



DENTAL HEALTH READINESS IN THE MILLENNIUM COHORT STUDY

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BACKGROUND



- ① Historically, dental caries (tooth decay or cavities) was a leading diagnosis for deployed soldiers, with high incidence of dental disease and nonbattle injury (D-DNBI or dental emergencies). (Simecek et al., 2014)
- ① During Operation Iraqi Freedom (2003–2004), 19% of all medical care needs were dental. (Murray et al., 2005)
- ① Prior to the addition of the periodic dental readiness evaluations in 2014, dental emergencies affected about 15% of service members annually. (Lee et al., 2019)



DENTAL HEALTH READINESS



“....about healthcare preparedness, when we look back at why people shortly after deployment have to be pulled off the line, interestingly it's dental care, primarily among the Guard and Reserve...”

– Maj Gen (Ret) Paul Friedrichs, Former Joint Staff Surgeon

Testimony on stabilizing the Military Health System to prepare for large-scale combat operations
United States Senate Committee on Armed Services (March 11, 2025)
<https://www.armed-services.senate.gov/hearings/to-receive-testimony-on-stabilizing-the-military-health-system-to-prepare-for-large-scale-combat-operations>



OBJECTIVE



- ① To describe dental needs and dental health readiness among a contemporary sample of U.S. active duty, Reserve, and National Guard military personnel
- ① To examine the role of health behaviors and stressors in dental readiness



MILLENNIUM COHORT STUDY (MCS)

- ① Largest and longest running military cohort study
 - Initiated July 2001 (FY1999 NDAA, Sec. 743)
 - 5 enrollment panels (2001, 2004, 2007, 2011, 2020)
 - Participants surveyed every 3–5 years during and after military service
- ① Objective: Determine the long-term health impacts of military service on service members and veterans





MILLENNIUM COHORT STUDY, PANEL 5



Panel	Enrollment Dates	Years of Service at Enrollment	Oversampled Groups	Roster Size (Date)	Total Contacted	Total Enrolled (%)
1	Jul 2001–Jun 2003	Unrestricted	Women Reserves/Guard Prior deployers*	256,400 (Oct 2000)	214,388	77,019 (36%)
2	Jun 2004–Feb 2006	1–2	Women Marine Corps	150,000 (Oct 2003)	123,001	31,110 (25%)
3	Jun 2007–Dec 2008	1–3	Women Marine Corps	200,000 (Oct 2006)	154,270	43,438 (28%)
4	Apr 2011–Apr 2013	2–5	Women Married	250,000 (Oct 2010)	247,266	50,052 (20%)
5	Sep 2020–Aug 2021	1–5	Women Married	500,000 (Jun 2020)	443,951	58,609 (13%)

*Deployment to Southwest Asia, Bosnia, and/or Kosovo after August 1997.



METHODS



① Cross-sectional analysis

① Linked MCS Panel 5 baseline survey data (enrolled 2020–2021) with clinical data from dental readiness classification (DRC) $\pm$ 12 months from survey date

① Logistic regression

- Based on Monte Carlo integration (FIML) in Mplus
- Outcome: **fully medically ready** (FMR) or not FMR



FULLY MEDICALLY READY (FMR) / DENTAL READINESS CLASSIFICATION (DRC)



CLASS		DEFINITION
FMR	DRC 1	Good oral health, does not require treatment, no emergency expected (<i>deployable</i>)
	DRC 2	Some oral conditions, no emergency expected in 12 months (<i>deployable</i>)
Not FMR	DRC 3	Oral conditions, emergency expected in 12 months if untreated (<i>temporary non-deployable</i>)
	DRC 4	Patient requires dental examination; dental classification unknown (<i>partially medically ready [PMR]</i>)

Clinician-assessed classification based on an annual dental exam (Form DD 2813)
Selected DRC closest to MCS survey date for this cross-sectional analysis
Study timeframe (MCS survey $\pm$ 12 months: Sep 2019–Aug 2022)

Source: DoDI 6025.19 (July 13, 2022)



PARTICIPANTS

N = 43,894



Demographics and military characteristics		%
Age (mean)		26 years
Sex	Men	70
	Women	30
Race and ethnicity	Asian/Pacific Islander	9
	American Indian/Alaska Native	1
	Black, Non-Hispanic	12
	Hispanic	18
	Multiracial	3
	White, Non-Hispanic	57
Marital status	Married	46
	Single	47
	No longer married	7
Service branch	Active duty	93
	Reserve and National Guard	7

Demographics and military characteristics		%
Service component	Air Force	41
	Army	33
	Coast Guard	2
	Marine Corps	12
	Navy	12
Pay grade	Junior enlisted	38
	Senior enlisted	40
	Officer	22
Occupation	Combat specialist	11
	Health care	26
	Functional support/administrative	25
	All others	48
Deployment and combat experience	Not deployed	67
	Deployed, no combat	20
	Deployed, combat	13



DRC, BY BRANCH



	FMR		Not FMR	
	n	%	n	%
Total population	41,790	95.2	2,104	4.7
By service branch				
Air Force	17,784	97.9	377	2.1
Army	13,987	97.6	350	2.4
Coast Guard	923	89.4	109	10.6
Marine Corps	4,435	87.6	625	12.4
Navy	4,661	87.9	643	12.1

Note. Percentage of military service members not fully medically ready (FMR) based on dental readiness classification (DRC), by service branch (N=43,894). Includes active duty, Reserve, and National Guard. Air Force includes Space Force
Not FMR = DRC 3 or DRC 4; FMR = DRC 1 or DRC 2



RELATIVE ODDS OF NOT BEING FMR



Outcome: Not FMR vs. FMR	
	Fully adjusted model AOR (95% CI)
Service component (ref: Active duty)	
Reserve/National Guard	3.44* (2.95-4.00)
Pay grade (ref: Officer)	
Junior enlisted	1.51* (1.28-1.78)
Senior enlisted	1.18* (1.02-1.36)
Service branch (ref: Army)	
Air Force (includes Space Force)	0.73* (0.62-0.86)
Coast Guard	5.37* (4.21-6.85)
Marine Corps	5.58* (4.79-6.49)
Navy	6.46* (5.60-7.47)
Deployment and combat experience (ref: Not deployed)	
Deployed, no combat	1.01 (0.88-1.16)
Deployed, with combat	1.15* (1.00-1.33)
Cigarette use in the last year (ref: no use)	1.16* (1.01-1.33)
Electronic cigarette/vape use (ref: no use)	1.16* (1.02-1.31)

Note. Models adjusted for the following demographic characteristics (not shown): sex, race and ethnicity, marital status, age. FMR = fully medically ready; AOR = adjusted odds ratio; CI = confidence interval

* $p < .05$



SUMMARY



In the final fully adjusted model, those who were not FMR were:

Ⓜ More likely

- Reserve/National Guard (ref: active duty)
- Enlisted (ref: Officer)
- Marine Corps, Navy, Coast Guard (ref: Army)
- To have deployment experience with combat (ref: not deployed)
- To smoke, vape (ref: not smoke or vape)

Ⓜ Less likely

- Air Force (ref: Army)
- Health care occupations (ref: combat specialist)



IMPLICATIONS / CONCLUSIONS



Ⓜ BLUF: Military factors, including rank, service branch, and component, were drivers of dental readiness. Tobacco use, a known risk factor for oral disease, was associated with not being fully medically ready.

Ⓜ Recommendations:

- Implications are different by component
- Ensure annual dental exams are completed on time
- Ensure dental workforce and capacity
- Monitor military experience and exposure to health risks, especially tobacco use, for all and encourage tobacco cessation



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QUESTIONS?



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REFERENCES



- Finlayson, T. L., Kolaja, C. A., Castañeda, S. F., Carey, F. R., Roesch, S. C., Beck, A. N., Villalobos, J., Jr., Rull, R. P., Mendoza, A. M., Macaoay, M., Mitchener, T. A., & Simecek, J. W. (2026). Dental health readiness among United States military service members in the Millennium Cohort Study. *Military Medicine*, usag300. <https://doi.org/10.1093/milmed/usag300>
- Galicia-Diez Barroso, D., Abeijón-Malvaez, L. D., Altamirano, G. A. M., Irigoyen-Camacho, M. E. J., Finlayson, T. L., & Borges-Yáñez, S. A. (2023). Using the expanded Andersen model to determine factors associated with Mexican adolescents' utilization of dental services. *Healthcare (Basel)*, 11(24), Article 3159. <https://doi.org/10.3390/healthcare11243159>
- Gelberg, L., Andersen, R. M., & Leake, B. D. (2000). The Behavioral Model for Vulnerable Populations: Application to medical care use and outcomes for homeless people. *Health Services Research*, 34(6), 1273–1302.
- Lee, L., Dickens, N., Mitchener, T., Qureshi, I., Cardin, S., & Simecek, J. (2019). The burden of dental emergencies, oral-maxillofacial, and cranio-maxillofacial injuries in US military personnel. *Military Medicine*, 184(7–8), e247–e252. <https://doi.org/10.1093/milmed/usz059>
- Murray, C. K., Reynolds, J. C., Schroeder, J. M., Harrison, M. B., Evans, O. M., & Hospenthal, D. R. (2005). Spectrum of care provided at an echelon II Medical Unit during Operation Iraqi Freedom. *Military Medicine*, 170(6), 516–520. <https://doi.org/10.7205/milmed.170.6.516>
- Simecek J. W., Colthirst, P., Wojcik, B. E., Eikenberg, S., Guerrero, A. C., Fedorowicz, A., Szeszel-Fedorowicz, W., & DeNicolo, P. (2014). The incidence of dental disease nonbattle injuries in deployed U.S. Army personnel. *Military Medicine*, 179(6), 666–673. <https://doi.org/10.7205/MILMED-D-13-00511>
- Velez, D., Palomo-Zerfas, A., Nunez-Alvarez, A., Ayala, G. X., & Finlayson, T. L. (2017). Facilitators and barriers to dental care among Mexican migrant women and their families in North San Diego County. *Journal of Immigrant and Minority Health*, 19(5), 1216–1226. <https://doi.org/10.1007/s10903-016-0467-2>



EXTRA SLIDES



FRAMEWORK



Adapted Andersen Behavioral Model of Health Services Use (Gelberg et al, 2000)

Adapted for dental and psychosocial factors (Galicia-Diez Barroso et al, 2023; Velez et al 2017)

