
Defense Health Agency – Public Health

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Incidence of Selected Health Conditions Among TRICARE Beneficiaries Exposed to the Red Hill Fuel Release

November 2019–December 2023

Approved for public release; distribution is unlimited.

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Executive Summary

- This report examines incident cases of conditions that have been reported by Red Hill, Hawai'i community members to Defense Health Agency (DHA) Public Health following the JP-5 fuel release at the Red Hill Bulk Storage Facility in November 2021. This report provides analyses of new cases of migraine, hematuria, irritable bowel syndrome, peripheral neuropathy, eosinophilic esophagitis (EoE), and Raynaud's syndrome following the potential JP-5 exposure among individuals included in the Red Hill Defense Occupational and Environmental Health Readiness System Incident Report roster.
- This analysis compares the incidence of these conditions to an unexposed cohort of DoD-affiliated individuals living on Oahu at the time of the Red Hill fuel release.
- Based on medical encounter diagnoses codes, individuals in the Red Hill Cohort were more likely to have incident (new) cases of migraine and EoE than the Comparison Cohort. There were no statistically significant differences in the incidence of the other listed conditions between the two cohorts.
- Within the Red Hill Cohort, there was a higher trend in the monthly number of individuals with health care encounters for migraine following the release event than in the period before the event. However, there was no statistically significant difference in overall trends for individuals with migraine diagnoses between the two cohorts.
- This report does not imply any causation links between the JP-5 exposure and the study outcomes. This report has several important limitations to note: The potential misclassification of conditions based on diagnosis codes from medical records, inability to account for all possible confounders, lack of current biological models linking JP-5 exposure to these conditions, and potential physician bias (the exposed cohort may be monitored for health conditions more closely than the comparison cohort).

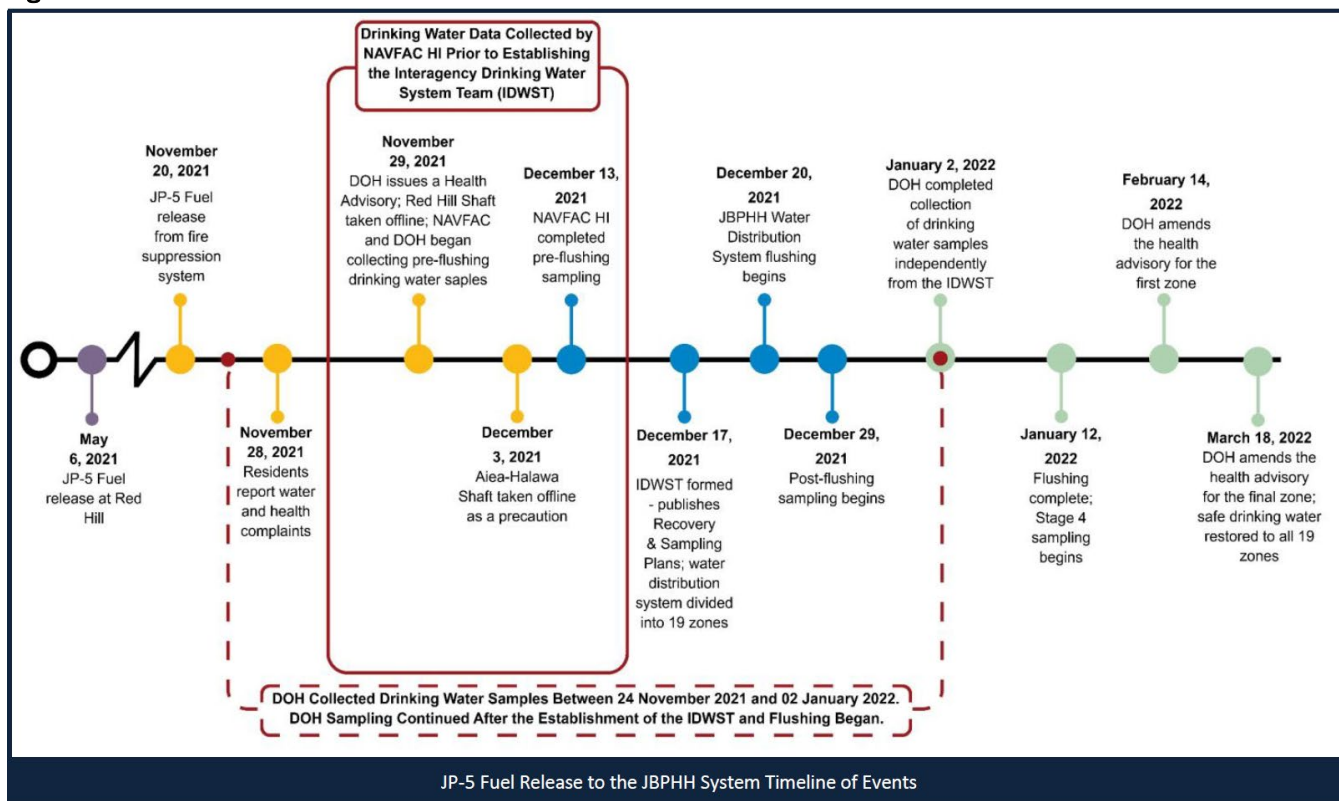
Background

On November 28, 2021, the Hawai'i Department of Health (DOH) and the Hawai'i Poison Center began receiving reports of a fuel-like taste, odor, and sheen in the drinking water at Joint Base Pearl Harbor-Hickam (JBPHH).¹ This was later attributed to a release of jet propellant 5 (JP-5) fuel at the Red Hill Bulk Fuel Storage facility on November 20, 2021 (the release event).² U.S. Navy water system users residing in JBPHH housing were potentially impacted by the contaminated drinking water³ and were provided an alternative drinking water source (i.e., bottled water) at no charge as well as off-base housing alternatives (e.g., Temporary Housing Allowance (TLA) quarters). It is estimated that individuals were exposed to JP-5 in drinking water for less than 10 days; the Red Hill Shaft was taken offline on November 29, 2021 (Figure 1).⁵ The Commander, U.S. Pacific Fleet, requested the establishment of a Defense Occupational and Environmental Health Readiness System Incident Report (DOEHRS-IR) to document the potential exposure event and provide a repository for Department of Defense (DoD)-affiliated beneficiaries potentially affected by exposure to JP-5 fuel in the JBPHH drinking water system.⁴ The DOEHRS-IR also includes individuals working on JBPHH at the time of the release event. Analyses of the health conditions of individuals included in the DOEHRS-IR (Red Hill Cohort) are ongoing.

The purpose of this report is to provide data on specific health conditions of concern as communicated by members of the Red Hill community to DHA Public Health and to evaluate the incidence of these conditions with those of a non-exposed comparison cohort. The health conditions of interest are migraine, eosinophilic esophagitis (EoE), hematuria, irritable bowel syndrome (IBS), peripheral neuropathy, and Raynaud's syndrome. Notably, case clusters of any of these conditions were not reported to DHA Public Health by health care providers. Further, these conditions were not analyzed in prior Red Hill reports, and current toxicologic research has not described an association between any of these conditions and short-term jet fuel exposure. However, DHA Public Health conducted this analysis in response to the concerns of the community.

To better understand the relationship between short-term JP-5 exposure and the conditions of interest, a Comparison Cohort was selected. This cohort was comprised of DoD-affiliated individuals living elsewhere on Oahu and not exposed to the JBPHH water system at the time of the fuel release. The relative incidence of health outcomes was compared in both cohorts.

Figure 1. Red Hill Fuel Release Timeline of Events



Methods

Study Design

This was a retrospective cohort study comparing two populations located on Oahu, Hawai'i, one potentially exposed and one unexposed.

Populations

The Red Hill Cohort was derived from the DOEHS-IR Red Hill roster, a roster of individuals living or working at JBPHH at the time of the release event. This cohort was considered the potentially "exposed" population. Individuals on the DOEHS-IR Red Hill roster were excluded from this analysis if they were not registered in the Defense Enrollment Eligibility System (DEERS), as their health information was not available.

The Comparison Cohort consisted of DoD-affiliated individuals identified in DEERS as residing in ZIP codes in or near Schofield Barracks or Marine Corps Base Hawai'i (Kaneohe) at the time of the release event. Individuals were excluded from the Comparison Cohort if they were also on the DOEHS-IR Red Hill Roster. The Comparison Cohort was considered the "non-exposed" population because its members did not obtain their drinking water from the JBPHH drinking water system. This cohort was selected based on proximity to JBPHH to reduce bias from

differences in access to health care and specialist referral patterns. Both cohorts were served by the same tertiary care military and civilian health care facilities on Oahu.

Data Sources

Cohort data obtained from DEERS included the demographic variables of age, beneficiary category, branch of service, and sex. In DEERS, the beneficiary category indicates if a person receiving military health benefits is an active-duty service member, a reservist, a family member, or a military retiree. Branch of service indicates if the individual is affiliated with the Army, Navy, Marine Corps, Air Force, Coast Guard, or other branch. Race and ethnicity data in DEERS were not used because the electronic records did not report race and ethnicity in a consistent manner. DEERS data were also used to determine how many months an individual was enrolled in the Military Health System (MHS) prior to the event and during the follow-up period.

Health care data were extracted from the MHS and private sector health care claims (care through TRICARE outside of the MHS). The following MHS databases were used in this analysis: the Standard Inpatient Data Record (SIDR), Theater Medical Data Store (TMDS), Comprehensive Ambulatory Professional Encounter Record (CAPER), MHS GENESIS Episodic, and MHS GENESIS Admissions. Private sector care data were obtained from the TRICARE Encounter Data – Institutional (TED-I) and the TRICARE Encounter Data – Non-Institutional (TED-NI), which are databases that track reimbursements to health care providers outside the MHS. Data from the Veterans Administration were not available.

Outcomes

Health conditions of interest analyzed in this report include migraine, hematuria, IBS, peripheral neuropathy, EoE, and Raynaud’s syndrome. The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) and the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) billable coding systems were used to search the medical encounter records. An encounter was considered related to a condition of interest if an associated diagnostic code was included in the electronic health record (Appendix).

Outcomes were dichotomized as an incident (new) case or non-case. For most of the conditions analyzed, an individual was considered to be an incident case if they had at least two encounters related to a condition of interest (in any diagnostic code position) between November 21, 2021 and December 31, 2023 and had no diagnoses for that condition in the 2 years preceding the release event (November 1, 2019–November 20, 2021). For hematuria cases, a 1-year look-back was used (November 21, 2020–November 20, 2021). Hematuria is a symptom which does not necessarily indicate a chronic condition.⁶ Older health records may relate to an acute condition that was fully resolved. All other diagnoses in this analysis are syndromes with high chronicity. The requirement for more than one encounter to be classified as an incident case reduced the possibility that a conditional diagnosis in a single encounter

was misclassified as an incident case. For IBS cases to be considered incident cases, a primary IBS diagnosis was required for at least one of the two encounters following the November 2021 fuel release, based on the case definition used in a report on functional gastrointestinal disorders in the *Medical Surveillance Monthly Report*.⁷

Analysis

Logistic Regression Comparing Cohorts

Logistic regression models were run for each health condition of interest to compare the odds of an incident case following the release event. Separate models were run for each condition, with the condition as the dependent variable and the Comparison Cohort as the reference population in all models. Covariates of age group, beneficiary category, branch of service, follow-up time, and sex were excluded from a model if the p -value was ≥ 0.4 in the fully adjusted model. For some health conditions, there were no cases in either cohort for specific age subgroups. Those age groups were excluded from the analysis for those conditions, while the other age groups remained as a covariate. As an example, none of the individuals under 5 years of age in either cohort developed incident peripheral neuropathy. The model for peripheral neuropathy analyzed cohort members 5 years old and older, controlling for the older age groups.

Covariate subgroups were combined based on the size of the subgroups and similar odds of reporting short-term jet fuel exposure symptoms in the Red Hill Cohort after the fuel release (previous unpublished analysis). Ages were grouped into the following categories: <5, 5–14, 15–34, 35–64, and ≥ 65 years. The Beneficiary category was classified by Active Duty/Active Guard/Active Reserve; Active Duty Family Members; Retiree/Survivor; Inactive Guard/Inactive Guard Dependents/Active Guard Dependents/Retiree Dependents/Other. Branch of Service was classified into Army, Marine Corps/Coast Guard, and Other (includes Navy, Air Force, and Space Force). Follow-up time in months was included as a continuous variable.

The Firth bias correction was used in two models, EoE and Raynaud's syndrome, because the number of cases was inadequate to support the number of included covariates.⁸ Odds were not calculated for conditions having fewer than 30 positive cases across both cohorts due to lack of power. To account for bias from conducting multiple logistic regression models, a Šidák⁹ correction was applied to a family-wise confidence level of 95%.

Monthly Trends

A migraine trend line was created for each cohort. These trends show the number of unique individuals who had health care encounters with a migraine diagnosis by month, including both incident and pre-established migraine diagnoses. Trendlines were not developed for other conditions due to low monthly numbers. Individuals were excluded from the trend lines if they did not maintain DEERS eligibility for the entire observation period, November 1, 2020 to December 31, 2023.

For the calculation of monthly trends, the numbers in the Comparison Cohort were weighted by age group, beneficiary category, and branch of service, using the Red Hill Cohort as the reference population to ensure comparability between the two cohorts. Thus, the Red Hill Cohort numbers were not weighted or otherwise adjusted. An interrupted time series analysis was used to compare the trends and levels between the Red Hill Cohort before and after the November 2021 release event, and to compare the trends and levels between the two cohorts after the release event.

Results

Demographics

There were 54,411 individuals identified from the DOEHRs-IR Red Hill roster; 44,373 were DEERS-eligible and therefore included in the analysis as comprising the Red Hill Cohort. Individuals identified from the roster but not registered in DEERS were excluded (n=10,038). The Comparison Cohort comprised 59,499 individuals selected from DEERS.

Table 1 presents the demographic characteristics of each cohort. The two cohorts had similar sex distributions, approximately 60% male and 40% female. The Red Hill Cohort had a higher proportion of reservists than the Comparison Cohort (~10% vs 1%, respectively).

The greatest demographic differences between the two cohorts were related to branch of service and age group. The Red Hill Cohort had a higher proportion of Air Force- (32.34% vs 6.78%) and Navy-affiliated (27.17% vs 12.38%) beneficiaries, while the Comparison Cohort had a higher proportion of Army- (56.04% vs 22.42%) and Marine Corps-affiliated (23.09% vs 3.51%) beneficiaries. The Red Hill Cohort had higher proportions of individuals aged 35–44 (22.32% vs 10.34%) and 45–64 (13.15% vs 7.22%), and lower proportions of individuals aged 18–24 (15.49% vs 27.13%) and ≥65 (0.88% vs 7.59%). Many of the smaller subgroups, such as Coast Guard and Retirees, were combined with other groups for the analysis. These differences were addressed in the analysis through multiple logistic regression and the use of weighting for the trend analysis, as unadjusted data from the Comparison Cohort would not be comparable to the Red Hill Cohort.

Table 1. Demographic Characteristics of Red Hill and Comparison Cohorts

Characteristic	Category	Red Hill Cohort (n=44,373)		Comparison Cohort (n=59,499)	
		Number	Percent	Number	Percent
Sex	Female	17,057	38.44	24,638	41.41
	Male	27,316	61.56	34,860	58.59
	Unknown			1	0.00
Beneficiary Category	Active Duty	18,060	40.70	25,899	43.53
	Active Duty Family Member	15,259	34.39	20,773	34.91
	Inactive Guard/Reserve	3,154	7.11	331	0.56
	Retirees	2,499	5.63	3,784	6.36
	Retiree Family	2,404	5.42	5,270	8.86
	AD Guard/Reserve	1,432	3.23	543	0.91
	AD Guard/Reserve Family Member	657	1.48	1,080	1.82
	Other	394	0.89	325	0.55
	Inactive Guard/Reserve Family Member	303	0.68	331	0.56
Surviving Family Member	211	0.48	1,069	1.80	
Service	Air Force	14,351	32.34	4,036	6.78
	Navy	12,056	27.17	7,365	12.38
	Army	9,949	22.42	33,343	56.04
	Other/Unknown	5,672	12.78	148	0.25
	Marine Corps	1,559	3.51	13,736	23.09
	Coast Guard	786	1.77	871	1.46
Age Group	0-4	2,710	6.11	5,310	8.92
	5-14	5,658	12.75	7,268	12.22
	15-17	1,038	2.34	1,283	2.16
	18-24	6,873	15.49	16,140	27.13
	25-34	11,967	26.97	14,530	24.42
	35-44	9,902	22.32	6,154	10.34
	45-64	5,836	13.15	4,298	7.22
	65+	389	0.88	4,516	7.59

Data Source: Defense Enrollment Eligibility System (DEERS)

Prepared by the EpiData Center, Defense Centers for Public Health – Portsmouth (DCPH-P), June 12, 2024

Logistic Regression Comparing Cohorts

Table 2 displays the results of the logistic regression models for odds of incident cases for the Red Hill and Comparison Cohorts following the release event. For the hematuria analysis, 1,261 individuals (2.84%) from the Red Hill Cohort and 2,192 individuals (3.69%) from the Comparison Cohort were removed due to not having 1 year of prior DEERS eligibility; children younger than 12 months of age and who were DEERS-eligible were retained. For all other analyses, 3,453 (7.78%) from the Red Hill Cohort and 7,745 (13.05%) from the Comparison Cohort were removed because they did not have at least 2 years of DEERS eligibility leading up to the fuel release.

The Šidák correction resulted in 99.15% confidence intervals (CI) per outcome.⁹ Two of the six conditions were statistically significant at the Šidák-corrected threshold of $P=0.0085$. The Red Hill Cohort had higher odds of incident migraine cases (OR = 1.38 [99.15% CI: 1.17–1.64]) and incident EoE cases (Firth-corrected OR=2.54 [99.15% CI: 1.08–6.04]) than the Comparison Cohort. However, the high ratio between the upper and lower confidence intervals for EoE indicate an imprecise estimate. Non-Firth-corrected models were also run for EoE and Raynaud’s syndrome for the purpose of comparison. The results showed no change in the level of statistical significance for either outcome.

Table 2. Logistic Regression Results for Odds of Incident Cases, Red Hill Cohort vs. Comparison Cohort, November 21, 2021–December 31, 2023

Condition ^a	Odds Ratio (99.15% Confidence Interval)	p-value	Total Incident Cases in Both Cohorts
Migraine ^b	1.38 (1.17-1.64)	<0.0001	1,535
Eosinophilic Esophagitis ^{c,d}	2.54 (1.08-6.04) ^h	0.0027	62
Hematuria ^e	1.28 (0.95-1.71)	0.0289	379
Irritable Bowel Syndrome ^{b,f}	0.84 (0.51-1.37)	0.3478	184
Peripheral Neuropathy ^{f,b}	0.81 (0.48-1.36)	0.2855	156
Raynaud's Syndrome ^f	2.03 (0.79-5.64) ^h	0.0440	33

Data Sources: Standard Inpatient Data Record (SIDR), Theater Medical Data Store (TMDS), Comprehensive Ambulatory Professional Encounter Record (CAPER), Military Health System (MHS) GENESIS, Tricare Encounter Data-Institutional (TED-I), the Tricare Encounter Data-Non-Institutional (TED-NI), and Defense Enrollment Eligibility System (DEERS).

^aEach condition was run as a separate model. Comparison cohort is the reference group in all analyses. Statistical significance set at 0.0085. All analyses adjusted for Age Group, Beneficiary Category and Sex.

^bAlso adjusted for Branch and follow-up time.

^cAges 45-54 and > 64 removed from analysis.

^dAlso adjusted for Branch.

^eAlso adjusted for follow-up time.

^fAges < 5 removed from analysis.

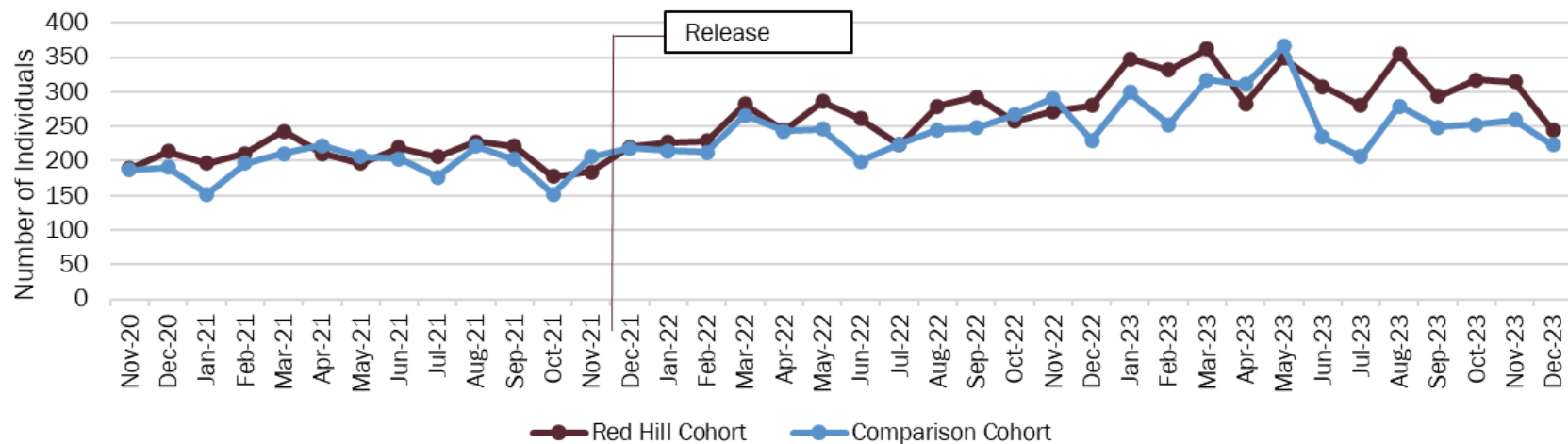
^hFirth correction applied. Statistical significance in non-Firth corrected models did not differ.

Prepared by the EpiData Center, Defense Centers for Public Health – Portsmouth (DCPH-P), July 23, 2024.

Migraine Trends

Figure 1 shows trends among individuals with health care encounters for migraine. After the fuel release, the average number of encounters per person was the same for both cohorts, 3.5 (data not shown). However, in the Red Hill Cohort, the period after the fuel release had a faster-increasing trend than the period before the fuel release (Interrupted Time Series, estimate=0.01, P=0.0466). In the period after the fuel release, the trend for the Red Hill Cohort did not differ from the trend for the Comparison Cohort (Interrupted Time Series, P=0.1158) but did have a higher overall number of people per month (Interrupted Times Series, estimate=0.38, P<0.0001; data not shown).

Figure 2. Monthly Number of Red Hill and Comparison Cohort Members Seeking Care for Migraine, November 1, 2020–December 31, 2023



Data Sources: Standard Inpatient Data Record (SIDR), Theater Medical Data Store (TMDS), Comprehensive Ambulatory Professional Encounter Record (CAPER), Military Health System (MHS) GENESIS, Tricare Encounter Data-Institutional (TED-I), the Tricare Encounter Data-Non-Institutional (TED-NI), Defense Enrollment Eligibility System (DEERS).

Prepared by the EpiData Center, Defense Centers for Public Health – Portsmouth (DCPH-P), June 12, 2024

Discussion

This report provides an analysis of specific health conditions among the Red Hill community following the JP-5 fuel release in November 2021. Notably, there is limited published literature on the health effects of JP-5 ingestion, and currently, no causal link has been established between this exposure and the specific health conditions reported by some Red Hill community members. These conditions occur in a small percentage of individuals, necessitating cautious interpretation of results due to the small case numbers for some conditions, and possible unknown demographic differences between the Red Hill Cohort and the Comparison Cohort. This study design does not imply any causal links between the JP-5 exposure and the study outcomes.

Individuals in the Red Hill Cohort showed a higher likelihood of having incident cases of migraines and EoE compared to the Comparison Cohort. No statistically significant differences were found for hematuria, IBS, peripheral neuropathy, or Raynaud's syndrome between the two cohorts. The strength of an association between an exposure and health outcome is based on three factors: the magnitude, statistical significance, and precision of the estimate. For migraine, the estimate was considered to be significant and precise, but the magnitude was low: 1.38. For EoE, the estimate magnitude was sufficiently elevated (2.54) and significant, but the precision was low. When all three conditions cannot be met, it is important not to over interpret the analysis results.

An increasing trend in monthly health care encounters for migraines was observed in both cohorts after the release event. The similar increasing trend in both cohorts suggests that factors other than the fuel release, possibly the sharp increase in COVID-19 cases in Hawai'i following the release event¹⁰ and the associated post-COVID conditions¹¹, might have contributed to the rise in migraine cases. This connection was not investigated as a part of this report.

Limitations

Records dating back to 2 years prior to the event were reviewed to rule out pre-existing cases. Diagnoses of conditions prior to this 20-year look-back were not identified for this analysis.

Physician chart reviews were conducted for EoE incident cases identified through diagnostic codes. Although 22.6% of cases identified as EoE were found to have a history of EoE before the fuel release, the rate of misidentification did not differ between the two groups. This indicates that the difference in odds of EoE between the two cohorts is not likely to be the result of misclassification.

Data for medical surveillance are considered provisional, and medical case counts may change if the electronic medical record was updated after this report was generated. Additionally, because private sector care records are submitted into the MHS at different

times, there may be a time lag that could alter the findings and conclusions of this report. Every effort was made to obtain the most up-to-date health records available.

This report is limited to available diagnostic codes entered into the electronic health record based on patient reports of symptoms to a health care provider. These administrative data analyze specific codes that may be related to health conditions on a population level; however, since potentially associated symptoms are common across many conditions, specific codes for a diagnosis of interest cannot be corroborated to either concerns of the release exposure or another unrelated medical issue, such as COVID. Due to Hawai'i Department of Health provider guidance following the exposure event,¹² there is a potential for physician bias in the diagnosis of these conditions among the Red Hill Cohort. There may be characteristic differences between the two cohorts that could not be measured in the current data; all confounders may not be included in statistical models. Observational epidemiology studies can reveal associations but cannot establish causal links due to the inability to control for confounding circumstances and characteristics. This necessitates cautious interpretation of results.

Contact Us

Since 2006, the EpiData Center (EDC) has provided timely, actionable data surveillance and analysis for the Department of the Navy and Department of Defense in support of military health and readiness. The EDC's epidemiological and technical expertise informs a comprehensive, evidence-based suite of public health products regarding reportable and emerging infections, health care-associated infections, delivery of care challenges, patient safety, behavioral and operational health, exposure and injury analysis, and application development and data systems support.

For questions about this report, or to inquire about project support, please contact the EDC at usn.hampton-roads.navmcpubhlthcenpors.list.nmcphc-epi-plls@health.mil.

Glossary

Comparison Cohort: DoD health care beneficiaries residing in ZIP codes in or near Scofield Barracks (96857, 96759, 96786, 96791, 96789) or Marine Corps Air Station Kaneohe Bay (96863, 96734, 96744 or 96795) in Hawai'i in November 2021.

Comprehensive Ambulatory Professional Encounter Record (CAPER): Records created by providers after a visit with a patient using the military health system. Each observation in the CAPER file represents an ambulatory visit at an MTF, inpatient rounds data, or administrative function.

Confidence Interval (CI): The expected variation of an estimate (percent, odds, average difference, etc.) around a given average.

Confidence Level: The percent of the time that the estimate is likely to fall within the confidence interval.

Covariates: Characteristics, such as age and affiliation, that may differ between two populations but are not the risk factor of interest. If covariate subgroups have different risk of a health condition, such as older individuals having higher risk than younger individuals, statistical analysis must control for these differences, or the conclusions may be invalid. Covariates used in this analysis were age, sex, beneficiary category, service branch affiliation, and months of DEERS eligibility following the release event.

Dependent Variable: An outcome of interest, such as a symptom or illness, in a health science analysis.

GENESIS Admissions Table: Inpatient data from military electronic health records. Each observation in the MHS GENESIS Admissions table represents an inpatient admission to an MTF that has transitioned to the MHS GENESIS system.

GENESIS Episodic Encounter Table: Records created by providers using the MHS electronic records system, MHS GENESIS (established in 2019), after a patient visit. Each observation in the MHS GENESIS Episodic Encounter table represents a visit at an MTF that has transitioned to the MHS GENESIS system and includes ambulatory or administrative function data.

Health Care Encounter: An individual visit or communication with a health care provider that was billed to insurance.

Independent Variable: A characteristic, exposure, or treatment that is believed to influence the outcome of interest (dependent variable) in a health science analysis. A covariate (see above) is a type of independent variable.

Logistic Regression: A method of estimating the probability that an individual will experience an outcome, such as an illness, based on a given set of characteristics of that individual.

Jet Propellant-5 (JP-5): A kerosene-based fuel used in military aircraft. It consists primarily of Total Petroleum Hydrocarbons (TPH) diesel range organics.

Military Health System (MHS): A health system that supports the military mission by fostering, protecting, sustaining, and restoring health; and providing the direction, resources, health care providers, and other means necessary for promoting the health of the beneficiary population.

Private Sector Care: Medical care provided by civilian providers, including individuals, groups, hospitals, and clinics, who have agreed to accept TRICARE beneficiaries. Providers in the private sector care system generally deliver health care at negotiated rates, adhere to provider agreements, and follow other requirements of the managed care program.

P-value: The probability that an observed difference between two groups is due to chance, rather than a true difference.

Red Hill Cohort: DoD-affiliated military housing residents (including Coast Guard) at JBPHH, temporary additional duty (TAD)/temporary duty travel (TDY) visitors, and base workers at the time of the JP-5 fuel release into its water system on 20 November 2021.

Reference Population: In a regression model, the group to which all other groups are compared. An odds ratio of 2.0 means twice the odds as the reference population.

Standard Inpatient Data Record (SIDR): Inpatient data from military electronic health records. Each observation in the SIDR file represents an inpatient admission to an MTF.

TRICARE Encounter Data Non-Institutional (TED-NI): Records created by private sector care providers after a visit with a patient enrolled in the TRICARE health care program. Each observation in the TED-NI file represents an ambulatory visit.

TRICARE Encounter Data Institutional (TED-I): Inpatient records created by private sector care providers after an inpatient admission for a patient enrolled in the TRICARE health care program.

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Appendix

Table A. Diagnostic Codes used in Case Definitions

Condition	ICD 10 Codes	ICD 9 Codes	Exclusions
EoE	K20.0	53013	
Hematuria	R31*	5997	N390, O23, O862, 5990, 6466
IBS	K58*	5641	
Migraine	G43*	346*	
Peripheral Neuropathy	G603, G608, G609, G618, G619, G622, G629, G6289, G64, G652	3564, 3568, 3569, 3577, 3579, 35789	
Raynaud's Syndrome	I73.0	4430	