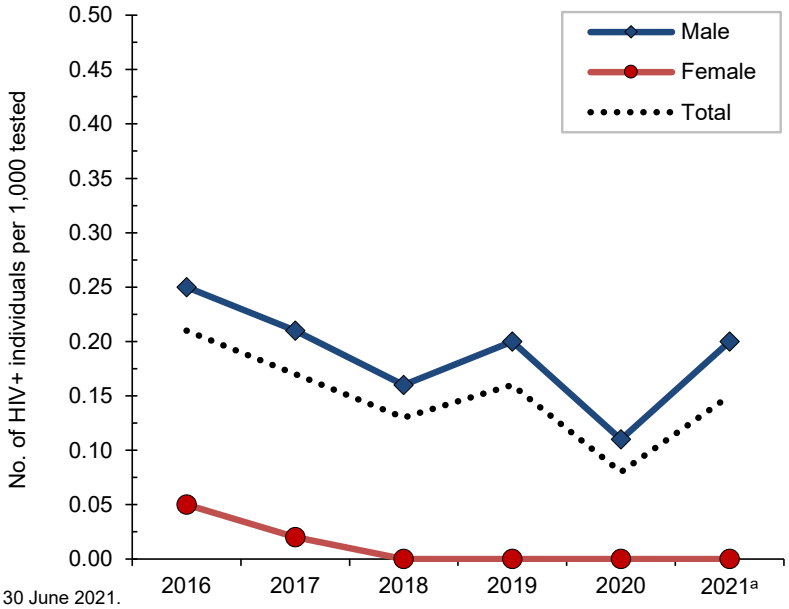
Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	242,827	196,486	157,837	38,649	**41**	39	2	**0.21**	0.25	0.05	21
2017	254,725	202,787	161,726	41,061	**35**	34	1	**0.17**	0.21	0.02	14
2018	258,664	207,702	164,676	43,026	**27**	27	0	**0.13**	0.16	0.00	12
2019	262,909	209,420	164,499	44,921	**33**	33	0	**0.16**	0.20	0.00	20
2020	243,383	194,124	152,053	42,071	**16**	16	0	**0.08**	0.11	0.00	16
2021[a]	127,760	117,931	91,490	26,441	**18**	18	0	**0.15**	0.20	0.00	18
Total	1,390,268	1,128,450	892,281	236,169	**170**	167	3	**0.15**	0.19	0.01	101

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

was detected among Air National Guard members per 11,319 screening tests **(Table 11)**. Of the 33 Air National Guard members diagnosed with HIV infections since 2016, 26 (78.8%) were still in military service in 2021.

Air Force Reserve: From January 2020 through June 2021, a total of 55,049 members of the Air Force Reserve were tested for antibodies to HIV, and 15 Air Force reservists were diagnosed with HIV infections (seroprevalence: 0.27 per 1,000 airmen tested) **(Table 12)**. During 2020, on average, 1 new HIV infection was detected among Air Force reservists per 6,490 screening tests **(Table 12)**. Of the 42 Air Force reservists diagnosed with HIV infections since 2016, 34 (81.0%) were still in military service in 2021.

FIGURE 6. New diagnoses of HIV infections by sex, active component, U.S. Air Force, January 2016–June 2021



[a]Through 30 June 2021.
HIV, human immunodeficiency virus; No., number.

TABLE 11. New diagnoses of HIV infections, by sex, U.S. Air National Guard, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	70,691	60,709	48,731	11,978	**6**	6	0	**0.10**	0.12	0.00	3
2017	67,843	58,819	46,915	11,904	**5**	5	0	**0.09**	0.11	0.00	4
2018	71,244	61,315	48,882	12,433	**4**	4	0	**0.07**	0.08	0.00	3
2019	67,339	58,867	46,280	12,587	**7**	7	0	**0.12**	0.15	0.00	5
2020	67,911	58,935	46,147	12,788	**6**	5	1	**0.10**	0.11	0.08	6
2021[a]	35,017	33,697	26,508	7,189	**5**	5	0	**0.15**	0.19	0.00	5
Total	380,045	332,342	263,463	68,879	**33**	32	1	**0.10**	0.12	0.01	26

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

TABLE 12. New diagnoses of HIV infections, by sex, U.S. Air Force Reserve, January 2016–June 2021

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2020
2016	41,176	36,453	26,796	9,657	**10**	10	0	**0.27**	0.37	0.00	7
2017	39,788	35,252	25,968	9,284	**6**	6	0	**0.17**	0.23	0.00	5
2018	41,402	36,816	26,973	9,843	**4**	4	0	**0.11**	0.15	0.00	2
2019	42,220	37,056	26,858	10,198	**7**	7	0	**0.19**	0.26	0.00	5
2020	38,938	33,941	24,605	9,336	**6**	6	0	**0.18**	0.24	0.00	6
2021[a]	21,985	21,108	15,314	5,794	**9**	8	1	**0.43**	0.52	0.17	9
Total	225,509	200,626	146,514	54,112	**42**	41	1	**0.21**	0.28	0.02	34

[a]Through 30 June 2021.
HIV, human immunodeficiency virus.

EDITORIAL COMMENT

The U.S. military has conducted routine screening for antibodies to HIV among all civilian applicants for service and all active and reserve component members of the services for more than 30 years.[2,3,5,6] Results of U.S. military HIV antibody testing programs have been summarized in the *MSMR* for more than 2 decades.[8]

This report documents that, since 2016, full-year prevalences of HIV seropositivity among civilian applicants for military service have fluctuated between 0.30 per 1,000 tested in 2017 and 0.36 per 1,000 applicants tested in 2019. It is important to note that because applicants for military service are not randomly selected from the general population of U.S. young adults, seroprevalences among applicants are not directly indicative of HIV prevalences, infection rates, or trends in the U.S. civilian population. As such, relatively low prevalences of HIV among civilian applicants for military service do not necessarily indicate low prevalences or incidence rates of HIV among young adults in the U.S. in general.

This report also documents that full-year HIV antibody seroprevalences among members of the active components ranged from 0.08 per 1,000 tested (Air Force, 2020) to 0.31 per 1,000 tested (Navy, 2017). Full-year seroprevalences among the reserve/Guard components fluctuated between 0.07 per 1,000 tested (Air National Guard, 2018) and 0.40 per 1,000 tested (Army Reserve, 2016); the greatest variations in full-year seroprevalences were observed among Marine Corps reservists. During the surveillance period, full-year seroprevalences among applicants for service were highest in 2019 (0.36 per 1,000 tested) and then decreased in 2020 (0.32 per 1,000 tested). Full-year seroprevalence peaked in 2019 for active component service members of the Army, in 2017 for the Navy, 2018 for the Marine Corps, and 2016 for the Air Force. Among

reserve and National Guard members, seroprevalence peaked in 2019 for the Air Force National Guard, 2016 for the Air Force reserve, in 2017 for the Marine Corps reserve, 2018 for the Navy reserve, and in 2016 for the Army National Guard and reserve. Overall (January 2016–June 2021) HIV antibody seroprevalences were highest among Army reservists, Army National Guard members, and Navy reservists and lowest among Air National Guard members, Marine Corps active component members, and Air Force active component members. Across active and reserve components of all services, seroprevalences continued to be higher among male than female service members.

There are several limitations that should be considered when interpreting the results of the current analysis. For example, because of the frequency of screening in the military (as an applicant, routinely every 2 years, and before and after overseas deployments), routine screening now detects relatively recently acquired HIV infections (i.e., infections acquired since the most recent negative test of each affected individual). As such, annual HIV-antibody seroprevalences during routine screening of military populations are reflective of, but are not direct unbiased estimates of, incidence rates and trends of acquisitions of HIV infections among military members.

In summary, the U.S. military has conducted comprehensive HIV prevention, education, counseling, and treatment programs for more than 30 years. Since the beginning of these programs, routine screening of all civilian applicants for service and routine periodic testing of all active and reserve component members of the services have been fundamental components of the military's HIV control and clinical management efforts.[9] Summaries of results of screening programs such as those in this report provide insights into the current status and trends of HIV's impacts in various U.S. military populations..

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