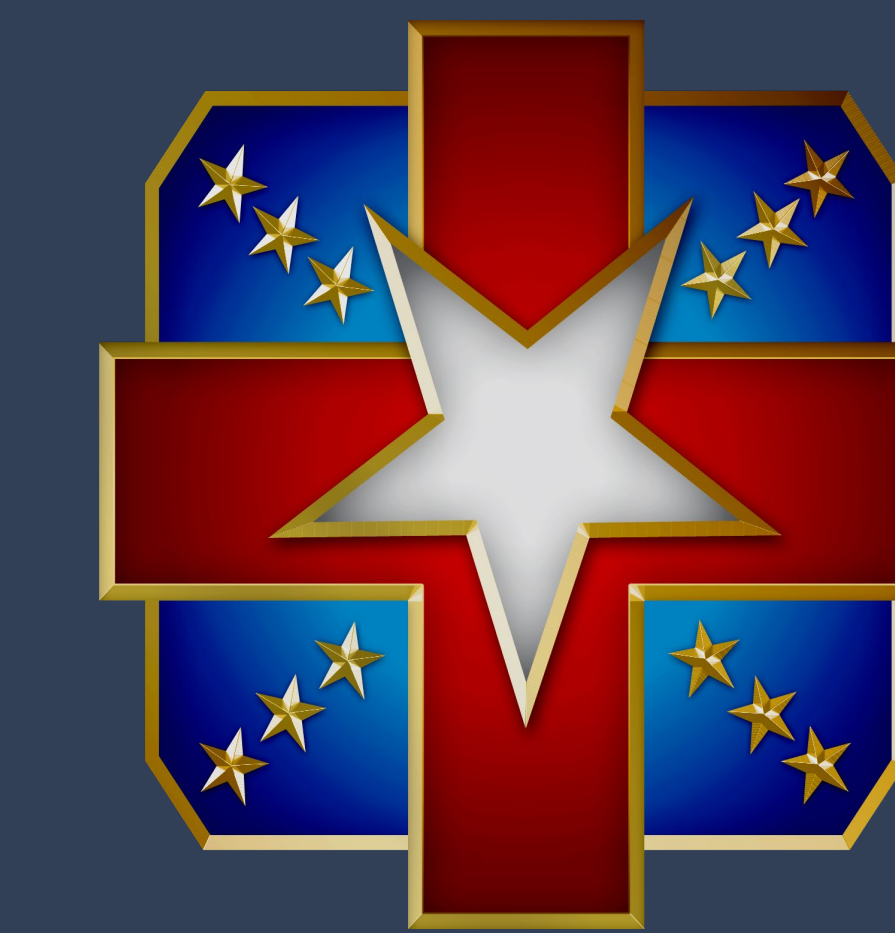




Human Papillomavirus Vaccination and Disease Burden within the U.S. Military System



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BACKGROUND

Human papillomavirus (HPV) is the most common sexually transmitted infection and is associated with six types of cancers, most notably oropharyngeal, anal, and cervical cancers. **Research has shown U.S. military members and veterans experience a greater burden of oropharyngeal and anal cancers compared to the general population**, and cervical cancer was the fifth leading cause of cancer diagnosis among service women between 2005 and 2014.

Infection with HPV is preventable with vaccination. The Food and Drug Administration has approved the Gardasil 9[®] vaccine, covering a total of 9 HPV types, for use in men and women ages 9 to 45 years. Despite established safety and efficacy data and the potential for HPV-related disease to interfere with deployment, **HPV vaccination is not required for military service.**

The study aims were to evaluate the percentage of total active-duty service members who had received HPV vaccines and identify rates of incident HPV related diagnosis and adjusted associations with risk factors.

METHODS

The Medical Assessment and Readiness System (MARS) located at Womack Army Medical Center, Fort Bragg, NC is a combined database of official administrative and health record data that includes information on the total active-duty U.S. military who served during 2011 to present. Eligible subjects were those who served in U.S. Army, Navy, Air Force or Marines. New service members entering in 2011-2021 were identified as a subgroup for the incident HPV diagnosis analysis.

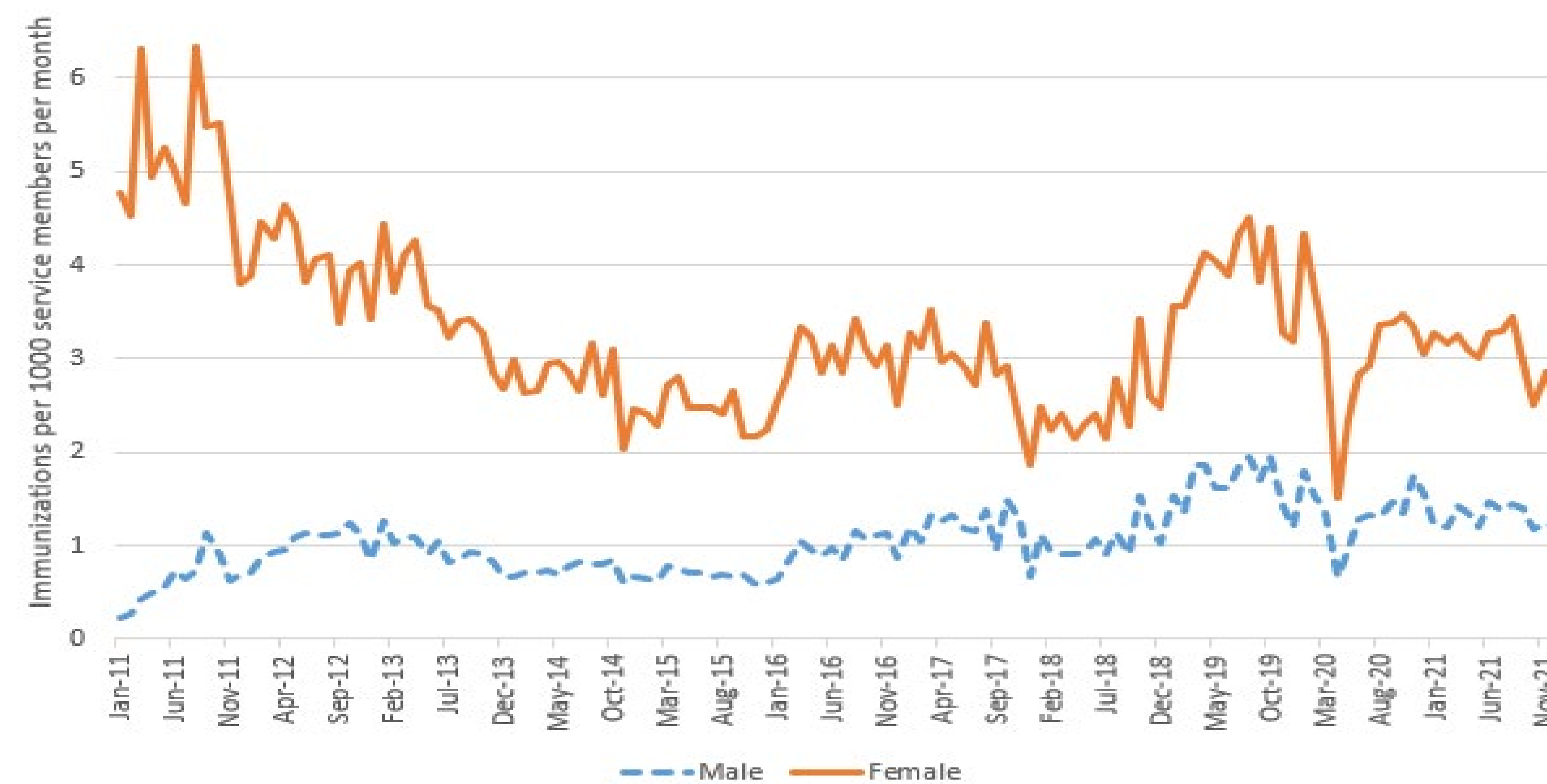
We created a person-month-based longitudinal panel structure for HPV diagnosis analysis in which subjects were observed from service entry until the incident outcome, discharge from service, or the end of available data. HPV vaccination was defined by CPT codes 90649-51. An incident HPV-related diagnosis was defined by the presence of selected diagnosis codes for condyloma acuminatum or examination findings.

Sociodemographic elements included sex, age, race, ethnicity, marital status, religious preference and education level. Military service-related factors included aptitude scores, pay grade and military branch. We additionally controlled for tobacco use. Unadjusted associations between predictors and endpoints were tested using chi square tests for categorical variables and two-sided t-tests for factors arising from continuous values. A multivariable survival model computed the risk of an incident HPV-related diagnosis among new service members expressed as adjusted hazard ratios.

Multivariable regression analysis of the proportion of new accession service members who received vs. never received an HPV-related diagnosis

Characteristic	Adjusted Hazard Ratio	95% Confidence Interval	Characteristic	Adjusted Hazard Ratio	95% Confidence Interval
Gender			Service Branch		
Male	1.00	Reference	Army	1.33	1.29-1.36
Female	19.71	19.27-20.17	Navy	1.00	Reference
Age, years			Air Force	1.49	1.45-1.53
≤21	1.00	Reference	Marines	1.20	1.16-1.24
22-25	1.90	1.85-1.96	Marital Status		
26-32	1.79	1.73-1.85	Married	0.82	0.80-0.84
≥33	1.70	1.60-1.79	Formerly Married	1.25	1.20-1.30
Tobacco Use			Never Married	1.00	Reference
Ever used	1.36	1.33-1.38			
Never	1.00	Reference			

HPV vaccine rate analyses over time among all members



Male servicemember vaccination rates are lower than women with overall stable vaccination rates over time amongst both groups

RESULTS

Of the total 3,112,598 subjects available, **3.17% of males and 9.67% of females received HPV vaccines.** Those ages 26-32 and black service members had the highest rate of vaccination when compared to their demographic groups. **Female members, those ages 22-25 years, formerly married service members, and tobacco users are all at the highest risk for acquiring HPV infections.**

DISCUSSION

The importance of recognizing the increased risks associated with certain demographic groups and HPV infections allows for further education and policy interventions to target these at-risk populations. There were a total of 1.33 million active-duty military members on duty in 2020, with 229,933 female service members and nearly half 25 years of age or younger. There is a significant cost burden for treatment of HPV-related disease and need for additional medical visits and procedures can negatively impact mission readiness. While the greatest benefit of the HPV vaccine is seen when administered prior to onset of sexual activity, **there is proven benefit of vaccination for those who have previously acquired HPV infections for prevention of persistent or recurrent disease.**

This study was limited by its reliance on CPT and ICD 9/10 coding, which may lead to a conservative estimate due to typical provider behavior. Due to potential generic coding behavior, we also could not conclusively determine whether members who received HPV vaccines initiated or completed the series. Based on the time of implementation of HPV vaccinations in the general U.S. population, many younger service members would likely have been eligible to receive HPV vaccines at the recommended 11-12 years of age; therefore, prior records of vaccination may not have been captured within the Military Health System. We were unable to detect any pre-2011 events among subjects who were already on duty in January 2011, or pre-service events for any subject.

CONCLUSION

The findings of our work and previous research together suggest that **military health providers should use every opportunity to assess the complete medical history and recommend HPV vaccines** for prevention of six different types of cancers. Given that young adults are at greatest risk for HPV infections, **the U.S. Military is in a position to improve overall readiness and reduce HPV-related disease burdens through mandatory HPV vaccination.**

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