

Perceived Health Status and Medical Conditions Among US Active-Duty Service Members

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Purpose: This paper investigates the association between self-reported perceived health status and doctor-informed medical conditions among US active duty service members (ADSM).

Methods: Data are from the 2018 Health-Related Behaviors Survey – a cross-sectional survey weighted to represent the US military (N = 17166). Perceived good health status was defined as having a response choice of “good”, “very good”, or “excellent” to the question: Would you say your overall physical health is ____? Medical conditions were based on self-reported presence of nine clinical conditions. Analysis included weighted prevalence and log-binomial regression models to explore relationships between ADSM characteristics with perceived good health status as well as concordance between perceived status and medical conditions.

Results: ADSM rated their health to be excellent (14.6%), very good (37.7%), good (36.2%), fair (9.7%) and poor (1.7%). About 88.5% perceived a good (to excellent) health status. Perceived good health status was negatively associated with the number of medical conditions present (adjusted odds ratio (aOR): ranging from 0.78 to 0.92) as well as several health behaviors (aOR): ranging from 0.86 to 0.98) and other sociodemographic factors. Among all ADSMs, 51% perceived good health in the absence of medical conditions, while 8% perceived poor health status in the presence of medical conditions. Concordance between perceived health status and medical conditions was significantly lower among ADSM who were older (aOR: 0.61; 95% CI: 0.54–0.69), with dependent children (aOR: 0.89; 95% CI: 0.84–0.95), or had been deployed (aOR: 0.89, 95% CI: 0.84–0.95).

Conclusion: The prevalence of perceived good health status among ADSMs was consistent with those documented in the general US population. The interrelationships between ADSM's perceptions, medical conditions and sociodemographic characteristics may have implications for their health literacy and utilization of health services. Study findings suggest that interventions promoting healthy behaviors, health literacy and treatment-seeking may influence perceived health status and mitigate medical conditions among ADSM, thus improving the US Military readiness, resilience and mission success.

Keywords: active duty service members, health status, medical conditions, risk behaviors, United States

Introduction

Self-reported indices of health status or have been frequently used in health surveys.^{1,2} Perceived health status is usually measured by asking the individual to rate their health on a four- or five-point ordinal scale or in comparison to peers.^{3,4} Such evaluations are typically based on a person's subjective assumption about their physical, mental and social well-being in addition to actual information about the diseases or injuries they have.⁵ Self-perceived health has been used to evaluate population-level health status, health inequities and general health care needs among diverse populations.^{1–5}

Perceived Health Status in the US

According to the National Center for Health Statistics in 2020, about 14% of Americans rated their health as fair or poor in general, ranking the US low among high-income countries.⁶ In addition, self-perceived poor health in the US varied substantially by sex, age, region, socioeconomic status and race. Specifically, perceived poor health was higher among adults 65 years or older, females and race/ethnic minority groups.⁷ Although perceived health status is often used as a proxy measure for disease and health behavior, research has demonstrated discordance between perceived and actual

health status in the US.^{8,9} Higher levels of this discordance have been reported among older, wealthier and ethnic minority sub-groups.^{8,9}

Review of Relevant Literature

Evidence indicates positive psychological states—such as having a sense of purpose, being satisfied with life, or having a sense of optimism—are associated with good physical and mental health, a key principle of positive epidemiology.¹⁰ Self-perceived health status is demonstrated to be a valid predictor of actual health status and outcomes.¹¹ Perceived health status could also be considered a proxy for psychosocial constructs in behavioral theories such as the Health Belief Model¹² and Theory of Planned Behavior,¹³ used to understand population-level health behaviors. Specifically, perceived health status may be a measure of perceived vulnerability (susceptibility to adverse health outcomes) and perceived severity (how serious such adverse outcomes would be in the event that they occur).¹⁴ Perceived health status may also reflect perceived community norms such regarding the population health status as well as personal values related to health. Thus, perceived health status may not only reflect actual health status but also a correlate of health behavior such as substance use or risky sexual behaviors.¹⁵

Study Rationale

The active-duty military population is generally considered to be fitter than the general population. Lower rates of obesity (18 versus 37%) and hypertension (13% versus 30%) were seen among ADSM compared to the overall US population.^{16,17} It is unclear the extent to which the prevalence and correlates of perceived health status would be similar across US military and general populations. Limited research among active duty Air Force recruits and Army personnel suggests that perceived health status was associated with harmful substance use, obesity, depression, poor sleep quality as well as outcomes such as increased risk of future hospitalization and illness-related ambulatory care visits.^{18,19} In addition, military members may be in a unique position to have differences in perceived versus actual health status due to prevailing expectations of health standards and ideals of self-image.²⁰ However, no study has systematically explored the concordance between perceived health status and presence of medical conditions or the interconnections between self-perceived, actual health status and risk behaviors among all the Nation's servicemen and women including the US Air Force, Army, Marine Corps, Navy and Coast Guard.

Study Aims and Conceptual Framework

The primary aim is to assess demographic, medical and behavioral risk factors associated with perceived health status among active duty military. The secondary aim is to explore the concordance between perceived health status and actual medical conditions as well as its correlates among ADSM. This analysis will enhance our current understanding of the utility, correlates and interpretation of self-perceived health status and inform the design of relevant preventive measures and provide recommendations that may support the design of timely health or behavioral interventions for service members.

The study's conceptual framework draws from available data in the Health-Related Behaviors Survey (HBRS) as well as psychosocial constructs from behavioral theories such as the Health Belief Model and Theory of Reasoned Action. Using a positive epidemiologic approach focused on health assets and a broader range of health-related states,¹⁰ the study hypothesizes relationships between measures available in HBRS such as sociodemographic factors, risk behaviors, medical conditions and perceived health status as shown in Figure 1. We posit perceived good health status is negatively associated with the presence of medical conditions and engagement in risk behaviors. In addition, sociodemographic factors of ADSM such as their age, sex, race and ethnicity, housing status, education, etc., may be distal factors influencing perceived health status.²¹ The study hypothesizes that perceived good health status is negatively associated with older age, race/ethnic minorities, lower socioeconomic or education levels. We also hypothesize that an arbitrary proportion of three quarters of ADSM would demonstrate concordance between their perceived health status and medical conditions.

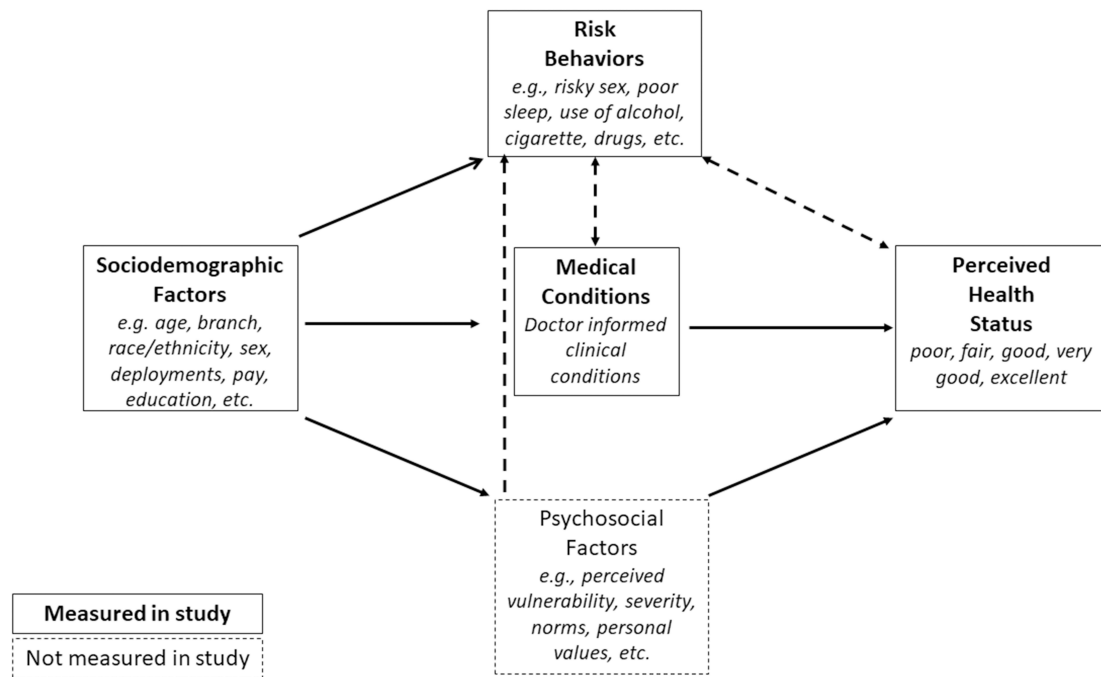


Figure 1 Study Conceptual Framework Showing Relationships between Perceived Health Status, Medical Conditions and Risk Behaviors.

Materials and Methods

Study Design and Population

The Health-Related Behaviors Survey (HRBS) is a recurring cross-sectional survey instituted by the Department of Defense (DoD) since 1980 and currently sponsored by the Defense Health Agency (DHA). It is the DoD's flagship survey for understanding the health, health-related behaviors, and well-being of service members which utilizes existing, validated measures that facilitate comparisons with civilian populations.²² The 2018 HRBS is the most recent iteration for which publicly available data have been released. This study excludes the reserve (not on active duty) component. The total sampling frame was 1,357,219 active component service members. The sampling frame utilized 50 strata based on the interaction of service branch (five categories), pay grade (five categories), and gender (two categories). By considering anticipated response rates that differ across these strata, the sampling plan attempted to minimize the survey design effect (ie, loss of precision). From the sampling frame of 1,357,219 service members, 199,996 active-duty service members were approached to complete the online survey. A total of 17,166 surveys were completed, resulting in a weighted response rate of 9.6% (N = 17,166 ADSM). First, design weights were employed to counteract the survey design, which slightly oversampled Marines, women, and junior enlisted personnel to guarantee enough of those groups to yield reliable estimates. Next, nonresponse weights were used to make the respondents representative of those who were selected for sampling. The final analytic weights were the product of the design and nonresponse weights to make the analytic sample representative of the eligible service member population. Missing data typically introduce bias due to unreported values being systematically different from reported ones. However, the missingness rates in the HRBS 2018 data ranged from less than 0.1% to 7%, and this was addressed by imputation to result in a data set that is more representative of the inferential population and makes more-efficient use of the available data for all cases even where they did not complete every survey item.²²

Measurements

Perceived Health Status

The HRBS includes the question: "Would you say your overall physical health is ___?" Response options were excellent, very good, good, fair or poor. This variable was explored as an ordinal variable as well as dichotomized into perceived good (good to excellent) versus poor (fair or poor) health status in keeping with other relevant nationally representative research.^{23,24}

Medical Conditions

This was self-reported based on 8 survey questions: “In the PAST 12 MONTHS has a doctor or other health professional told you that you had”: i) High blood pressure; ii) High blood sugar or diabetes; iii) High cholesterol; iv) Asthma; v) Angina or coronary heart disease; vi) Heart attack; vii) Back pain; viii) Bone, joint, or muscle injury or condition. Obesity was based on the self-reported height (inches) and weight (pounds) of ADSM ($BMI > 30 \text{ kg/m}^2$).²² The number of doctor-informed medical conditions and obesity status were explored as continuous (ranging from 0 to 9), categorical (none, 1–2, 3+) and dichotomous variables (0 versus 1+ conditions). This manuscript focuses on self-reported data, typically considered subjective instead of the more objective confirmed medical status, because this is a secondary analysis of confidential survey data that is not linked to the medical records of participants.

Mental Health Status

The HRBS also included a measure of an ADSM’s mental health based on the validated Kessler Mental Health Scale (K6) battery of questions to assess nonspecific serious psychological distress.²⁵ The score ranges between 0 and 24 with “serious distress” being identified as a mean K6 score greater than 12.

Risky Behaviors

This included the following five short-term and two long-term self-reported behaviors within the past 30 days and 12 months, respectively:

1. Infrequent physical activity and/or strength training in the past 30 days defined as less than three days per week of strength training, moderate or vigorous physical activity.
2. Screen time (spent using a device with a screen for activities other than for work or school) over than two hours/day in past 30 days.
3. Bad sleeping habits in past 30 days defined as a composite measure of all of the following: a) sleeping less than seven hours/day, b) self-rated quality of sleep as insufficient, c) the use of prescription medications to go to sleep, d) use of energy drinks, caffeinated beverages, or over-the-counter medications to stay awake.
4. Weekly binge drinking of alcohol in the past 30 days. This is defined as consumption of five or more drinks on the same occasion for men and consumption of four or more drinks on the same occasion for women.
5. Current smoker or substance (marijuana or hashish, synthetic cannabis, other illegal drugs, inhalants, synthetic stimulants, non-prescription cough or cold medicine to get high) user in past 30 days.
6. No visit to the doctor for a routine checkup in past 12 months.
7. Risky sexual behavior in past 12 months defined as two or more sexual partners or sex with a new partner without a condom.

Covariates

These included sociodemographic variables identified from the literature or a priori understanding to be associated with risk behaviors and health outcomes. They included i) service branch, ii) sex, iii) age group, iv) pay grade, v) race/ethnicity, vi) education level, vii) marital status, viii) having dependent children, ix) number of deployments, x) current housing status and xi) sexual orientation (lesbian, gay or bisexual versus not).

Statistical Analysis

Weighted prevalence and standard error (SE) were reported for the ADSM characteristics, perceived health status and doctor-informed medical conditions. Bivariate associations were tested using weighted Rao-Scott tests. Concordance in actual versus perceived health status was explored based on dichotomous variables of perceived health (good (defined as good, very good or excellent) versus poor (defined as fair or poor) and medical conditions (0 versus 1+ conditions). Crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated using weighted log-binomial regression models to assess associations between ADSM characteristics and perceived good health status as well concordance between health status and the presence of medical conditions (defined as perceived good health in the absence of medical conditions or perceived less than good health status in the presence of medical conditions). Adjusted

models controlled for all the sociodemographic covariates listed above. This model was used due to the high prevalence of perceived good health status. Ordered logistic regressions were used to explore the associations between ADsM characteristics and perceived health status as an ordinal variable. Statistical significance was set at 0.05 for all statistical tests. STATA 17.0 (College Station, TX: StataCorp LLC.) and SAS 9.4 (RTI International, Research Triangle Park, NC) were employed to confirm all analyses.

Results

Description of Study Population

Table 1 shows the characteristics of the study population of ADsMs by their perceived health status. ADsM were mostly male (83.3%), less than 35 years old (77.7%), with a high school level of education or less (64.4%), non-Hispanic White (57.6%), with no dependent children (60.3%), and deployed at least once (60.4%). Of note, 14.6% of ADsM perceived their health status to be excellent, 37.7% considered their status was very good, 36.2% thought their status was good, while 9.7% identified their status as fair and 1.7% described it as being poor. Thus, 88.5% perceived their health status to be good (or very good or excellent), while 11.5% perceived their health status to be poor (or fair). In addition, the majority of ADsM characteristics differed significantly by perceived health status.

Table 1 ADsM Characteristics by Their Perceived Health Status, 2018 Department of Defense Health-Related Behaviors Survey (N = 17166)

ADsM Characteristics	Total	Perceived Health Status				
	Unweighted N (Weighted %)	Excellent % (SE)	Very Good % (SE)	Good % (SE)	Fair % (SE)	Poor % (SE)
Overall N (%)	N=17166 (100%)	N=2512 (14.6%)	N=6475 (37.7%)	N=6212 (36.2%)	N=1537 (9.7%)	N=297 (1.7%)
Sex						
Male	11,813 (83.3)	15.3(0.5)***	38.2(0.7)*	35.5(0.7)**	9.2(0.4)***	1.7(0.2)
Female	5353 (16.7)	11.3(0.6)	35.3(1)	39.6(1)	12.2(0.7)	1.7(0.3)
Service Branch						
Army	3646 (34.5)	15.5(1)***	36.3(1.3)***	35(1.3)**	11.1(0.9)***	2.2(0.4)**
Air Force	5579 (24.1)	16.9(0.6)	41.6(0.8)	34.6(0.7)	6.2(0.4)	0.7(0.1)
Marine Corps	2569 (13.9)	11.8(0.9)	38.7(1.4)	35.5(1.4)	11.9(0.9)	2.1(0.5)
Navy	3675 (24.4)	13.1(0.9)	34.7(1.2)	39.6(1.3)	10.5(0.8)	2.1(0.4)
Coast Guard	1697 (3.2)	11.5(0.9)	42.5(1.4)	39(1.4)	6.2(0.7)	0.8(0.2)
Pay Grade						
Enlisted 1–4	4444 (42.4)	15.6(0.9) ***	35.7(1.1)***	36.3(1.1)***	10.4(0.8)***	2.1(0.4)**
Enlisted 5–6	4585 (29.8)	10.7(0.6)	36.9(1)	39.6(1)	11(0.7)	1.8(0.3)
Enlisted 7-Warrant Officer 5	3125 (11.3)	7.2(0.6)	34.9(1.1)	44(1.2)	12(0.7)	1.9(0.3)
Officer 1–3	2469 (10.1)	25.8(1.2)	46.9(1.3)	22.9(1.1)	3.9(0.5)	0.5(0.2)
Officer 4–6	2543 (6.3)	22.4(1)	45.5(1.1)	27(1)	4.6(0.4)	0.5(0.1)

(Continued)

Table 1 (Continued).

ADSM Characteristics	Total	Perceived Health Status				
	Unweighted N (Weighted %)	Excellent % (SE)	Very Good % (SE)	Good % (SE)	Fair % (SE)	Poor % (SE)
Age Group in years						
17–24	3642 (37.8)	16.7(1)***	36.5(1.2)*	35.7(1.2)***	9.2(0.8)	1.9(0.4)
25–34	6467 (39.9)	14.2(0.6)	39.9(0.8)	34.7(0.8)	9.7(0.6)	1.6(0.3)
35–44	5311 (18.3)	11.1(0.5)	35.5(0.8)	41(0.8)	10.7(0.5)	1.8(0.3)
45+	1746 (4.0)	15(1.1)	37.7(1.4)	34.4(1.6)	11.4(0.9)	1.6(0.3)
Education Level						
High School or less	7990 (64.4)	13.2(0.7)***	35.6(0.8)***	37.7(0.9)***	11.4(0.6)***	2.1(0.3)**
Some College	2625 (12.8)	11(0.8)	37.7(1.2)	41(1.2)	8.8(0.7)	1.5(0.4)
≥Bachelor's Degree	6301 (21.6)	20.3(0.7)	43.7(0.8)	29.5(0.7)	5.6(0.3)	0.8(0.2)
Unknown	250 (1.2)	29.9(4.9)	42.8(5.2)	23.8(6.9)	3.5(1.4)	0(0)
Race and Ethnicity						
White	10,666 (57.6)	15.4(0.6)	39.4(0.8)**	35.3(0.8)	8.5(0.5)***	1.5(0.2)
Black	2226 (16.2)	12.2(1.1)	32.6(1.5)	39.9(1.7)	13.2(1.2)	2.1(0.5)
Hispanic	2459 (16.0)	14.6(1.3)	37.8(1.6)	35.2(1.5)	10.8(1)	1.6(0.5)
Other	1747 (9.5)	13.9(1.5)	36.3(1.8)	36.6(1.7)	10.3(1)	2.8(0.7)
Unknown	68 (0.7)	23.5(10.1)	33.7(8.9)	40.5(11.8)	2.3(1.8)	0(0)
Marital Status						
Married	10,776 (53.8)	13.5(0.5)***	37.1(0.7)	37.7(0.7)**	10(0.5)***	1.6(0.2)
Cohabiting	1042 (7.8)	15.3(1.7)	38.1(2.4)	35.9(2.3)	9.1(1.2)	1.5(0.7)
Separated, Divorced, or Widowed	1284 (6.3)	10.1(1.3)	33.5(2)	38.8(2.2)	14.9(1.9)	2.7(0.8)
Never Married	4064 (32.1)	17.2(1.1)	39.5(1.3)	33.2(1.2)	8.4(0.7)	1.8(0.4)
Dependent Children						
No	8629 (60.3)	16.4(0.7)***	38.3(0.9)	34.4(0.8)***	9.1(0.5)*	1.8(0.3)
Yes	8537 (39.7)	12(0.5)	36.8(0.7)	38.9(0.8)	10.7(0.6)	1.6(0.2)
Deployments						
Never	5550 (39.6)	18.1(0.9)***	38.1(1.1)	33.4(1.1)***	8.5(0.7)*	1.9(0.4)
One time	2692 (19.3)	12.8(1)	37.2(1.4)	37.9(1.5)	10.6(1)	1.5(0.5)
Two times	2102 (12.7)	13.6(1.2)	37.6(1.5)	35.6(1.6)	11.6(1.1)	1.5(0.4)
Three or more times	6822 (28.4)	11.5(0.5)	37.6(0.8)	39.2(0.8)	10(0.5)	1.8(0.2)

(Continued)

Table 1 (Continued).

ADSM Characteristics	Total	Perceived Health Status				
	Unweighted N (Weighted %)	Excellent % (SE)	Very Good % (SE)	Good % (SE)	Fair % (SE)	Poor % (SE)
Housing Status						
Living in Dorms/Barracks on Installation	2244 (23.7)	17.3(1.4)*	39.4(1.6)*	33.7(1.5)*	8(0.8)***	1.6(0.4)*
Other Housing on Installation	2481 (14.6)	14.3(1.1)	36.5(1.4)	39(1.5)	9.8(1)	0.4(0.1)
Housing Off Installation	12,191 (58.8)	14(0.5)	38.1(0.6)	36(0.7)	9.9(0.5)	2(0.2)
Other Living Situation	250 (2.9)	7.1(2.9)	22.4(4.1)	46.9(5.4)	20.4(4.4)	3.2(2.2)
Sexual orientation (lesbian, gay or bisexual)						
No	15,930 (93.7)	15.0 (0.5)**	37.6 (0.6)	36.1 (0.6)	9.6 (0.4)	1.7 (0.2)
Yes	1236 (6.3)	10.0 (1.4)	38.8 (2.2)	38.0 (2.1)	11.6 (1.3)	1.7 (0.5)

Notes: *p<0.05; **p<0.01; ***p<0.001 chi-square tests of association between each level of perceived health status and ADSM characteristics. Abbreviations: SE, standard error.

Medical Conditions and Risk Behaviors by Perceived Health Status

Table 2 highlights the prevalence of doctor-informed medical conditions and risk behaviors among ADSMs as well as by their perceived health status. The most prevalent medical conditions were bone, joint, or muscle injury or condition (26.4%), back pain (24.6%), obesity (14.4%) and high blood pressure (9.1%). Other medical conditions included high

Table 2 Medical Conditions and Risk Behaviors Among ADSM by Their Perceived Health Status, 2018 Department of Defense Health-Related Behaviors Survey (N = 17,166)

ADSM Characteristics	Total	Perceived Health Status				
	Unweighted N (Weighted %)	Excellent %(SE)	Very Good %(SE)	Good % (SE)	Fair % (SE)	Poor % (SE)
Overall N (%)	N = 17166 (100%)	N = 2512 (14.6%)	N = 6475 (37.7%)	N = 6212, (36.2%)	N = 1537, (9.7%)	N = 297 (1.7%)
Medical Conditions						
High blood pressure	1749 (9.1)	5.4(0.8)***	28.1(1.7)***	44.0(1.9)***	17.1(1.4)***	5.4(0.9)***
High blood sugar or diabetes	229 (0.9)	8.6 (3.0)	18.1(3.9)***	43.6(6.1)	15.9(3.0)*	13.7(4.7)***
High cholesterol	1076 (4.2)	8.4(1.3)***	27.2(2.0)***	44.0(2.3)***	16.1(1.6)***	4.3(0.8)***
Asthma	322 (1.7)	5.2(1.7)***	28.7(4.1)*	38.1(4.3)	20.3(3.4)***	7.7(2.7)***
Angina or coronary heart disease	60 (0.3)	17.7(8.8)	14.0(4.7)***	30.1(9.1)	30.1(9.1)**	8.2(3.7)***
Heart attack	23 (0.1)	37.1(15.2)*	2.3(2.3)***	21.0(10.5)	26.5(12.4)*	13.1(7.0)***
Back pain	4596 (24.6)	5.3(0.6)***	29.1(1.0)***	43.4(1.2)***	18.5(1.0)***	3.7(0.5)***
Bone, joint, or muscle injury or condition	5130 (26.4)	6.3(0.6)***	28.7(1.0)***	43.4(1.1)***	18.3(1.0)***	3.4(0.5)***
Obesity	2467 (14.4)	16.4(0.5)***	39.8(0.7)***	33.8(0.6)***	8.6(0.4)***	1.4(0.2)***

(Continued)

Table 2 (Continued).

ADSM Characteristics	Total	Perceived Health Status				
	Unweighted N (Weighted %)	Excellent % (SE)	Very Good % (SE)	Good % (SE)	Fair % (SE)	Poor % (SE)
Mental Health Status						
Mean K6 score (mean (SE))	1240 (4.4)	2.2(0.1)***	3.2(0.1)***	5.2(0.1)*	8.3(0.3)***	12.3(0.7)***
Behaviors						
Infrequent physical activity/ strength training in past month	3775 (19.3)	5.3(0.6)***	24.3(1.1)***	46.4(1.3)***	19.1(1.1)***	5.0(0.6)***
Screen time over than 2 hours/day in past month	10,091 (65.0)	12.5(0.6)***	36.9(0.8)*	38.2(0.8)***	10.6(0.5)**	1.8(0.3)
Bad sleeping habits in past month	8825 (53.1)	10.2(0.6)***	33.3(0.8)***	41.7(0.9)***	12.5(0.6)***	2.3(0.3)**
Heavy alcohol drinking in past month	1336 (9.8)	11.9(1.5)	31.8(2.0)**	37.7(2.0)	14.9(1.6)***	3.7(0.8)
Current smoker or substance user in past month	2302 (18.6)	9.5(1.1)*	32.7(1.5)***	40.5(1.6)**	14.7(1.2)***	2.6(0.6)*
No routine checkup in past 12 months	4494 (29.7)	13.3(0.9)	35.2(1.2)**	38.2(1.2)*	11.6(0.9)**	1.8(0.4)
Risky sexual behavior in past 12 months	6391 (41.7)	13.9(0.7)	36.8(1.0)	37.1(1.0)	10.5(0.6)	1.7(0.3)

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ chi-square tests of association between each level of perceived health status and presence versus absence of ADSM characteristics. **Abbreviations:** ADSM, active duty service member; K6, Kessler Mental Health Scale; SE, standard error.

cholesterol (4.2%), asthma (1.7%), high blood sugar (0.9%), angina or coronary heart disease (0.3%), and heart attack (0.1%). Furthermore, there was a significant association between all medical conditions and ADSM perceived health status. The overall mental health distress (mean k6) score was 5.7 (range 0 to 24). With regard to risk behaviors, many ADSM had high levels of screen time use (65.0%), bad sleeping habits (53.1%) in the past month, while 41.7% reported risky sexual behavior in the past year and 29.7% did not have a routine health check-up in the past year.

Figure 2 summarizes the average number of medical conditions and risk behaviors among ADSMs by their perceived health status. As perceived health status changed from excellent to poor, the percentage of ADSMs with no medical conditions reduced (78% to 19%), while the percentage with three or more conditions increased (2% to 31%). Similarly, the percentage of ADSMs engaging in three or more risk behaviors increased from 35% to 57% among those who perceived their health status to be excellent and poor, respectively.

ADSM Characteristics Associated with Perceived Good Health Status

Table 3 shows the crude and adjusted odds ratios using logistic regressions of ADSM characteristics associated with perceived good health status. Sociodemographic factors positively associated with perceived good health included being in the Air Force, Navy, and Coast Guard compared with the Army, increasing pay grade and levels of education. Conversely, being female, older age, and Black, and housing off the installation were associated with reduced odds of perceiving good health status.

The likelihood of perceiving good health status was lower as the number of medical conditions increased from zero to one/two (adjusted odds ratio (aOR): 0.92; 95% Confidence Interval (CI): 0.92, 0.94) and to three or more medical conditions (aOR: 0.78; 95% CI: 0.74, 0.82).

In addition, a K6-score greater than 12 and many risk behaviors were associated with reduced odds of perceiving a good health status (aOR ranging from 0.98 among ADSM with bad sleeping habits to an aOR of 0.86 among ADSM



Figure 2 Number of Medical Conditions and Risky Behaviors among US Active Duty Service Members by their Perceived Health Status, 2018 Department of Defense Health-Related Behaviors Survey (N = 17,166).

with reduced physical activity/strength training). On the other hand, screen time, heavy alcohol drinking or risky sexual behavior were not significantly associated with perceived good health status. Additional results from ordered logistic regression of perceived health as an ordinal variable by ADSM characteristics are presented in [Supplemental Table 1](#). Similarly, perceived health status was progressively better (each unit increase from poor to excellent) with increasing pay grade and education level, worsening with presence of medical conditions and engagement in risk behaviors.

Concordance in Perceived Health Status and Medical Conditions

[Figure 3](#) displays the concordance between perceived health status and medical conditions. Among all ADSMs, 50.8% accurately perceived good health (in the absence of medical conditions), 37.8% inaccurately perceived or overestimated their good health (perceived good health with medical conditions present), 8.3% accurately perceived less than good health status (in the presence of medical conditions), while 3.1% inaccurately perceived or underestimated their poor health (perceived poor health in the absence of medical conditions). Of note, the correlation between presence of medical conditions and perceived good health status was 0.40.

[Table 4](#) presents the crude and adjusted odds ratios of concordance between ADSM perceived health status and medical conditions. Concordance is defined as perceived good health in the absence of medical conditions or perceived less than good health status in the presence of medical conditions. Factors associated with increased odds of concordance included coast guard service branch (aOR: 1.14; 95% CI: 1.06–1.21), Officer 1–3 pay grade (aOR: 1.10; 95% CI: 1.02–

Table 3 Crude and Adjusted Odds Ratios of Perceived Good Health, 2018 Department of Defense Health-Related Behaviors Survey (N = 17166)

ADSM Characteristics	OR	(95% CI)	aOR ^a	(95% CI)
Sex				
Male	1.00	N/A	1.00	N/A
Female	0.97***	0.95–0.99	0.98*	0.96–0.99
Service Branch				
Army (ref)	1.00	N/A	1.00	N/A
Air Force	2.06***	1.70–2.50	1.05*	1.03–1.07
Marine Corps	0.94	0.74–1.18	0.99	0.96–1.02
Navy	1.06	0.85–1.33	1.04**	1.01–1.07
Coast Guard	2.01***	1.54–2.62	1.07***	1.04–1.09
Pay Grade				
Enlisted 1 - Enlisted 4 (ref)	1.00	N/A	1.00	N/A
Enlisted 5 - Enlisted 6	1.00	0.97–1.02	1.03	1.00–1.07
Enlisted 7-Warrant Officer 5	0.98	0.96–1.01	1.04**	1.00–1.08
Officer 1 - Officer 3	1.09***	1.07–1.12	1.05**	1.01–1.08
Officer 4 - Officer 6	1.08***	1.06–1.11	1.08***	1.04–1.12
Age Group in years				
17–24 (ref)	1.00	N/A	1.00	N/A
25–34	1.00	0.98–1.02	0.97	0.94–1.00
35–44	0.99	0.96–1.01	0.95**	0.91–0.98
45+	0.98	0.95–1.01	0.94**	0.90–0.98
Education Level				
High School or less (ref)	1.00	N/A	1.00	N/A
Some College	1.04***	1.01–1.06	1.05***	1.02–1.07
Bachelor's Degree or more	1.08***	1.06–1.10	1.05***	1.03–1.07
Race and Ethnicity				
White (ref)	1.00	N/A	1.00	N/A
Black	0.94***	0.91–0.97	0.96**	0.93–0.99
Hispanic	0.97*	0.95–1.00	0.98	0.96–1.01
Other	0.96**	0.94–0.99	0.98	0.95–1.01
Marital Status				
Married (ref)	1.00	N/A	1.00	N/A
Cohabiting	1.01	0.98–1.05	1.02	0.98–1.05
Separated, Divorced, or Widowed	0.93***	0.89–0.98	0.97	0.93–1.02

(Continued)

Table 3 (Continued).

ADSM Characteristics	OR	(95% CI)	aOR^a	(95% CI)
Never Married	1.02	1.00–1.04	1.00	0.97–1.02
Has Dependent Children				
No (ref)	1.00	N/A	1.00	N/A
Yes	0.98	0.97–1.00*	1.01	0.98–1.04
Number of Deployments				
Never (ref)	1.00	N/A	1.00	N/A
One	0.98	0.95–1.01	0.99	0.97–1.02
Two	0.97	0.94–1.00*	0.98	0.95–1.01
Three or more	0.99	0.97–1.01	1.01	0.98–1.04
Current Housing Status				
Living in Dorms/Barracks on Installation (ref)	1.00	N/A	1.00	N/A
Other Housing on Installation	0.99	0.96–1.02	0.99	0.95–1.02
Housing Off Installation	0.97**	0.95–1.00	0.96**	0.93–0.99
Other Living Situation	0.85**	0.75–0.96	0.91	0.82–1.01
Sexual orientation (lesbian, gay or bisexual)				
No (ref)	1.00	N/A	1.00	N/A
Yes	0.98	0.95–1.01	1.01	0.97–1.04
Number of medical conditions				
None	1.00	N/A	1.00	N/A
One to Two	0.90***	0.88–0.92	0.92***	0.90–0.94
Three or more	0.74***	0.70–0.78	0.78***	0.74–0.82
Mental Health Status				
Mean K6 score>12/serious distress (ref=no)	0.69***	0.64–0.74	0.74***	0.69–0.79
Behaviors				
Reduced physical activity/ strength training in past month (ref=no)	0.83***	0.80–0.86	0.86***	0.83–0.88
Screen time over than 2 hours/day in past month (ref=no)	0.97***	0.95–0.99	0.99	0.97–1.01
Bad sleeping habits in past month (ref=no)	0.92***	0.91–0.94	0.98*	0.96–1.00
Heavy alcohol drinking in past month (ref=no)	0.91***	0.87–0.95	0.97	0.93–1.01
Current smoker or substance user in past month (ref=no)	0.92***	0.89–0.95	0.96*	0.94–0.99
No routine checkup in past 12 months (ref=no)	0.97***	0.95–0.99	0.97*	0.95–1.00
Risky sexual behavior in past 12 months (ref=no)	0.99	0.97–1.00	1.02	1.00–1.03

Notes: ^aAdjusted for all covariates in the table *p<0.05; **p<0.01; ***p<0.001.

Abbreviations: ADSM, Active duty servicemember; K6, Kessler Mental Health Scale; ref, reference category.

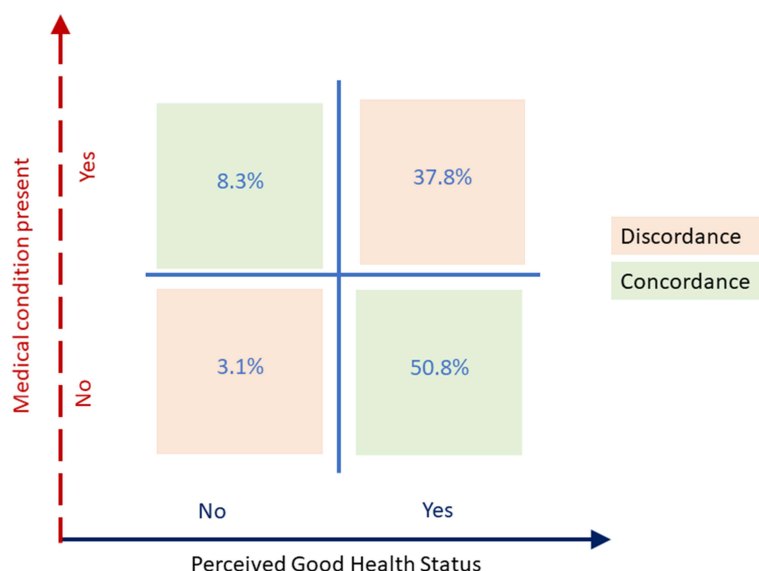


Figure 3 Concordance in Perceived Health Status and Medical Conditions Present among US Active Duty Service Members, 2018 Department of Defense Health-Related Behaviors Survey (N=17,166).

1.18) and not having a routine medical checkup in the past year (aOR: 1.09; 95% CI: 1.04–1.13). On the other hand, the odds of concordance was reduced among the following: older ADSM aged 35–44 years (aOR: 0.75; 95% CI: 0.68–0.81) or 45 years and above (aOR: 0.61; 95% CI: 0.54–0.69); those with dependent children (aOR: 0.89; 95% CI: 0.84–0.95); having one (aOR: 0.94; 95% CI: 0.89–1.00) or three or more deployments (aOR: 0.89; 95% CI: 0.84–0.95); living in other housing on (aOR: 0.92; 95% CI: 0.85–0.99) or off installation (aOR: 0.93; 95% CI: 0.88–0.99); screen time more than two hours per day (aOR: 0.94; 95% CI: 0.90–0.98) or bad sleeping habits in the past month (aOR: 0.85; 95% CI: 0.82–0.89).

Table 4 Crude and Adjusted Odds Ratios of Concordance Between Perceived Health Status and Medical Conditions, 2018 Department of Defense Health-Related Behaviors Survey (N = 17166)

ADSM Characteristics	OR	(95% CI)	aOR ^a	(95% CI)
Sex				
Male	1.00	N/A	1.00	N/A
Female	1.05*	1.00–1.09	0.98	0.94–1.02
Service Branch				
Army (ref)	1.00	N/A	1.00	N/A
Air Force	1.09**	1.03–1.14	1.04	0.99–1.09
Marine Corps	1.11**	1.04–1.18	1.03	0.97–1.10
Navy	1.04	0.98–1.11	1.04	0.98–1.11
Coast Guard	1.08*	1.01–1.15	1.14***	1.06–1.21

(Continued)

Table 4 (Continued).

ADSM Characteristics	OR	(95% CI)	aOR ^a	(95% CI)
Pay Grade				
Enlisted 1 - Enlisted 4 (ref)	1.00	N/A	1.00	N/A
Enlisted 5 - Enlisted 6	0.78***	0.74–0.82	0.97	0.91–1.03
Enlisted 7-Warrant Officer 5	0.60***	0.56–0.64	0.95	0.86–1.04
Officer 1 - Officer 3	1.01	0.96–1.05	1.10*	1.02–1.18
Officer 4 - Officer 6	0.65***	0.62–0.69	1.02	0.92–1.13
Age Group in years				
17–24 (ref)	1.00	N/A	1.00	N/A
25–34	0.86***	0.82–0.89	0.94	0.89–1.00
35–44	0.60***	0.57–0.63	0.75***	0.68–0.81
45+	0.51***	0.46–0.55	0.61***	0.54–0.69
Education Level				
High School or less (ref)	1.00	N/A	1.00	N/A
Some College	0.80***	0.75–0.84	0.99	0.93–1.05
Bachelor's Degree or more	0.89***	0.86–0.93	1.02	0.97–1.09
Race and Ethnicity				
White (ref)	1.00	N/A	1.00	N/A
Black	0.99	0.94–1.06	1.01	0.95–1.07
Hispanic	1.00	0.94–1.06	0.97	0.91–1.02
Other	1.04	0.97–1.10	1.03	0.97–1.10
Marital Status				
Married (ref)	1.00	N/A	1.00	N/A
Cohabiting	1.26***	1.17–1.35	1.06	0.99–1.14
Separated, Divorced, or Widowed	0.98	0.90–1.07	1.03	0.94–1.12
Never Married	1.33***	1.27–1.39	1.05	1.00–1.11
Has Dependent Children				
No (ref)	1.00	N/A	1.00	N/A
Yes	0.70***	0.67–0.73	0.89***	0.84–0.95
Number of Deployments				
Never (ref)	1.00	N/A	1.00	N/A
One	0.88***	0.83–0.93	0.94*	0.89–1.00
Two	0.84***	0.79–0.90	0.98	0.92–1.05
Three or more	0.66***	0.63–0.70	0.89***	0.84–0.95

(Continued)

Table 4 (Continued).

ADSM Characteristics	OR	(95% CI)	aOR ^a	(95% CI)
Current Housing Status				
Living in Dorms/Barracks on Installation (ref)	1.00	N/A	1.00	N/A
Other Housing on Installation	0.74***	0.69–0.79	0.92*	0.85–0.99
Housing Off Installation	0.78***	0.75–0.82	0.93*	0.88–0.99
Other Living Situation	0.86	0.72–1.03	0.91	0.76–1.08
Sexual orientation (lesbian, gay or bisexual)				
No (ref)	1.00	N/A	1.00	N/A
Yes	1.06	0.99–1.13	0.99	0.93–1.07
Mental Health Status				
Mean K6 score > 12/serious distress (ref=no)	0.96	0.88–1.04	0.97	0.90–1.06
Behaviors				
Reduced physical activity/ strength training in past month (ref=no)	1.00	0.95–1.05	1.03	0.98–1.08
Screen time over than 2 hours/day in past month (ref=no)	1.01	0.97–1.05	0.94**	0.90–0.98
Bad sleeping habits in past month (ref=no)	0.81***	0.78–0.84	0.85***	0.82–0.89
Heavy alcohol drinking in past month (ref=no)	0.92	0.85–1.00	0.95	0.88–1.03
Current smoker or substance user in past month (ref=no)	0.96	0.91–1.02	0.97	0.92–1.03
No routine checkup in past 12 months (ref=no)	1.14***	1.09–1.19	1.09***	1.04–1.13
Risky sexual behavior in past 12 months (ref=no)	0.97	0.93–1.01	0.95*	0.91–0.99

Notes: ^aAdjusted for all covariates in the table *p<0.05; **p<0.01; ***p<0.001.

Abbreviations: ADSM, Active duty servicemember; K6, Kessler Mental Health Scale; ref, reference category.

Discussion

This exploratory study assessed prevalence of perceived health status and its interconnections with doctor-informed medical conditions, risk behaviors and sociodemographic characteristics among ADSMs in the US Military. Per the conceptual framework, this study hypothesized that ADSM's perceived good health status was negatively associated with the presence of medical conditions, engagement in risk behaviors as well as certain sociodemographic characteristics. The high prevalence of perceived good health status observed in this study may corroborate prevailing expectations of health standards, ideals of self-image and other social norms within the military.²⁶ However, the rates of perceived good health status among ADSMs were comparable with the age-adjusted rates among the general US population in 2018 at 88.5%,⁶ and 90%, respectively, which challenges the healthy soldier effect assumption in which military populations' are presumed to be fitter and healthier than the general population due to initial physical screenings for service, requirements to maintain a certain standard of physical well-being, and better access to medical care during and after military service.²⁷ However, comparability in perceived health status across US ADSM and general populations does not appear to translate to a similar comparability in actual health status as rates of chronic medical conditions such as obesity, hypertension and diabetes were notably lower among ADSM compared to the general US population. Among ADSM, the most prevalent doctor-informed medical conditions included back pain, bone, joint, or muscle injury or condition as well as obesity. These musculoskeletal medical conditions may be attributable to the fact that ADSMs engage in high levels of physical activity.²⁸ In addition, obesity assessed using body mass index might reflect high muscle mass and not a true measure of nutrition or physical fitness.²⁹

Study findings demonstrate a relationship between perceived health status, doctor-informed medical conditions and behaviors. Specifically, presence of an increasing number of medical conditions, reduced physical activity, poor sleeping habits, current smoking/substance use, and lack of routine medical checkup were inversely associated with perceiving a good health status. These associations may reflect ADMS beliefs that these risk behaviors result in poorer health. These findings emphasize the promotion of healthy behaviors and prevention of health conditions as important to perceived health. Engaging in healthy behaviors might help ADMS feel better about themselves and perhaps be more focused on the mission and able to fulfill assigned military duties and overall readiness. Alternatively, ADMS who feel healthy may wish to avoid risky behaviors in order to maintain their perceived good health status.³⁰ Thus, the directionality and temporality of the relationship between risk behaviors and perceived good health status needs to be further explored using longitudinal studies. Of note, the study did not reveal any association between screen time, heavy alcohol use or risky sexual behaviors with perceived health status, warranting future exploration to understand this phenomenon.

The study also demonstrated concordance or agreement between perceived health status and medical conditions among two-thirds of ADMS. However, the remaining third of ADMS had incorrect perceptions of their health status when compared with actual medical conditions present. It is unclear if this is comparable with the general populations, prompting the need for further research. Furthermore, concordance was seen to be reduced among presumably more experienced ADMS (who were older, with dependent children or had been deployed). It is worth researching the degree to which such aspects of the military experiences might be impacting ADMS's ability to correctly assess their health status.

The interrelationships between behaviors, perceptions and medical conditions have implications for the health literacy and seeking of health services among ADMS. This paper posits that perceived health status may be an indirect measure of health literacy.³¹ This is important in an increasingly fiscally restrained Military Health System where access can be positively impacted by informed self-care measures.³² If an active-duty service member (ADMS) perceives their health status correctly or has high health literacy, s/h/they can judiciously use limited health resources.³² Interventions that promote health literacy, address treatment-seeking stigma³¹ and demand-generation for needed health services need to be complemented with interventions that ensure access and supply of health services for ADMSs.³² This is particularly important given the fiscal austerity measures faced within the military health system.³³ In addition, it is to the US Military's advantage to cultivate an environment where wellness is prioritized as study findings highlight the role of mental health in perceived health status. This includes the implementation of relevant policies and interventions that reduce mental health distress and promote work/life balance within the military population.³⁴ Additional research on how to promote resilience is needed as this remains a potential mitigating factor for mental distress and other downstream effects including health status.³⁵

This study also highlighted heterogeneity in perceived health status within ADMSs with perceived worse health status among women, enlisted, and black service members despite adjusting for a large variety of factors, including those which are intermediates in causal pathways. The military population is typically considered to be an equal access environment in which there are substantially less health disparities. However, persisting race, ethnicity and social differences suggest the need to further explore ADMS intersectionality,³⁶ the role of social determinants of health³⁷ and their influence on readiness as well as the need for targeted interventions to such sub-groups.

This novel study exploring interrelationships between perceived health status, medical conditions and risk behaviors within the US military boasts a few strengths, including the use of a large, nationally representative sample with robust sociodemographic, medical and behavioral data and a conceptual framework detailing hypothesized pathways. The large sample size allowed a detailed examination of perceived health status (as an ordinal scale) by ADMS characteristics. However, key limitations include the use of self-reported data which may be subject to social desirability or recall bias, the cross-sectional study design which limits the ability to make causal inferences, and unmeasured confounding from other mental health conditions and psychosocial factors which might influence perceived health status. As with most of HRBS, we noted a suboptimal response rate (9.6% weighted). However, sample weights were used to generate similar estimates of ADMS population characteristics. Thus, this study is positioned as a simple exploratory study to inform the design of future research and/or longitudinal studies to corroborate study findings and further elucidate hypothesized causal pathways. Additional qualitative research may explore how ADMS perceive their health status, what it means to them and how it is influenced by internal and external factors. We also acknowledge that unmeasured psychosocial

constructs identified in the conceptual framework may be associated with ADSM's perceptions of their health status.³⁸ Such constructs include perceived vulnerability, perceived severity of medical conditions, perceived norms regarding health status within the military as well as ADSM's personal values relating to health.³⁹ Future prospective studies should aim to better explore psychosocial factors influencing perceived health status in order to identify additional opportunities for relevant interventions.

Conclusion

In conclusion, this study employed a positive epidemiology approach to assess correlates of perceived good health status among US ADSM, which was negatively associated with the presence of doctor informed medical conditions and engagement in risky behaviors. Most ADSM demonstrated concordance between their perceived health status and medical conditions, but this was significantly lower among ADSM who were older, with dependent children or had been deployed. Study findings suggest that interventions promoting healthy behaviors, health literacy and treatment-seeking may influence perceived health status and mitigate medical conditions among ADSM, thus improving the US Military readiness, resilience and mission success.

Data Sharing Statement

The data that support the findings of this study are available from RAND and DOD but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of RAND and DOD.

Ethical Approval and Informed Consent

This secondary data analysis research was reviewed by the Uniformed Services University (USU) Human Research Protections Program (HRPP) which granted ethical approval waiver for the study with a determination of Research Not Involving Human Subjects (Protocol DBS.2022.408). The HRBS study protocol and all methods were carried out in accordance with the Declaration of Helsinki and other relevant guidelines and regulations. Informed consent was obtained from all study participants. The HRBS study were approved by RAND's Institutional Review Board (known as the Human Subjects Protection Committee), the Westat Institutional Review Board, the Coast Guard's Institutional Review Board, the Office of People Analytics, the Office of the Under Secretary of Defense for Personnel and Readiness's Research Regulatory Oversight Office, the Office of the Assistant Secretary of Defense for Health Affairs and the Defense Health Agency's Human Research Protection Office, and the DoD Security Office. All survey materials included the survey report control system license number: DD-HA(BE)2189.

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Author Contributions

BO Conceptualized the study while BO and AA conducted all data analysis and drafted the manuscript. KC, JY and JM provided technical feedback to the manuscript. All authors read and approved the final version of the manuscript. All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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