



Celiac Disease on the Rise in the US Military Population: A 22 Year Retrospective Epidemiologic Study

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Abstract

Introduction We describe celiac disease epidemiology in the US military population.

Methods This is a population-based study from data collected between 2000 and 2021. Incidence and prevalence rates and descriptive statistics for demographics are presented.

Results Overall, 2248 incident cases of celiac disease were identified. The incidence rate increased from 1.2 to 14.0 per 100,000 person-years and the overall lifetime prevalence increased from 3.1 to 57.4 per 100,000 service members. In gastroenterology clinics, the incidence rate increased from 1.4 to 8.2 per 100,000 person-years, while prevalence increased from 3.3 to 33.4 per 100,000 service members.

Discussion In this study, celiac disease incidence and prevalence increased significantly.

Keywords Celiac disease · Epidemiology · Immune mediated food allergy · Gluten · Wheat allergy

Introduction

Celiac disease (CD) is an increasingly common condition affecting approximately 1% of the global population and 1–2% of Americans [1]. Recent epidemiologic data suggests an increase in the prevalence over the last several decades. Incidence and prevalence within the US military population has previously been assessed and thought to be higher than other population-based estimates [2, 3]. Given that this is a diagnosis that can preclude accession into the military and deployment to austere environments where dietary options are limited, we conducted a study to better define the epidemiology and impact of CD in the US military population over a 22-year period.

Methods

This study was a retrospective population-based cohort from the Defense Medical Surveillance System (DMSS), a longitudinal data system that collects data from all medical encounters of all active duty military members received both in the military treatment facilities and privately sourced care from civilian facilities (if reimbursed through Tricare) [4]. The surveillance period for data was January 1, 2000, through December 31, 2021. The population included active duty military service members of the US Army, Navy, Air Force, and Marine Corps who served during the period. Activated reserve and guard members were excluded due to incomplete data capture for these populations. An individual was counted as a case if they had at least two inpatient or outpatient encounters within 6 months of each other, with a qualifying International Classification of Diseases (ICD), Ninth and Tenth Revision code in any diagnostic position of ICD-9-CM (579.0) or ICD-10-CM (K90.0). In a separate analysis, a service member was counted as a case if they had at least one outpatient encounter in a military treatment facility (MTF) gastroenterology (GI) specialty clinic.

For the incidence analysis, an individual was considered an incident case only once; person time was censored after initial diagnosis and prevalent cases were removed. Annual incidence rates were calculated per 100,000

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person-years (PY). Annual lifetime prevalence was calculated by dividing the number of individuals in members who had a previous qualifying diagnosis of CD by the number of active duty service members in service during each calendar year. Prevalence of disease was reported as rate per 100,000 service members. Demographic characteristics, including gender, age, race/ethnicity, branch of service and home of record as reflected in the DMSS were included. This study was approved by the Walter Reed National Military Medical Center Institutional Review Board (WRNMMC-EDO-2021-0677).

Results

Over the study period, 2248 military members were newly diagnosed with CD. Annual incidence rose from 1.2 per 100,000 to 14.0 per 100,000 PY in 2000 and 2021, respectively (Fig. 1). In GI specialty clinics, it increased from 1.4 per 100,000 to 8.2 per 100,000 PY in the corresponding years. The prevalence also increased from 3.1 per 100,000 service members in 2000 to 57.4 per 100,000 servicemembers in 2021 (Fig. 2). When stratified by GI clinic diagnosis, prevalence rates increased from 3.3 to 33.4 per 100,000 service members over the same period. Rates in 2021 were higher in women, white-non-Hispanics, and older age groups (Table 1). By service, the Air Force had the highest

Fig. 1 Incidence of Celiac disease, active component service members, U.S. Armed Forces, 2000–2021

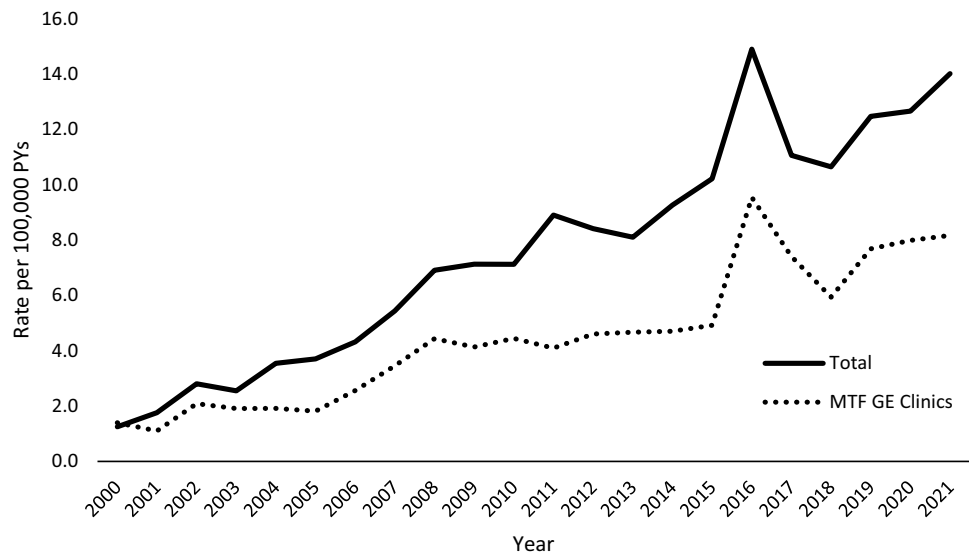


Fig. 2 Lifetime prevalence of Celiac disease, active component service members, U.S. Armed Forces, 2000–2021

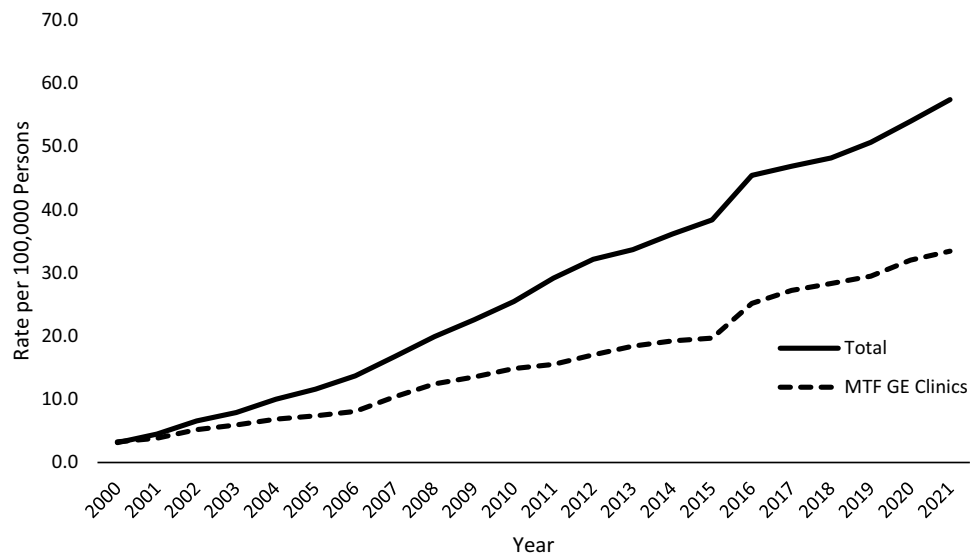


Table 1 Incidence and prevalence of all celiac disease diagnoses and by gastroenterology specialty clinics, Active Duty Members, 2021

	Incidence				Prevalence			
	All diagnosis		GI		All diagnosis		GI	
	No	Rate ^a	No	Rate ^a	No	Rate ^b	No	Rate ^b
Total	187	14.0	109	8.2	850	57.4	495	33.4
Sex								
Male	122	11.1	74	6.7	566	46.3	337	27.5
Female	65	28.2	35	15.2	284	110.4	158	61.4
Age group (years)								
18–25	54	9.1	21	3.5	155	19.9	69	8.9
26–35	72	14.8	44	9.1	314	64.7	184	37.9
36–45	44	20.6	30	14.0	311	165.7	181	96.4
46+	17	43.8	14	36.1	70	228.5	61	199.1
Race/ethnicity								
White, non-Hispanic	131	18.0	79	10.8	651	80.4	389	48.1
Black, non-Hispanic	12	5.6	10	4.6	41	17.1	25	10.4
Hispanic	24	10.2	8	3.4	75	28.5	39	14.8
Other/unknown	20	13.0	12	7.8	83	49.3	42	25.0
Service branch								
Army	60	12.5	53	11.0	280	52.4	180	33.7
Navy	51	14.9	20	5.8	204	54.1	119	31.6
Air force	60	18.2	26	7.9	305	84.9	161	44.8
Marine corps	16	8.9	10	5.5	61	29.0	35	16.6

^aRate per 100,000 person-years

^bRate per 100,000 persons

incidence and prevalence rates in 2021, while the Marine Corps had the lowest (Table 1).

Discussion

Our study demonstrates an increase in the overall incidence and prevalence of CD in the active duty military population over a 22 year period, with a higher incidence and prevalence in white non-Hispanic women, consistent with other studies [1, 5]. It is unclear whether this is due to an increase in disease burden or an increased recognition of disease [2]. Although other studies indicate that most patients develop the disease in childhood, our study showed an increasing age of diagnosis and incidence in adults [5]. Also, despite the Sars Cov-2 pandemic and decreased access to healthcare, incidence and prevalence rates of CD continued to rise in 2020 and 2021.

A limitation of our study is that it relies on ICD-9 and ICD-10 codes and not biopsy specimens. Given that some clinics are in military community hospitals with no access to endoscopic services, service members may see gastroenterology consults outside of the MTF’s. Specimens from these consultations are often not available to allow confirmation of disease on chart review. Another limitation of this study is

that incorrect coding for food allergies and non-celiac gluten sensitivity may have occurred, particularly in non-GI clinics. This is mitigated by using 2 encounters separated by 6 months to qualify for inclusion in the study.

These studies are important for the military due to the requirements and constraints of military service. In stark environments, gluten free meals are not always available and therefore CD is generally not compatible with deployment or accession to military service. We previously showed an increase in food allergies in this population [6]; this creates a potentially risky situation when members are unable to have control of their diet and ingredient (allergen) lists available. Identifying increased rate of CD in the military highlights more awareness and research to identify potential mechanisms in pathogenesis, dietary research, and policies. The US military population reflects a subset of the US general population; given the increase with highest rates of diagnosis at later ages in this population, environmental factors such as vitamin D, diet, viral infections, antibiotic use, and other factors should also be considered and studied further [5, 7].

The strength of our study is that it is one of the largest and longest epidemiologic studies in a population with universal health insurance. A limitation of our study includes the inability to complete a chart review for tissue diagnosis of celiac disease as the gold standard for diagnosis. Also, as

a retrospective observational data study of ICD codes, there is a possibility for inaccurate diagnosis. We believe that the data collected by GI specialty clinics likely reflect a more accurate assessment and diagnosis of disease.

Previous epidemiologic data demonstrated growing incidence of CD in the US military which appears to be higher than other estimates [2]. We specifically evaluated diagnosis by gastroenterologists and therefore may be more accurate in identifying this trend. This may be an overestimation based on provider misclassification using ICD codes or there may be an underestimation if individuals have mild or no symptoms, or present with off target symptoms which are not diagnosed.

The incidence and prevalence of CD within the US military is increasing; this can be disqualifying for entry into the military and is of concern for operational readiness and health of our servicemembers. The incidence and prevalence vary with gender, age, race/ethnicity and branch of service. Further studies are needed to examine the genetic and environmental factors affecting CD and implications for military members.

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Author's contribution RL: study concept and design, interpretation of the data, intellectual content, writing of draft. SS: study design, data extraction and analysis, review and editing of draft. JM: study interpretation, writing of draft, review and editing. He presented a poster with a portion of the data at the American College of Gastroenterology Annual Scientific Meeting in October 2021, Las Vegas, NV.

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Declarations

Competing interest None to report.

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