UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

DEC 23 2021

The Honorable Jack Reed
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The Department's response to House Report 116-442, page 157, accompanying H.R. 6395, the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, on Ultrasound Technology to Identify Subdermal Injuries in Strangulation Victims, is enclosed.

The report summarizes the quantity, distribution, and cost of diagnostic devices necessary to conduct diagnostic assessment of strangulation victims across Military Health System (MHS) emergency departments. Findings indicate ultrasound is not the preferred imaging modality in strangulation cases, irrespective of acquisition cost. Computed tomography (CT) or CT Angiography (CTA) is the clinically-indicated and physician-endorsed standard for diagnostic assessment of strangulation victims. Analysis of MHS infrastructure indicates CT and/or CTA capability exists onsite or at a co-located radiology department at all operational emergency departments.

Thank you for your continued strong support for the health and well-being of our Service members, veterans, and families. I am sending a similar letter to the House Armed Services Committee.

Sincerely,

Gilbert R. Cisneros, Jr.

Enclosure:
As stated

cc:
The Honorable James M. Inhofe
Ranking Member

UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

DEC 23 2021

The Honorable Adam Smith
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

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cc:
The Honorable Mike D. Rogers
Ranking Member

Report to Congress

House Report 116-442, page 157, accompanying H.R. 6395, the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, on Ultrasound Technology to Identify Subdermal Injuries in Strangulation Victims

December 2021

The estimated cost of this report for the Department of Defense (DoD) is approximately $8,260 in Fiscal Years 2020 and 2021. This includes $5,770 in expenses and $2,490 in DoD labor.

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EXECUTIVE SUMMARY

This report is in response to House Report 116-442, page 157, accompanying H.R. 6395, the William M. (Mac) Thornberry National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2021, on Ultrasound Technology to Identify Subdermal Injuries in Strangulation Victims, which requests the quantity, distribution, and cost of devices necessary to conduct diagnostic assessment of strangulation victims across Military Health System (MHS) military medical treatment facility (MTF) emergency departments (EDs), which will be referred to in this report as "EDs," "MHS EDs" or "MTF EDs." It is the conclusion of the MHS medical subject matter experts (SMEs) that a multimodal approach is optimal to diagnose strangulation injuries in EDs. Computed tomography (CT) or CT Angiography (CTA) is the clinically-indicated and physician-endorsed standard for diagnostic assessment of subdermal injuries in strangulation victims. Analysis of MHS infrastructure indicates CT and/or CTA capability exists on-site or at a co-located radiology department at all operational EDs.

While ultrasound is a common modality with immediate availability in most ED settings, ultrasound is not the recommended modality to detect subdermal injuries in strangulation victims, irrespective of acquisition cost. Most MHS EDs are co-located with a radiology department with alternate diagnostic modalities (e.g., X-ray, magnetic resonance imaging (MRI), or CT scan) that are better suited to conduct comprehensive assessment of injuries associated with strangulation as directed by a physician.

An objective and detailed screening by a qualified physician for non-fatal strangulation (NFS)-related injuries in the ED is a prerequisite for the identification and risk stratification of current or delayed injuries, and subsequent diagnostics. Clinical findings may be relevant to subsequent forensic investigations; however, emergency medicine and trauma physicians are bound by duties to perform only life-saving and clinically-indicated evaluation and treatment.

Access to trained ED physicians and to clinically-indicated diagnostic modalities is the standard for NFS injury diagnosis and re-evaluation based upon delayed symptoms in MHS Direct Care, as in civilian sector settings. Analysis reveals that 100 percent of operational MHS EDs have access to on-site or co-located CT capability. Based on the expert opinion of several military physicians queried and data analysis conducted for this report, access to CT capability is not an issue for patients presenting in MHS EDs. There is adequate CT capability across MHS EDs (i.e., within conjoined radiology departments) to diagnose patients with NFS-related injuries.

BACKGROUND

Intimate partner violence (IPV) (often termed domestic violence) is a serious public health concern affecting millions of Americans.[1] IPV is associated with several short-term and long-term negative health consequences for survivors, such as depression and anxiety disorders, as well as economic and social costs.[3,4] The John S. McCain NDAA for FY 2019 (Public Law 115-232) enacted a specific "domestic violence" offense under the Uniform Code of Military Justice.

IPV is described by the Centers for Disease Control and Prevention (CDC) as physical violence, sexual violence, stalking, or psychological harm by a current or former partner or spouse.[1] One in four women and one in ten men have reported some form of IPV during their lifetime.[2] In addition, the CDC identified that approximately one in six homicide victims are killed by an intimate partner.[3]

Intimate partner related homicide is often preceded by a history of violence; therefore, risk factor assessment of IPV is paramount.[5,6] NFS has been identified as a significant predictor for future morbidity and mortality as a result of escalating IPV.[5] To improve treatment and strengthen safety planning for this high-risk group of victims, early recognition and evaluation of injuries associated with an incident of NFS may be vital to prevent future lethal violence.[7]

PURPOSE AND SCOPE OF REPORT

The House Report expressed concern that the MHS does not have ample capability to diagnose strangulation injuries in its EDs to properly treat victims and produce evidence for military criminal investigators. The Report requests that the Secretary of Defense submit a report on the current number and types of devices available in the MHS to evaluate victims of strangulation in military MTF EDs, the cost of each device, and the number of devices required to diagnose these injuries in each ED in the MHS.

The scope of this report and related inquiries/complete report is confined to the MHS clinical, diagnostic infrastructure in place to evaluate strangulation victims seen in the ED, and associated ancillary service departments (e.g., radiology). Though they play an important role in both victim diagnosis and treatment, MHS physicians, nurses, and clinical technicians may lack the specialized forensic knowledge and skills necessary to appropriately manage the forensic needs of violent crime victims.

To respond to the House Armed Service Committee's inquiry regarding the quantity and types of devices available in the MHS to evaluate strangulation victims in EDs, the cost of each device, and the number of devices required to provide the capability across the MHS, data was compiled by the Defense Health Agency (DHA) Medical Logistics (MEDLOG) team to establish an environmental scan of existing diagnostic capabilities. MEDLOG's data pull spanned diagnostic modalities in several medical department locations within the MTF, which is necessary to capture holistic diagnostic capability available to presenting ED patients with NFS-related injuries. Data analysis featured a breakdown of diagnostic modality by location to provide a complete picture of capability at each MTF. The data set was then vetted with the Military Service ED Consultants (Army, Navy, Air Force) to validate that said diagnostic capabilities are

available to MTF ED physicians to perform an objective and clinically-indicated assessment of patients presenting with NFS-related symptoms at MTF EDs.

MHS medical personnel perform screening and diagnostics based on medical need and acute clinical indications; medical information may be permissible as legal evidence, but physicians are not dual-hatted as evidence collectors with an investigative mandate. Patient screening and treatment procedures must follow standards for Informed Consent and associated privacy laws. Specific inquiries on Department of Defense (DoD) capabilities, policy, response, and data collection associated with IPV, or other forms of assault, should be referred to the appropriate DoD investigative and/or personnel authorities, in addition to local and State law enforcement (as relevant). Non-clinical stakeholders who may be responsible for varying aspects of responding to a presenting IPV case may include the Military Departments' Judge Advocates General offices, Family Advocacy Programs, Defense Human Resources Activity (including the Sexual Assault Prevention and Response Office), DoD IPV Working Group (including representation by forensic nurses), and/or Sexual Assault Prevention and Response Victim Advocates and/or Coordinators.

DISCUSSION

Mechanism of Injury

Strangulation is defined as external pressure placed on an individual's neck constricting blood flow to the brain and/or airway, causing the inability to breathe.[5] The most common mechanism for a strangulation injury is manual strangulation, with the use of one or two hands or the forearms, or by a combination of different mechanisms.[8, 9] Loss of consciousness secondary to strangulation may occur within 10 seconds and brain death can occur within 5 minutes.[5]

Types of Injuries

NFS victims can present with multiple physical injuries dependent on the force that was applied and the length of time it was applied to disrupt blood flow and cause oxygen deprivation. Some injuries will be immediately visible while others may present days to weeks later, and may only be detectable via radiological imaging.[8, 10]

NFS victims may present with superficial injuries such as bruising, scratch marks, abrasions, and swelling to the neck that can be seen upon physical exam to support a diagnosis.[8] The victim may also suffer loss of consciousness and subsequent medical consequences, such as seizures, cardiac arrest, stroke, and severe brain injury. Latent NFS injuries can cause severe life-threatening complications, such as blood clots, vascular compromise, respiratory issues, or long-lasting neurological disorders. [8, 9]

Diagnostic Modalities

Clinical evidence and MHS expert opinion both support a multimodality approach to diagnosis of NFS-related injuries. Commonly used diagnostic modalities include: CT scan and CTA; MRI and magnetic resonance angiography (MRA) of the brain; chest X-ray; and Doppler

ultrasonography. Further description of each applicable diagnostic tool for assessment of NFS-related injuries in ED and trauma settings is below:

Modality	Description
CT scan	Recommended as a first line radiologic evaluation of strangulation injuries because of its rapid diagnostic capability and its widespread availability.[11]
CTA	A type of CT that is considered the gold standard for evaluation of vessels and vascular compromise. [8, 10, 11, 12]
MRI and MRA	While not as expedient or widely available as CT/CTA, an MRI/MRA is an additional non-emergent adjunctive tool that can be used as a follow-on modality in the inpatient or outpatient setting. MRI/MRA is a recommended choice to accurately assess for soft tissue injuries of the neck and severe injuries to the brain secondary to NFS.[8, 9, 12]
Chest X-ray	Simple and widely available diagnostic modality that is recommended to diagnose conditions related to respiratory compromise or for use in victims requiring airway support. [8, 9, 12]
Doppler ultrasonography	Not a preferred diagnostic tool to evaluate NFS injuries. While it may be used as an ancillary diagnostic modality, ultrasound is the least sensitive study and cannot comprehensively assess all the structures involved in strangulation injuries.[11, 12, 13]

CT and/or CTA, as augmented by additional modalities on a case-by-case basis, is the clinically-indicated and preferred method to perform diagnostic assessment of strangulation within MHS EDs and trauma settings. Other diagnostic modalities are often considered adjunctive based on presentation of injury, physician preference, or risk stratification for delayed injuries related to NFS. While other diagnostic tools may have some efficacy in specific cases based on injury type, CT and/or CTA is the optimal method and preferred over Doppler ultrasound due to vastly greater sensitivity and superior visibility. Based on the recommendation of the National Training Institute on Strangulation Prevention, CTA is the gold standard diagnostic modality for strangulation assessment, whereas Doppler ultrasound is specifically not recommended as a primary form of clinical evaluation.[2]

Data Analysis

To conduct the analysis within this report, data was compiled by DHA MEDLOG, and validated by the Military Service ED Consultants (Army, Navy, Air Force), to establish an environmental scan of existing capabilities. Compiled data includes an overview of MHS diagnostic tools stratified by equipment type, clinic type, purchasing Military Service/agency, and cost. The following analyses and graphics reflect diagnostic devices acquired by MHS from 1999-2020. Prevalence and cost data for NFS-related diagnostic modalities within MHS assists with understanding disparities across sponsoring Service/agency, where MHS diagnostic equipment is located (geographically, and in which medical settings), and overall cost or cost per unit.

Quantity and Types of Diagnostic Equipment

Across the MHS, there are currently a total of 1,112 medical diagnostic imaging devices acquired since 1999 for potential use (as medically directed) to evaluate victims of strangulation.

Data on diagnostic tool acquisition, maintenance, and utilization for devices acquired before that time frame was not available. Of those devices, breakdowns by type are as follows across all MHS locations: CT scan – 75 devices (6.7 percent); MRI – 81 devices (7.3 percent); ultrasound – 424 devices (38.1 percent); and X-ray – 532 devices (47.9 percent).

CT/CTA, MRI, and X-ray devices are predominantly funded, maintained, and physically located in radiology departments, but these diagnostic modalities are largely available to MHS ED patients in real time, based on chief complaint, history of present illness, physical exam, and established best practices of patient care by a qualified health care provider. As the radiology department is commonly co-located or adjacent to the ED at an MTF, priority order for evaluation using these modalities is based on severity of injury and risk stratification by an ED physician. CT/CTA, MRI, and X-ray devices are frequently shared by several clinics (including inpatient, outpatient, and ED), but priority for assessment is based upon immediacy.

As detailed in Figure 1 and Table 1, stratification of diagnostic tools by Service generally reflects the number of MTFs, EDs, and radiology departments historically owned/funded by each Military Department, with Army having the most devices and highest acquisition cost. Navy and Air Force unit quantity and device type are comparable, with a slight advantage in number of ultrasound devices owned by Air Force reflecting a higher number of EDs across smaller, geographically dispersed installations as opposed to large Navy bases (e.g., San Diego, Portsmouth). DHA accounts for the smallest proportion of historical device ownership, with budgetary authority for diagnostic equipment in National Capital Region facilities owned and operated under DHA authority.

Figure 1: Diagnostic Equipment Type (by owning authority)

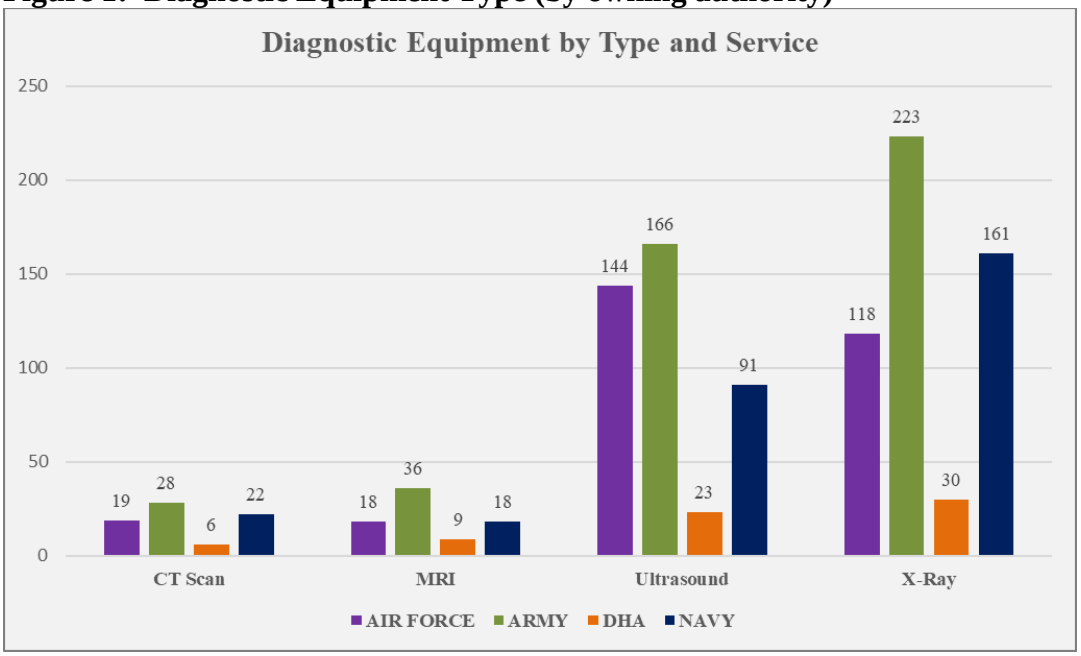


Table 1: Diagnostic Equipment Acquisition (cumulative cost, by commanding authority)

Diagnostic Tool Class	AIR FORCE Acquisition Cost	ARMY Acquisition Cost	DHA Acquisition Cost	NAVY Acquisition Cost	Acquisition Cost (cumulative)
CT Scan	$ 20,289,747	$ 30,172,993	$ 8,263,421	$ 23,376,249	$ 82,102,410
MRI	$ 36,453,882	$ 64,649,728	$ 23,455,965	$ 42,058,995	$166,618,570
Ultrasound	$ 11,957,181	$ 19,491,783	$ 3,002,911	$ 11,338,499	$ 45,790,374
X-Ray	$ 33,880,477	$ 60,419,121	$ 8,716,551	$ 37,748,212	$140,764,361
Total	$ 102,581,287	$ 174,733,625	$ 43,438,848	$ 114,521,955	$435,275,715

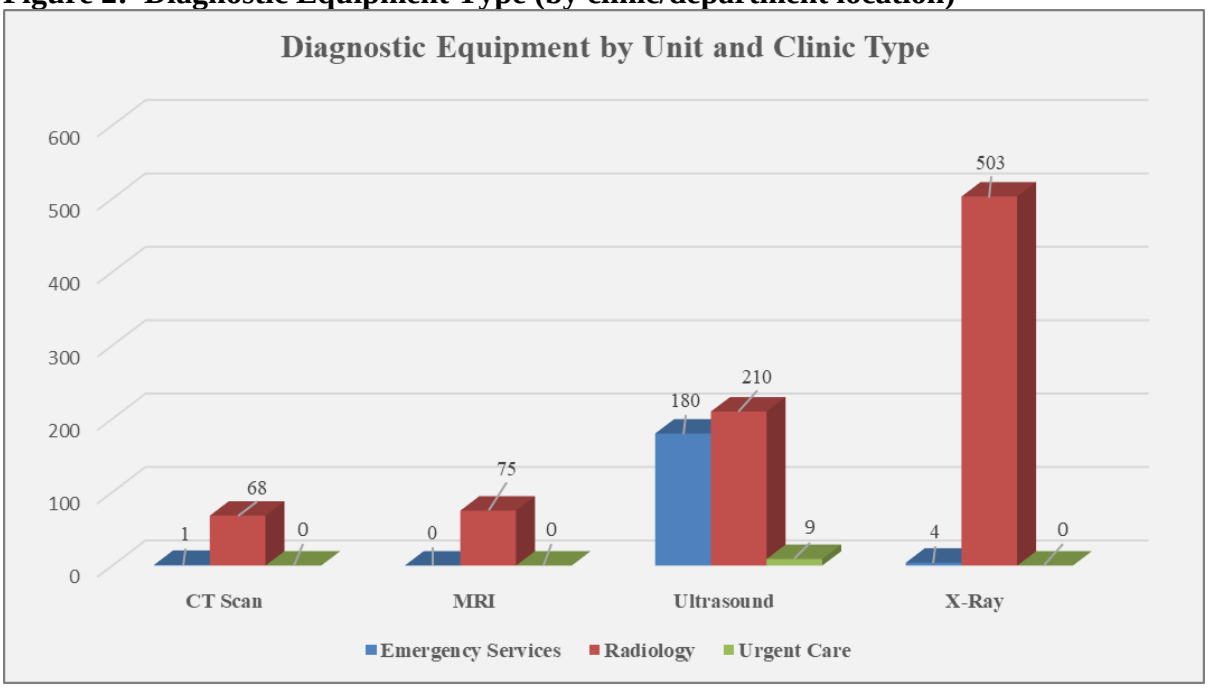
As detailed in Table 2 and Figure 2, ultrasound is the most commonly-found diagnostic tool owned and located immediately in ED and urgent care clinics, whereas CT scan, MRI, and X-ray devices are commonly owned and located in MTF radiology departments, but readily accessible to ED patients as clinically indicated. This largely reflects the complex safety requirements, preventative maintenance, and size and stationary nature of each type of diagnostic device predominantly found within radiology departments where there are fewer physical limitations caused by patient treatment/bed space, staffing, and other administrative functionality needed for clinic operation. In addition, the diagnostic devices housed within radiology suites often serve both routine inpatient and scheduled outpatient services.

Table 2: Diagnostic Equipment Type (by clinic/department location)

	Diagnostic Tool Type				
Clinic/Lab Type	CT Scan	MRI	Ultrasound	X Ray	Total
Emergency Services	1	0	186	4	191
Radiology	74	81	229	528	912
Urgent Care*	0	0	9	0	9

**Urgent Care clinic capabilities are not the equivalent of an ED evaluation; however, some patients may present to Urgent Care clinics. Urgent Care clinicians may refer patients with injuries consistent with NFS to ED, as clinically indicated.*

Figure 2: Diagnostic Equipment Type (by clinic/department location)



Diagnostic modalities primarily found within radiology departments are largely available to evaluate strangulation victims presenting in ED or trauma settings, as radiology departments are commonly co-located adjacent to the ED at MTFs, resulting in seamless access following a physician's order for a given diagnostic evaluation to be performed. As such, determinations over which modality is most appropriate are primarily driven by patient presentation and corresponding history of present illness, physical exam, and treatment course, rather than accessibility of a particular diagnostic tool.

Cost of Diagnostic Equipment

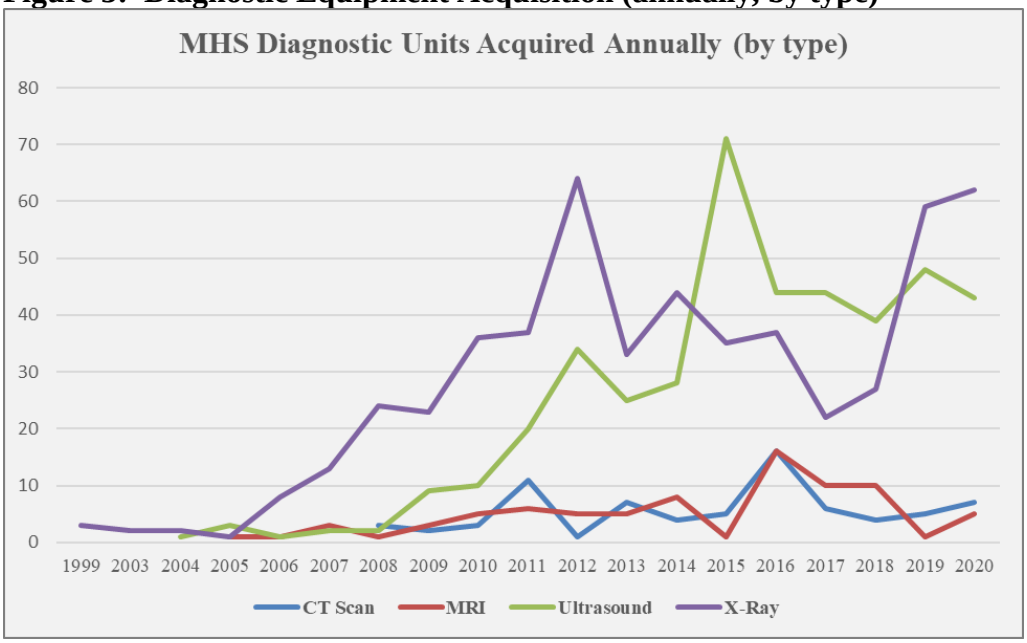
Average acquisition cost by unit type is as follows, from least to most expensive (not accounting for inflation from 1999-2020): ultrasound – $109,285.43 per unit; X-ray – $263,567.01 per unit; CT scan – $1,094,698.80 per unit; and MRI – $2,057,019.50 per unit. As detailed in Table 3 and Figure 3, total diagnostic units acquired by the MHS enterprise (and corresponding cost) have trended upward since 2008 with annual acquisition of MRI and CT scan tools remaining relatively static. While cost may have a direct relationship to acquisition/frequency of device replacement, the relatively lower cost/greater quantity of ultrasound and X-ray units in the MHS does not render these tools superior with respect to evaluation and diagnosis of NFS-related injuries by clinicians. Cost by commanding Service/agency is largely a function of the number of operational EDs and co-located radiology departments, as correlated with equipment costs (see Table 1).

Table 3: Annual Acquisition Cost per Unit Type

Year	Diagnostic Modality Cost (all new units)			
	CT Scan	MRI	Ultrasound	X Ray
1999	--	--	--	$ 209,137
2003	--	--	--	$ 81,637
2004	--	--	$ 16,976	$ 513,039
2005	--	$ 1,904,076	$ 31,552	$ 35,524
2006	$ 1,826,041	$ 2,082,976	$ 36,551	$ 1,459,877
2007	--	$ 6,336,671	$ 641,753	$ 2,062,530
2008	$ 2,206,379	$ 2,560,039	$ 164,262	$ 4,627,195
2009	$ 2,170,734	$ 7,444,301	$ 824,432	$ 5,974,343
2010	$ 2,770,700	$ 10,248,395	$ 910,618	$ 8,205,308
2011	$ 13,854,686	$ 15,369,072	$ 1,679,774	$ 8,871,761
2012	$ 1,428,367	$ 19,088,343	$ 3,309,387	$ 14,420,834
2013	$ 7,221,487	$ 9,462,581	$ 3,187,326	$ 8,602,043
2014	$ 4,227,142	$ 15,652,877	$ 2,817,871	$ 11,764,057
2015	$ 4,364,017	$ 2,216,261	$ 7,480,978	$ 9,603,770
2016	$ 17,704,742	$ 26,890,051	$ 5,768,802	$ 11,603,218
2017	$ 7,155,937	$ 18,740,401	$ 3,584,731	$ 6,691,996
2018	$ 2,993,568	$ 18,843,390	$ 4,663,905	$ 6,557,281
2019	$ 5,989,002	$ 1,388,162	$ 6,701,658	$ 22,463,371
2020	$ 8,189,607	$ 8,390,983	$ 4,516,444	$ 16,470,728
Total	$ 82,102,409	$166,618,579	$ 46,337,020	$ 140,217,649

**All costs in U.S. dollars. No data available for blank cells.*

Figure 3: Diagnostic Equipment Acquisition (annually, by type)



Diagnostic Capability in ED Settings

Based on validated reporting by the ED consultants from each Military Service, all MTFs with full-scale EDs have on-site or co-located CT/CTA capability, which is the optimal/preferred diagnostic modality of ED clinicians to assess and diagnose suspected strangulation injuries. Every MHS ED also has access to X-ray equipment housed on-site or in a directly-adjoined radiology department. Ultrasound and MRI capabilities are largely available at or adjacent to most MTF EDs as well, at 98 percent and 85 percent of MTFs, respectively (see Table 4).

Table 4: Number/Percentage of EDs with Diagnostic Capability

Service / Commanding Authority	**# of EDs**	**% with Capability ǂ**			
		CT Scan	*MRI*	*Ultrasound*	*X-Ray*
Air Force	11	100%	73%	100%	100%
Army	18	100%	100%	94%	100%
*DHA**	6	100%	100%	100%	100%
Navy	11	100%	69%	100%	100%
Total	46	100%	85%	98%	100%

**Includes MTFs in Waves 0 and 1 of transition to DHA Authority, Direction, and Control (as of March 2021).*

ǂ *Includes all MTFs reporting capability; infrastructure acquisition/sustainment not validated by DHA Medical Logistics.*

CONCLUSION

Clinician SMEs from all three Military Medical Departments in the areas of emergency medicine, critical care, and trauma were consulted to provide experiential knowledge regarding the detection of subdermal injuries in strangulation victims. The consensus among responding SMEs across several impacted specialties is that, while every MHS ED should have ultrasound capability (or, access to such ancillary services), ultrasound is not the preferred imaging modality in strangulation cases, irrespective of acquisition cost. CT and/or CTA provide more comprehensive imaging, and should be available in every MHS ED or adjoining radiology department. Diagnostic modalities are most valuable when coupled with a comprehensive history, physical exam, and risk stratification by a qualified Emergency Physician.

An objective and detailed screening by a qualified physician for NFS-related injuries in the ED is a prerequisite for the identification and risk stratification of current or delayed injuries, and subsequent diagnostics. Clinical findings may be relevant to subsequent forensic investigations; however, emergency medicine and trauma physicians are bound by duties to perform only life-saving and clinically-indicated evaluation and treatment. Exhaustive, multimodal diagnostics beyond the standard of care are outside the purview of emergency medicine and trauma physicians who have ethical responsibilities to their patients and to the appropriate use of medical care resources.

With respect to the optimal number of devices required to provide the diagnostic capability for NFS related injuries in ED settings across MHS, the recommendation from a purely clinical standpoint is to ensure the availability of CT/CTA capability co-located with every MHS ED and trauma unit where a strangulation victim may present. All operational MTF EDs with a co-

located radiology department have immediate access to CT/CTA capabilities, as validated by data provided by each Service's ED consultant and DHA MEDLOG. In instances where diagnostic capability is limited, a stabilized patient with injuries consistent with strangulation may be transferred to another facility with the optimal capability for diagnosis of NFS-related injuries, which may be in Direct or Private Sector Care.

Understanding that logistical and budgetary constraints may not permit each MHS ED patient with NFS-consistent injuries to receive on-site diagnostics by CT/CTA, ultrasound may be a supplemental tool. From the clinician's perspective, however, ultrasound does not have the same sensitivity, diagnostic accuracy, or efficacy to diagnose injuries related to NFS. As such, rather than ensuring each MHS ED has ultrasound capability (which is presently true), DoD will continue to assess if there is any gap in availability of CT/CTA devices at MTFs with EDs.

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