Intratheater Dental Evacuation Trends within U.S. CENTCOM: From the Global War on Terror to the Era of Large-Scale Combat Operations, 2009-2023

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INTRODUCTION

As the U.S. Army prepares for large-scale combat operations (LSCO) against near-peer adversaries, medical planners anticipate that medical evacuation (MEDEVAC) will not be guaranteed in the future.[1] The loss of air superiority overturns the historic reliance on air MEDEVAC which was so effective during counterinsurgency (COIN) operations in Afghanistan and Iraq. It is predicted that contested domains and the volume of casualties in LSCO will only allow for brief windows of evacuation.[2] In addition to the myriad wounded-in-action and trauma patients, the burden of routine disease and non-battle injuries (DNBI) must also be considered. A 2021 report found that mental health and non-battle injuries were the two most common reasons for evacuations out of the United States Central Command (U.S. CENTCOM) area of responsibility.[3] Dental patients can comprise 19% of the workload at U.S. Role II medical treatment facilities (MTFs) and up to 46% at multinational Role II MTFs.[4,5] In 2013, French forces deployed to Mali without organic dental support and found that dental emergencies accounted for 16% of all air MEDEVAC out of theater.[6] The military health system (MHS) must consider the burden that Dental-DNBI impose on both treatment facilities and evacuation platforms.

MEDEVAC is defined as patient movement on dedicated and marked medical platforms with en route care provided by medical personnel.[7] Conversely, casualty evacuation (CASEVAC) is defined as patient movement aboard non-medical platforms without en route medical care.[7] This study utilized data from the Dental-DNBI Encounter Module to analyze intratheater dental evacuations by both MEDEVAC and CASEVAC to dental treatment facilities (DTFs). Intratheater evacuation describes the system that uses resources to move patients to and from treatment facilities within a theater of operations.[7] The Dental-DNBI Encounter Module is a data entry form that has been attached to the Corporate Dental Application (CDA) since 2009. The module appears whenever a dentist enters the dental treatment codes for either a dental emergency or a problem-focused examination.[8] The module is then completed by the provider to document additional variables.[8] The Dental-DNBI Encounter Module supplements dental treatment codes and provider narratives captured by the CDA to better understand the burden of Dental-DNBI in deployed environments.

The objective of this study is to determine the distribution of travel modes to DTFs within the U.S. CENTCOM area of responsibility from 2009 to 2023. Understanding evacuation methods utilized during the Global War on Terror will inform best practices as the U.S. Army enters the era of large-scale combat with near peer adversaries. This study focused on Dental-DNBI data collected across years of COIN operations in Afghanistan, Iraq, and Kuwait.

METHODS

This study used deidentified data from the Dental-DNBI Encounter Module within the U.S. Army Corporate Dental Application (CDA). The Dental-DNBI Encounter Module includes a series of intake questions completed by the dental provider at the DTF. This information is collected to supplement the provider narratives and procedure codes captured within the CDA. The data was recorded at U.S. Army DTFs during military deployments to Afghanistan, Iraq, and Kuwait from 2009-2023. In Afghanistan, data collection ranged from June 2010 to December 2020. In Iraq, data collection ranged from January 2010 to May 2023. In Kuwait, data collection ranged from April 2009 to July 2023. Data were collected and deidentified by personnel at the Joint Operational Medicine Information Systems (JOMIS) Program, Dental Integration Service Center (DISC). Due to the deidentified nature of the data, this study was approved as research not involving human subjects and provided U.S. Army Institute of Surgical Research Log Number H-25-006nh.

Dataset variables include travel (transportation) mode, which describes patient arrival to the dental treatment facility (DTF) for routine or emergency dental treatment. Travel mode included: Foot (Walk), Air-Unit, Air-Medical, Ground-Unit, Ground-Medical. Air-Unit and Ground-Unit were organized as CASEVAC. Air-Medical and Ground-Medical were organized as MEDEVAC. Additional variables include patient U.S. branch of service: Army, Air Force, Marine Corps, Navy, and Space Force. In addition to military personnel, the data set also captured evacuations among contractor and civilian personnel by each branch of service. These categories were consolidated into two groups, Department of Defense (DOD) civilians and contractors. Additional variables include appointment date and number of months the patient had been deployed when seeking dental treatment. The dataset documented travel encounters for over 30,000 U.S Army Active-Duty, National Guard, and Army Reserve personnel. An analysis of variance (ANOVA) and a Tukey's Honestly Significant Difference (HSD) Post-hoc Test were performed to compare the average (mean) time of Army personnel seeking dental treatment in the three theaters of operation. This study concentrated on the travel manner for routine and emergency dental visits in the deployed theater of operations.

RESULTS

The Dental-DNBI Encounter Module recorded 34,318 travel entries among military personnel in Afghanistan, Iraq, and Kuwait during the observed period (Table 1). In Afghanistan, 14,514 (90.0%) of all evacuations occurred from Calendar Year (CY) 2010-2014 during Operation Enduring Freedom (OEF). In Afghanistan, the primary travel mode to the DTF was Ground-Unit, or Ground casualty evacuation (CASEVAC) at 59.2% (n=9,542). Foot transportation, due to proximity to a DTF, accounted 33.9% (n=5,467).

In Iraq, there were 14,201 travel entries among military personnel and 96.2% of all transports occurred from 2010-2011. This timeframe coincides with the end of Operation Iraqi Freedom (OIF) and the drawdown during Operation New Dawn (OND). In Iraq, Ground CASEVAC accounted for 56.8 % (n=8,073) of transports, foot transportation accounted for 41.4% (n=5,885), and Air CASEVAC accounted for 1.2% (n=174). In Kuwait, 63.7% of transports were by ground CASEVAC (n=2,540) and 35.7% were by foot transportation (n=1,425). All others form of transportation totaled 0.6% (n=25).

Table 2 shows monthly average dental transport rates for the three countries. Afghanistan had a peak monthly transport rate during CY 2011 of 401 transports per month and dropped off dramatically after the end of OEF on 31 December 2014. In Afghanistan during CY 2020, the monthly transport rate was only 13 transports per month. Iraq had a peak monthly transport rate in CY 2010 of 723 transports per month. After the end of OND in December 2011, the monthly transport rate in Iraq dropped from 415 transports per month in CY 2011 to zero in CY 2012. Subsequent years never saw the monthly transport rate rise above 14 transports per month. For Kuwait, the peak year for transports was CY 2016 with only 59 transports per month.

Table 3 provides the intratheater evacuations by branch of service. U.S. Army active-duty personnel accounted for a total of 41.6% (n=14,282) transports. The Army National Guard (ARNG) accounted for 26.4% and the U.S. Army Reserve (USAR) accounted 18.7%. All three Army components combined to account for over 85% of all transports. No other branch and component approached 5.0% of the total. Regarding the Total Army, the Dental-DNBI Encounter Module also recorded the number of months each patient had been deployed when they traveled to the DTF. From this, the mean number of months of deployment in theater when seeking dental treatment were calculated (Table 4). It should be noted that in Afghanistan, the average time to seek routine or emergency dental treatment in theater were similar for all Army components. However, in Iraq, Army active-duty personnel sought dental treatment significantly earlier than the USAR (5.28 months vs. 5.62 months, p=.0001). The mean number of months for the ARNG (5.41 months) fell in between the Army active-duty and the

Table 1. U.S. CENTCOM Intratheater Dental Evacuations, Military Personnel

	Afghanistan	Iraq	Kuwait
Ground CASEVAC	9,542 (59.2%)	8,073 (56.8%)	2,540 (63.7%)
Foot	5,467 (33.9%)	5,885 (41.4%)	1,425 (35.7%)
Air CASEVAC	977 (6.1%)	174 (1.2%)	13 (0.3%)
Air MEDEVAC	119 (0.7%)	55 (0.4%)	8 (0.3%)
Ground MEDEVAC	22 (0.1%)	14 (0.1%)	4 (0.1%)
Total	16,127	14,201	3,990
Notes:	14,514 (90.0%) occurred from CY 2010-2014. None occurred after CY 2020.	13,660 (96.2%) occurred from CY 2010-2011.	

Table 2. Average Monthly Military Transports (transports to dental treatment facility/month)

Year	Afghanistan	Iraq	Kuwait
2010	66	723	35
2011	401	415	29
2012	375	0	21
2013	223	0	19
2014	144	0	22
2015	37	0	35
2016	9	2	59
2017	19	13	33
2018	33	14	6
2019	24	8	3
2020	13	1	7
2021	x	5	33
2022	x	3	25
2023	x	0	4

Operation New Dawn ended CY 2011.Operation Enduring Freedom ended CY 2014.All U.S. troops departed Afghanistan in August 2021.

Table 3. U.S. CENTCOM Intratheater Dental Evacuations, Branch of Service

	Afghanistan	Iraq	Kuwait	Total	Total %
Army Active Duty	6,887	6,054	1,341	14,282	41.6%
Army National Guard	3,765	3,953	1,349	9,067	26.4%
Army Reserve	2,546	2,809	1,077	6,432	18.7%
Air Force	908	443	53	1,403	4.1%
Air National Guard	492	222	48	762	2.2%
Navy Reserve	486	192	0	678	2.0%
Navy Active Duty	345	238	18	601	1.8%
Air Force Reserve	301	197	19	517	1.5%
Marines	295	43	72	410	1.2%
Marine Reserves	75	17	13	105	0.3%
Space Force	14	10	0	24	<0.1%
Coast Guard	8	8	0	16	<0.1%
Coast Guard Reserve	3	11	0	14	<0.1%
Public Health Service	2	2	0	4	<0.1%
Army Cadet	0	2	0	2	<0.1%
Total	16,127	14,201	3,990	34,318	
Notes:	14,514 (90.0%) occurred from CY 2010-2014. None occurred after CY 2020.	13,660 (96.2%) occurred from CY 2010-2011.			a

a: 29,783 (86.8%) All Army Components: Active, Guard, Reserve, Cadet; 2,682 (7.8%) All Air Force components: Active, Guard, Reserve;1, 279 (3.7%) Navy: Active & Reserve; 515 (1.5%) Marine: Active & Reserve

ARNG. In Kuwait, the ARNG sought dental treatment significantly earlier than both the USAR (4.92 months vs. 5.29 months, p=.00083) and Army active-duty (4.92 months vs. 5.31 months, p=.00026).

The Dental-DNBI Encounter Module recorded 2,949 travel entries among DoD civilians and contractors in Afghanistan, Iraq, and Kuwait during the observed period (Table 5). In Afghanistan, 75.8% (n=554) DoD civilians and 58.5% (n=502) contractors were transported by Ground CASEVAC, respectively. In Afghanistan, 86.1% (n=1,368) of all transports occurred from 2010-2014. In Iraq, 77.4% (n=443) DoD civilians and 61.4% (n=348) contractors were transported by Ground CASEVAC, respectively. In Iraq, 94.0% (n=1,070) of all transports occurred from 2010-2011.

DISCUSSION

During the Global War on Terror, the U.S. military experienced the highest survival rates in the history of warfare. The "golden hour" policy to evacuate patients to lifesaving treatments within 60 minutes of injury was unprecedented in warfare.[9] Future large-scale combat and observations from the Russo-Ukrainian War suggest there will be brief opportunities for evacuation which emphasizes the need for prolonged care.[10] Among these significant medical and tactical problem sets, we must also consider patients with routine, disease and non-battle injuries. To contextualize future concerns for Dental-DNBI patients, the authors analyzed evacuation trends during the Global War on Terror.

The results in this study demonstrate an overwhelming trend for the use of CASEVAC platforms to transport Dental-DNBI within the CENTCOM area of responsibility. CASEVAC maintains MEDEVAC availability for wounded and critical patients which enables freedom of medical movement in the battlespace. In future large-scale combat, Ground CASEVAC may be the most reliable method of evacuating Dental-DNBI patients, especially given its successful employment during the Global War on Terror. Additional considerations include the impact of terrain. Air CASEVAC was more utilized in Afghanistan compared to Iraq. Air CASEVAC accounted

Table 4. Mean months in theater when seeking dental treatment. Army components

	Afghanistan	Iraq	Kuwait
Army Active Duty	5.22	5.28[a]	5.31
ARNG	5.26	5.41	4.92[b]
USAR	5.24	5.62	5.29

a: Significantly sooner than the USAR (5.28 months vs. 5.62 months, p=.0001) b: Significantly sooner than the USAR & Army Active-Duty (4.92 months vs. 5.29 months, p=.00083) (4.92 months vs. 5.31 months, p=.00026)

for 6.1% of total transportations in Afghanistan compared to 1.2% in Iraq, and this is likely attributed to the rugged, mountainous terrain.

Medical planners must consider the duration of an operational deployment when timing the need for dental support in a theater of operations. In this study, all Army personnel had been transported for dental treatment before the 6-month point of their respective deployment. As observed in Kuwait, ARNG personnel required dental treatment as early as 4.92 mean months into their deployment. To sustain combat readiness and minimize risk to the combatant commander, if a deployment exceeds 4 months, then dental support should be forward deployed and prepared to receive patients. If a unit deploys without dental support, then there will be a greater risk of dental evacuations out of theater as described by Gunepin et al in Mali.[6] Conversely, if a deployment is shorter than 4 months, then the risk to combat effectiveness may be minimal, however, this topic requires further research and policy consideration.

Wojcik et. al. determined that in Afghanistan and Iraq, both ARNG and USAR personnel had a higher risk of experiencing a Dental-DNBI compared to their active-duty counterparts.[11] This study confirmed that there are significant dental needs in these populations as the ARNG and USAR combined to account for 45.1% of all intratheater dental evacuations. Large-scale combat operations will undoubtedly require mobilization of the ARNG and USAR and these populations may rely on active-duty dentists for treatment. The basis of allocation for dentist-to-patient ratios may require future research and consideration.

During the height of counterinsurgency operations in 2007, the DoD utilized the civilian workforce to compensate for the strain on active and reserve military personnel. According to Headquarters Department of the Army (HQDA) G-1, the DoD deployed over 50,000 civilians during the Afghanistan and Iraq conflicts.[12] Like their military counterparts, the DoD civilian workforce also requires medical and dental care. Mitchener et. al. discussed the dental treatment needs among DoD civilian employees and contractors.[13] From 2007 to 2008 in Iraq, nearly 400 U.S. civilian and contract employees arrived at deployed Navy DTFs to seek treatment for a dental emergency (DE).[13] In addition, nearly 60 U.S. DoD civilian and contract employees arrived at deployed Navy DTFs in Afghanistan during a four-month period in 2009 seeking treatment for a DE.[13] In this study, it is noteworthy that nearly 3,000 DoD civilians and contractors sought transportation for routine or emergency dental treatment while deployed. The overwhelming number of these cases occurred prior to the end of OND for Iraq and OEF for Afghanistan. This number of patients approximates an entire brigade combat team requiring evacuations for dental treatment. The civilian workforce will unquestionably support the DoD during a global large-scale conflict and their demands on dental treatment facilities and evacuation platforms must be considered.

Table 5. U.S. CENTCOM Intratheater Dental Evacuations, DoD Civilian and Contractor

	DoD Civilian	Contractor	DoD Civilian	Contractor	DoD Civilian	Contractor
GROUND CASEVAC	554 (75.8%)	502 (58.5%)	443 (77.4%)	348 (61.4%)	124 (82.1%)	47 (66.2%)
FOOT	163 (22.3%)	314 (36.6%)	126 (22.0%)	215 (38.0%)	26 (17.2%)	23 (32.4%)
AIR CASEVAC	14 (1.9%)	35 (4.1%)	3 (0.6%)	3 (0.6%)	0	1 (1.4%)
AIR MEDEVAC	0	5 (0.6%)	0	0	1 (0.7%)	0
GROUND MEDEVAC	0	0	0	0	0	0
Total	731	858	572	566	151	71
	Afghanistan		**Iraq**		**Kuwait**	
Combined Total	1,589		1,138		222	
Notes:	1,368 of 1589 (86.1%) occurred from CY 2010-2014. Last one occurred in July 2021 (one Contractor in that CY)		1,070 of 1,138 (94.0%) from CY 2010-2011.			

Among the operating forces, dentists are assigned to Role II units such as a Brigade Support Medical Company and provide dedicated support to a division. Dentists are also assigned to Role III units such as the Dental Company Area Support (DCAS) within a medical brigade. A DCAS plays a vital role in providing treatment to units who lack dedicated, organic dental support. Indeed, the volume and variety of military patients in this study underscore the critical role of area support units. Yet according to the Army Structure Memorandum (ARSTRUC) Fiscal Year 2025-2029, the 673RD DCAS from Joint Base Lewis-McCord, WA will be inactivated.[14] There are four active-duty DCAS. The change eliminates one-third of the active-duty deployable dental companies because the 618TH DCAS is geographically fixed to support Soldiers in the Korean peninsula. The ASTRUC will leave the 257TH DCAS and 502ND DCAS as the only remaining deployable active-duty dental companies. The inactivation will leave globally deployed personnel at greater risk for dental emergencies requiring evacuation for treatment, incurring lost productivity, and reducing combat strength. With fewer dental companies, the need for garrison care and predeployment dental readiness will be even more critical in the future.

There were significant limitations in the data set due to the incomplete nature of the encounter forms. As previously stated, the Dental DNBI Encounter Module is a two-page form that appears when the dental emergency code (A0199) or problem-focused code (A0140) is entered by the dental provider. The Dental-DNBI Encounter Module forms had incomplete portions for nearly 95% of the patient entries. These incomplete variables included the patient Dental Readiness Classification (DRC), dental procedure codes and dental examination dates. During correspondence with the JOMIS DISC and CDA staff, the investigators requested that the deidentified data set be reconciled to include dental procedure codes linked to each patient transport. These missing variables could not be reconciled since it was considered an error during initial patient intake and was not recognized during the subsequent health records audits. The records audits may have decreased in frequency during the drawdown of the Iraq and Afghanistan theaters. It is also possible that the dentists did not complete the entries on dental readiness classification or procedure codes because this information is already captured during the narrative and procedure entries linked to each patient encounter in the CDA. The encounter module is "an extra step" of data entry and there may have been limited compliance for that reason. These gaps in information indicate a need to educate and train providers on the module prior to an operational deployment.

Despite these shortcomings, the Dental DNBI Encounter Module represents a repository for continuous data collection that should be integrated with the Department of Defense Trauma Registry (DoDTR). The DoDTR has made efforts to holistically understand battlefield health and is fully integrated with sub-registries such as acoustic, vision, and military working dog.[15] Dental-DNBI should be integrated under the DoDTR umbrella to ensure the military has a comprehensive understanding of all battlefield health risks in preparation for large-scale combat operations. This retrospective study is the first analysis of dental evacuations conducted using the Dental DNBI Encounter Module and improves understanding of evacuation methods employed during the Global War on Terror. To the authors knowledge, there are no other studies which have reported on intratheater evacuations for dental treatment during any major conflict.

CONCLUSION

The Dental-DNBI Encounter Module recorded 34,318 travel entries among military personnel in Afghanistan, Iraq, and Kuwait from 2009 to 2023. In Afghanistan, 14,514 (90.0%) of all evacuations occurred from Calendar Year 2010-2014 during Operation Enduring Freedom. In Iraq, there were 14,201 travel entries among military personnel and 13,660 (96.2%) of all transports occurred from CY 2010-2011 which coincides with the end of Operation New Dawn. In all three theaters, ground CASEVAC (n=20,155) was the primary method of evacuation followed by foot transportation (n=12,777), with overall averages of 58.7% and 37.2%, respectively. Perhaps due to harsh terrain, air CASEVAC (n=1164) appeared more frequently in Afghanistan compared to other theaters. Also, ground MEDEVAC (n=40) and air MEDEVAC (n=182) occurred more frequently in Afghanistan than the other theaters. The results of this study demonstrate an overwhelming trend for the use of CASEVAC platforms to transport Dental-DNBI in the CENTCOM area of responsibility. In future large-scale combat, Ground CASEVAC may be the most reliable method of evacuating Dental-DNBI patients, especially given its successful employment during the Global War on Terror.

U.S. Army active-duty personnel accounted for a total of 41.6% (n=14,282) transports. The Army National Guard (ARNG) accounted for 26.4% and the U.S. Army Reserve (USAR) accounted 18.7%. All three Army components combined to account for over 85% of all transports. In Iraq, Army active-duty personnel sought dental treatment significantly earlier than the USAR (5.28 months vs. 5.62 months, p=.0001). In Kuwait, the ARNG sought dental treatment significantly earlier than both the USAR (4.92 months vs. 5.29 months, p=.00083) and Army active-duty (4.92 months vs. 5.31 months, p=.00026). Medical planners must consider when dental support must be established in a theater of operations. Based on these findings, if a deployment exceeds 4 months, then dental support should be forward deployed and prepared to receive patients. If a unit deploys without dental support, then there will be a greater risk of dental evacuations out of theater. However, this topic requires

further research and policy consideration on the appropriate methods to utilize resources, sustain combat readiness, and minimize risk to the combatant commander.

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