LEADERSHIP AND THE CHANGING CHARACTER OF WAR

Medical Capabilities in a Future Conflict Within the Indo-Pacific

Danielle Presley, Major, USAF

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Medical Capabilities in a Future Conflict Within the Indo-Pacific

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Foreword

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About the Author

Major Danielle "TIC" Presley enlisted in the Navy in 2004, serving nearly seven years as a Hospital Corpsman, including humanitarian response aboard the USNS Comfort after Hurricane Katrina and a combat deployment to Kandahar in support of Operation Enduring Freedom. She later earned an MPH from an Australian university and subsequently became an Air Force physician. She served as a flight surgeon at Incirlik AB and Moody AFB, attended the Air Command and Staff College in residence, and now serves as Chief of Aerospace Medicine at Kunsan AB.

Abstract

The People's Republic of China (PRC) remains the most dangerous adversary to US interests, actively challenging American influence and global stability. The character of war is evolving, particularly within the context of great-power competition, necessitating essential changes in how the Department of War (DOW) prepares its personnel. A future conflict in the Indo-Pacific region will occur in contested, resource constrained environments marked by disrupted supply chains, degraded communications, and a lack of air and maritime superiority. This paper argues that to sustain combat operations and maximize survivability, the DOW must modernize its medical strategies in two key areas. First, it must strengthen relationships with regional allies to enhance blood product capabilities and ensure faster delivery of lifesaving medical assets. Second, it must improve medical capabilities during Agile Combat Employment operations by prioritizing first responder skills and prolonged field care. This includes integrating reverse triage and expanding simulation based joint training to improve interoperability. Drawing on data from prior wars and wargaming scenarios, this paper demonstrates the importance of medical preparedness in achieving operational objectives and presents potential solutions for a high intensity conflict with the PRC through proactive measures.

Introduction

The changing character of war requires the Department of War (DOW) to rethink how it prepares for future conflicts in which US forces may not enjoy air or maritime superiority. Although no universally accepted definition captures this shift across all services and domains, it clearly demands a reorientation from past wars to those anticipated ahead. This includes reshaping the mindset of every Sailor, Airman, Marine, Guardian, and Soldier through deliberate, scenario-based training. Military leaders who proactively prepare service members for these emerging challenges will strengthen operational effectiveness and improve survivability.

The wars in Iraq and Afghanistan—Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF)—required extraordinary levels of medical support. Hemorrhage consistently emerged as the leading cause of death, making blood products the single most critical resource in combat resuscitation. Between the start of OIF in 2001 and December 2010, "more than 258,000 units of blood products had been transfused to more than 26,000 US military personnel, local civilians, third-country nationals, and enemy combatant casualties."[1] Continuous refinement by logisticians, blood bankers, and clinicians allowed the military to develop a process capable of delivering blood into theater in less than 14 days from collection—an efficiency possible only because US operations occurred in largely permissive air and logistics environments.[2]

Historically, US all-domain superiority "enabled the U.S. to operate with a sense of security, largely insulated from enemy strikes."[3] For decades, medevac operations and the steady flow of critical medical supplies—including blood products—depended on the Air Force's ability to establish and maintain air superiority. That assumption is no longer valid. Near-peer competitors have advanced significantly in space, cyber, and long-range precision-strike capabilities, and US national strategy has formally shifted toward great-power competition (GPC).

The 2022 *National Defense Strategy* identifies the People's Republic of China (PRC) as the primary "pacing threat," describing it as the "most comprehensive and serious challenge to U.S. national security due to its coercive and increasingly aggressive efforts to reshape the Indo-Pacific region and the international system."[4] Consequently, US Indo-Pacific Command (USINDOPACOM) remains the military's most demanding area of responsibility (AOR), overseeing more than 375,000 military and civilian personnel. Major concentrations of US forces in Japan, Hawaii, South Korea, and Guam support operations across an AOR containing four high-risk flashpoints: Taiwan, the Korean Peninsula, the South China Sea (SCS), and the East China Sea (ECS).[5] Since WWII, the United States has held dominant air and maritime power throughout the region and has built a far-reaching network of alliances, partnerships, and more than 40 military sites—an extensive footprint that requires a robust and distributed medical-support architecture.[6]

Yet the United States' ability to sustain medical operations in the Indo-Pacific will be severely constrained in a highend conflict. The PRC's expanding antiaccess/area denial (A2/AD) capabilities threaten logistics routes, complicate resupply of medical materiel, and restrict both casualty evacuation and MEDEVAC options. Without significant changes, frontline warfighting units will face degraded medical support. Current US medical response planning still overemphasizes logistics throughput and underemphasizes the readiness of first responders who may need to operate for extended periods in isolated, resource-constrained environments—likely far longer than timelines observed in OIF or OEF.

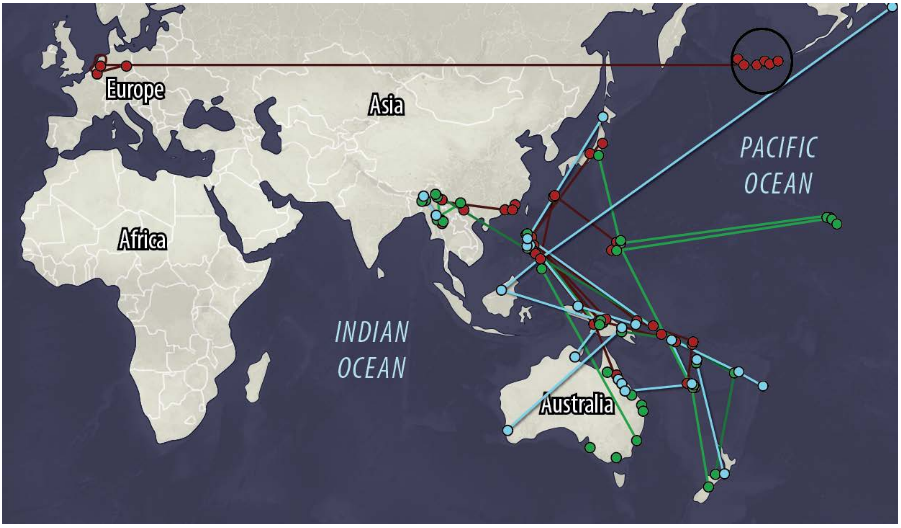
To support operational requirements and maximize survivability in a future Indo-Pacific conflict against the PRC, the DOW must break from legacy medical-operations models. It must shift from status quo practices to a proactive, theater-informed approach that anticipates contested logistics, degraded evacuation pathways, and an unprecedented scale of medical challenges.

Context

MEDEVAC capabilities in the Army Air Corps emerged toward the end of WWII, and the Air Force Medical Service was officially established soon after the war. Although the United States initially lacked air superiority in the Pacific theater against the technologically advanced Japanese Air Force, Japan did not possess the systems required to effectively prevent US movement of personnel or materiel. Throughout the Pacific theater, medical facilities regularly relocated to keep pace with shifting battlefronts, with departing units quickly replaced by incoming ones.

Figure 1 provides a rough depiction of the locations and movements of evacuation hospitals, field hospitals, and general hospitals across the Pacific during WWII. The dots indicate staging locations, while the lines trace medical-facility movements. Blue denotes evacuation hospitals, green indicates general hospitals, and red represents field hospitals; the associated units appear below the figure. This schematic highlights the ability of medical assets to maneuver and sustain combat operations. Surgical hospitals were primarily located in Australia and consisted of three major commands: the 7th, 28th, and 33rd Surgical Hospitals.[7] In addition to those shown (though not depicted), numerous station hospitals, medical battalions, and ancillary medical services supported operations.[8]

Figure 1. Medical facilities in the Pacific Theater during WWII



The United States relied heavily on partner nations for access to land and resources, especially in Australia, New Zealand, the Aleutians, and the European theater. In effect, WWII medical units operated in a manner similar to today's Air Force concept of Agile Combat Employment (ACE), moving entire commands and demonstrating the agility and flexibility required to ensure mission success and survivability.

While the exact locations and numbers of US military personnel and supply centers in the present day remain classified, planning experts within USINDOPACOM generally agree that the region's current resources are less than half of what existed during WWII—an especially concerning shortfall given today's reduced maneuvering space.

Many strategists believe a war against the PRC would take the form of hybrid warfare, with cyber and space serving as the leading domains, and that the extensive resources required during WWII would not be necessary. Some experts, however, warn that space and cyber capabilities could degrade within hours of the outbreak of a conflict with China, forcing the United States into a predominantly conventional fight characterized by mass and attrition. The PRC continues to take overtly aggressive actions to assert its rising regional hegemony, yet the threshold that would trigger a US military response remains unclear. A large-scale conflict with China is possible, even if not necessarily likely.

Table 1. Medical facilities in the Pacific Theater during WWII

Unit Type	Unit Designation	Deployment History (Dates & Locations)
General	1st GEN HOSP	23 Dec 41 Philippines
	2d GEN HOSP	5 Jan 42 Philippines
	4th GEN HOSP	23 Jan 42 Australia
	8th GEN HOSP	27 Nov 42 New Caledonia
	9th GEN HOSP	31 Jul 43 Guadalcanal; 1945 Papua-New Guinea
	13th GEN HOSP	5 Jan 44 New Guinea
	18th GEN HOSP	12 Jun 42 N. Zealand; 3 Oct 42 Fiji; Sep 44 Ledo Road (India); 12 Mar 45 Myitkyina (Burma)
	20th GEN HOSP	19 Jan 43 India; Dec 43 Burma
	27th GEN HOSP	5 Jan 44 Australia
	29th GEN HOSP	3 Nov 44 New Caledonia
	31st GEN HOSP	18 Oct 43 Espiritu Santo
	35th GEN HOSP	1944 New Guinea; 1945 Luzon
	39th GEN HOSP	3 Nov 42 New Zealand; 1 Jan 45 New Caledonia; Jan 45 Saipan
	42d GEN HOSP	19 May 42 Australia
	44th GEN HOSP	25 Sep 43 Australia
	47th GEN HOSP	11 Jan 44 New Guinea; Burma
	49th GEN HOSP	1 Mar 45 Philippines
	51st GEN HOSP	1 Apr 44 New Guinea
	53d GEN HOSP	ETO Sep-Oct 45; Embarked for South Pacific
	54th GEN HOSP	30 Jun 44 New Guinea
	60th GEN HOSP	18 Jul 44 New Guinea; 2 Apr 45 Philippines
	69th GEN HOSP	1945 Burma
	71st GEN HOSP	5 Jan 44 Australia
	105th GEN HOSP	19 May 42 Australia
	118th GEN HOSP	19 May 42 Australia; 1944 Philippines
	133d GEN HOSP	25 Nov 44 Leyte
	142d GEN HOSP	26 May 42 New Zealand; 1943 Fiji; Nov 44 India
	147th GEN HOSP	16 Jun 42 Hawaii; 19 Nov 43 Gilberts; 1 Aug 44 Hawaii
	172d GEN HOSP	1944 India; Burma; 1945 China
	181st GEN HOSP	1943 India
	204th GEN HOSP	8 Apr 42 Hawaii; 28 Dec 44 Guam
	218th GEN HOSP	8 Jan 42 Panama; 1 Aug 44 Hawaii
	232d GEN HOSP	27 Feb 45 Iwo Jima; Mar 45 Saipan
	234th GEN HOSP	*No specific data provided*
	247th GEN HOSP	1945 Philippines
	263d GEN HOSP	1943 India
	307th GEN HOSP	*No specific data provided*
	Sternberg GEN HOSP	Philippines
	Tripler GEN HOSP	Hawaii
	GEN HOSP No. 1	Limay, Philippines
	GEN HOSP No. 2	Cabcaben, Philippines
	Malinta Tunnel	Corregidor, Philippines

Unit Type	Unit Designation	Deployment History (Dates & Locations)
Field	1st FLD HOSP	Papua-New Guinea; 20 Oct 44 Leyte
	2d FLD HOSP	Australia; 24 Nov 42 Papua-New Guinea; 20 Oct 44 Leyte
	3d FLD HOSP	Nov-Dec 42 Guadalcanal; Jan 43 New Guinea; Oct 44 Leyte; Jan 45 Luzon
	4th Prov. FLD HOSP	Dec 43 China
	5th FLD HOSP	1944 Papua-New Guinea; 9 Jan 45 Luzon; 15 Feb 45 Manila
	6th FLD HOSP	15 Aug 43 Aleutians
	14th FLD HOSP	11 May 43 Aleutians
	17th FLD HOSP	Jun 43 Russell Is.; 28 Jul 43 New Georgia
	20th FLD HOSP	11 May 43 Aleutians; 1945 Holland; 1945 Belgium; 1945 Germany
	22d FLD HOSP	1945 China
	23d FLD HOSP	Jun 43 New Guinea; 13 Jan 45 Luzon
	24th FLD HOSP	1943-44 Pacific/Solomons; 11 Jan 45 Luzon; 17 Sep 45 Honshū (Japan)
	25th FLD HOSP	Late 43 Burma; May 45 Burma
	27th FLD HOSP	27 Oct 44 China
	28th FLD HOSP	22 Aug 43 Aleutians
	29th FLD HOSP	22 Aug 43 Aleutians
	30th FLD HOSP	15 Aug 43 Aleutians
	31st FLD HOSP	20 Jun 44 Saipan Is; Apr 45 Okinawa
	34th FLD HOSP	Philippines
	36th FLD HOSP	25 Jul 44 Guam
	37th FLD HOSP	1943 New Guinea; 9 Jan 45 Luzon
	38th FLD HOSP	20 Jun 44 Saipan Is; 26 Feb 45 Okinawa
	41st FLD HOSP	9 Jan 45 Luzon; 15 Feb 45 Manila
	43d FLD HOSP	9 Jan 45 Luzon
	44th FLD HOSP	3 May 45 Burma
	52d FLD HOSP	Guadalcanal; Jun 43 Bougainville
	69th FLD HOSP	26 Oct 44 Leyte; 7 Apr 45 Okinawa
	70th FLD HOSP	1944 Burma
	71st FLD HOSP	1944 India
	72d FLD HOSP	1944 India; China
	73d FLD HOSP	Feb 45 Philippines; Japan
	74th FLD HOSP	Apr 45 Okinawa
	76th FLD HOSP	Apr 45 Okinawa
	82d FLD HOSP	Apr 45 Okinawa
	88th FLD HOSP	Sep 45 Okinawa
	91st FLD HOSP	15 Jun 45 Philippines
	92d FLD HOSP	15 Jun 45 Luzon
	455th FLD HOSP	*No specific data provided*

Unit Type	Unit Designation	Deployment History (Dates & Locations)
Evacuation	1st EVAC HOSP	4 Mar 42 Australia
	7th EVAC HOSP	7 Apr 42 Tongatabu; Fiji; Guadalcanal; 9 Jan 45 Luzon
	10th EVAC HOSP	4 Mar 42 Australia; Dec 42 New Guinea
	14th EVAC HOSP	10 Jul 43 India; 12 Dec 43 Burma
	21st EVAC HOSP	1943-44 South Pacific; 11 Jan 45 Luzon; 7 Feb 45 Manila
	25th EVAC HOSP	19 Oct 42 New Zealand; Nov 42 Espiritu Santo
	29th EVAC HOSP	1943 New Britain; 1944 Noemfoor Is; 13 Jan 45 Luzon; 7 Feb 45 Manila
	30th EVAC HOSP	1943-44 New Guinea/New Britain; 27 May 45 Philippines; 17 Dec 45 Japan
	48th EVAC HOSP	18 Jan 43 India; Dec 43 Burma
	52d EVAC HOSP	23 Jan 42 New Caledonia; Feb 42 Australia; Mar 42 New Caledonia
	54th EVAC HOSP	31 Jul 43 Australia; Sep 43 New Guinea; 13 Jan 45 Luzon; 9 Feb 45 Manila
	56th EVAC HOSP	19 Feb 44 New Guinea; 26 Oct 44 Leyte
	58th EVAC HOSP	Jun 43 Admiralty Is; 26 Oct 44 Leyte
	71st EVAC HOSP	7 Feb 45 Manila
	73d EVAC HOSP	20 Jan 43 India; Dec 43 Burma
	86th EVAC HOSP	1944-45 Asiatic-Pacific Theater
	92d EVAC HOSP	1943 Australia; 1944 New Guinea; 13 Jan 45 Philippines; Oct 45 Japan
	99th EVAC HOSP	1944 New Guinea/NEI; 27 Apr 45 Philippines; Sep 45 Japan
	361st EVAC HOSP	28 Oct 43 Australia

Given the advanced weapons systems the PRC has developed, the United States faces limitations in both force posture and movement across the theater. Figure 2 illustrates the PRC's 10-dash line, a territorial claim encompassing a significant portion of the SCS. The international community does not recognize this claim, leaving the area within the dashed lines highly contested. Figure 3 depicts the PRC's munitions capabilities, including short-range ballistic missiles (SRBM), medium-range ballistic missiles (MRBM), and intermediate-range ballistic missiles (IRBM).[9] When comparing Figure 1 with Figure 3, it becomes clear that the WWII-style posture would leave US forces highly vulnerable to attack unless air and maritime superiority can be achieved and maintained.

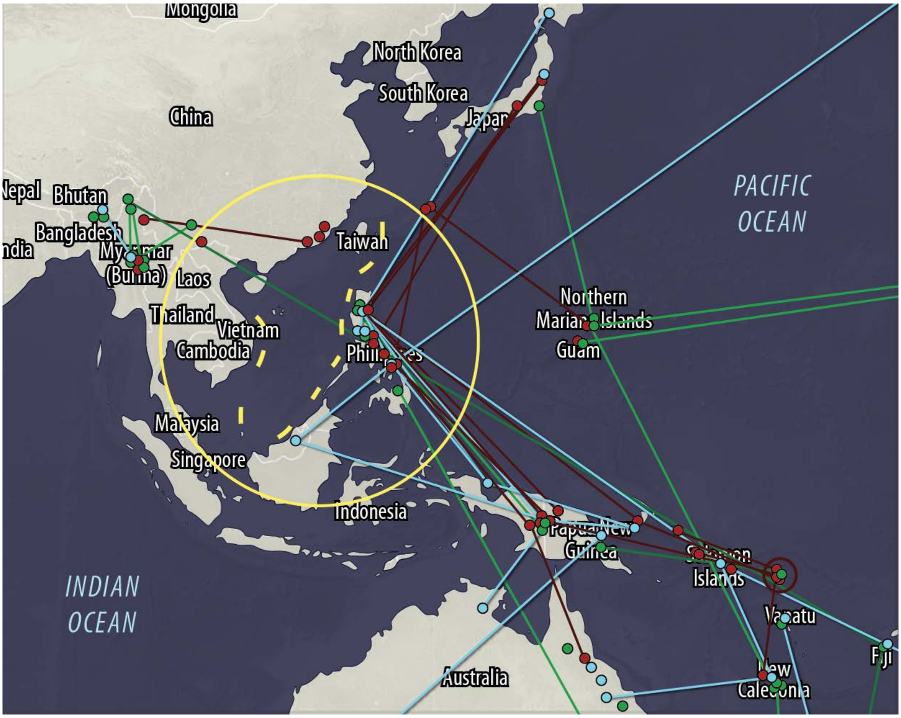


Figure 2. PRC's 10-dash line representing its territorial claims

Ensuring force readiness directly contributes to mission capability and supports integrated deterrence in the region. Readiness includes the ability to manage large-scale casualties in a dispersed, resource-constrained environment without guaranteed air superiority for medical transport.

The US often approaches conflicts with a mindset shaped by Operation Desert Storm, expecting a swift and decisive victory with minimal casualties. Applying this approach to a near-peer adversary, however, reflects an underestimation of that adversary's capabilities and determination to achieve victory and enhance its international standing. There is also concern about the US population's willingness to endure a prolonged, high-intensity conflict, particularly one driven by attrition.[10] This point is essential because information about the likely character of a future conflict is not reaching the military members who need it most—the young, enlisted warfighters. "The challenge of human attrition has the most significant impact on will to fight, further compounded by the likely decrease in end strength over time, longer replacement times for high-tech weapons expertise, and strains on the force without significant personnel change."[11] The DOW needs to begin preparing warfighters across all services for the realities of a future conflict.

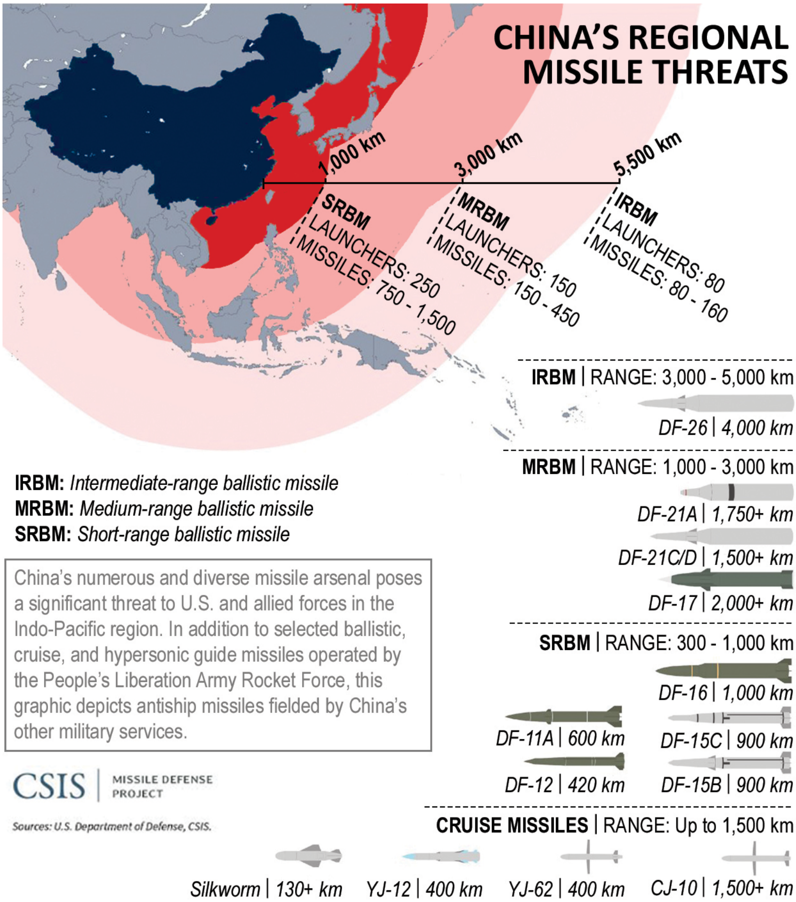


Figure 3. PRC's known missile defense capabilities.

Over the past few decades, the PRC has invested heavily in technology, developing advanced weapons and detection systems for A2/AD that prevent US forces from maneuvering undetected. The "permissive environment" the United States once enjoyed—and assumed would continue—no longer exists. With the PRC's growing arsenal of long-range, precision-guided conventional missiles capable of striking US and allied forward operating bases across much of the Pacific region, the United States must adapt its operations and anticipate the potential for higher casualties than in recent conflicts.[12] One article suggests, "Any conflict with China could immediately eclipse casualties of the past 17 years."[13] Without proper adjustments within the medical community and the DOW, the fighting force will be debilitated and unable to perform its mission.

A paradigm shift in combat casualty triage is emerging in preparation for a potential conflict with the PRC in the Indo-Pacific. Blood products, supply distribution, and medical evacuation remain the most active and critical medical "pacing challenges." However, logistical problems are only one part of the strategic picture. More pressing are the gaps in medical training and preparation for an operational environment unlike any the DOW has faced. Each service's medical community still trains largely independently and continues to prepare for conflicts where the United States enjoys unimpeded air superiority. Medics will face not only combat injuries they may be ill-equipped to treat but also numerous communicable diseases endemic to the region, which could rapidly deplete medical supplies and degrade the fighting force's ability to perform its mission.

Although many of these issues are well known, each requires modernization to remain effective against a near-peer competitor such as the PRC. Despite ongoing discussions about needed reforms, there is a noticeable lack of urgency and progress. While a head-to-head conflict with China in the Pacific remains unlikely, it would be a disservice to the American people to underestimate the capabilities of a rising great power. To prepare effectively, the DOW must focus on three main areas: strengthening agreements with regional allies for medical support, properly prepositioning non-perishable Class VIII materials, and implementing new training programs that emphasize first responder skills and reverse triage.

Regional Partnerships and Blood-Sharing Programs

Strong partnerships and allied cooperation play key roles in augmenting medical support on the battlefield, particularly in the sharing and distribution of blood products for life-sustaining interventions. Throughout OIF and OEF, a significant amount of research focused on maximizing survivability for casualties in the field, resulting in substantial improvements in mortality rates. Data shows that most combat casualties who die do so in the prehospital setting.[14] The Golden Hour Policy, mandated by Secretary of Defense Robert M. Gates in 2008, is credited with reducing early deaths before wounded personnel reached higher levels of care. The policy requires that all medical evacuations delivering a patient to a surgeon occur within 60 minutes of the point of injury. One retrospective study of 4,542 casualties in Afghanistan from 11 September 2001 to 31 March 2014, showed a decrease in the killed-in-action (KIA) rate from 16.0 percent before the mandate to 9.9 percent afterward.[15] The success of the Golden Hour Policy rested on joint operations within the combat health support system.

Three conditions that enabled this success will not be guaranteed in a future conflict.[16] The first was the presence of Role 3 facilities in key locations—one in Kandahar, Afghanistan, and another in Baghdad, Iraq. These facilities provided advanced imaging, full surgical capability, and blood banking. Multiple Role 1 and Role 2 facilities also operated in heavy combat zones, able to hold casualties for extended periods until evacuation could be coordinated. The second condition was the near-air-supremacy environment enjoyed by the US Air Force throughout most of OIF and OEF, which enabled largely unobstructed patient movement. The third was the relatively short flight times required within those theaters. The most significant barrier in a future conflict is likely to be the lack of available blood products for initial resuscitation—a critical element of Golden Hour success. Without these conditions, the policy's effectiveness would diminish, and US combat deaths would almost certainly rise.

On the battlefield, "hemorrhage is the most common cause of potentially preventable death" and remains the cornerstone of combat casualty care training.[17] Current resuscitation guidelines prioritize cold-stored low-titer O whole blood (LTOWB), followed by pre-screened fresh LTOWB; if unavailable, plasma, platelets, and packed red blood cells (PRBC) in a 1:1:1 ratio serve as acceptable substitutes.[18] The volume of blood required during the Iraq and Afghanistan wars was staggering. One study reported that "from November 2001 to December 2010, more than 258,000 units of blood products had been transfused to more than 26,000 U.S. military personnel, local civilians, third-country nationals, and enemy combatant casualties."[19] Another retrospective study drawing from the Department of Defense Trauma Registry (DODTR) covering January 1, 2007, to March 17, 2020, documented 28,950 encounters with prehospital activity, of which "2,414 (8.3%) received massive transfusions of 10 or more units of PRBC and/or WB."[20] By convention, a massive transfusion involves administering 10 or more units of PRBCs within 24 hours.[21]

This data points to two key observations. First, casualties categorized as receiving "10 or more" units often required far more than the minimum threshold. Second, wargaming estimates project a significantly higher volume of casualties in an Indo-Pacific conflict compared to OIF and OEF. Across twenty-four iterations of wargaming by the Center for Strategic and International Studies (CSIS), "U.S. casualties averaged almost 7000, of which around 3200 were killed in action" within the first few weeks of conflict.[22] Extrapolating from the percentage requiring massive transfusion suggests a demand of at least 70,000 units of blood products during the opening weeks—possibly two to three times that amount to support adequate resuscitation. This total would approach the entire volume used during the 20-year Iraq and Afghanistan wars.

It is also important to note that while the DODTR reports exceptional survival rates, the majority of battlefield deaths—roughly 80 percent—occurred before casualties reached medical care. One study documented a 97.5-percent survival rate among 1,008 patients medically evacuated between 2009 and 2014–2015, but the registry does not account for those who died before receiving definitive surgical care.[23] Regardless of force size, inadequate logistics capacity to resupply medical materiel will cripple US combat power and diminish overall power projection.[24] The United States should anticipate sustained attacks on established bases within A2/AD missile ranges; therefore, it must rely heavily on regional partners for access to facilities and resources.

Enhancing Blood Product Capabilities

One of the most significant limitations in military medical support for a war in the Indo-Pacific is the DOW's blood supply capacity. Logistically, the DOW must ensure that substantial quantities of Class VIII supplies are properly postured and prepositioned before a conflict, allowing them to be moved at operational warning rather than stored in inaccessible warehouses. Class VIII supplies fall into two categories: alpha and bravo. Alpha supplies include consumables such as gauze, syringes, and disposable plastic equipment that do not require strict storage conditions. Bravo supplies include blood products, which are far more challenging to maintain.

Multiple depots throughout the Indo-Pacific and other major commands store Class VIII materials, but the overall storage capacity remains limited relative to projected requirements in the critical early weeks of a conflict. Additionally, shortages of ready-to-deploy Class VIII supplies persist. Five tri-service donor centers worldwide currently supply blood exclusively for service members deployed in combat. While this system has historically been effective, distribution across the vast Indo-Pacific AOR remains the primary logistical challenge. Without guaranteed air superiority and with limited availability of functional airfields for US cargo aircraft across regional partner nations, planners are working to expand capacity beyond US-only distribution by partnering with allies to utilize foreign blood products.

A limited war with the PRC will not allow for the extensive facilities, movement, or resources available throughout the WWII Pacific theater or during later conflicts where the United States enjoyed uncontested air superiority. Positioning blood supplies along the first island chain would improve accessibility and increase the likelihood of timely retrieval during critical situations, but doing so requires strong ally support. The DOW is actively collaborating with Indo-Pacific partners to improve access to essential medical supplies by leveraging partner facilities, resources, and expanded supply-chain pathways. Currently, there is only one dedicated blood donor center in the region that supports US forces in combat. Its limited capacity requires either transporting blood forward into contested areas or evacuating casualties to the island for treatment.

To address these shortfalls, USINDOPACOM blood program experts are working to strengthen partnership agreements with nations beyond the third island chain. A core objective is securing arrangements that allow the United States to preposition blood supplies in forward-deployed depots across the Philippines, Taiwan, Japan, and Australia. Tables 1 and 2 show temperature requirements and shelf life for RBCs and whole blood (WB), both fresh and frozen.[25] Using these data, the United States can ensure that adequate blood stocks are properly stored, monitored, and maintained while gaining air superiority and establishing more reliable supply chains.

Table 2. Red blood cell storage temperature requirement and shelf life

Blood Product	Storage Conditions	Transport Conditions	Shelf Life / Expiration
Red blood cells (RBC)	1–6 °C	1–10 °C	ACD / CPD / CP2D: 21 days CPDA1: 35 days Additive solution: 42 days Open system: 24 hours
Deglycerolized RBCs	1–6 °C	1–10 °C	Open system: 24 hours Closed system: 14 days or as FDA approved
Frozen RBCs (40-percent glycerol)	−65 °C or colder if 40% glycerol or as FDA approved	Maintain frozen state	10 years (a policy shall be developed if rare frozen units are to be retained beyond this time) Freeze within 6 days of collection unless rejuvenated Freeze before expiration if rare unit
RBCs irradiated	1–6 °C	1–10 °C	Original expiration or 28 days from date of irradiation, whichever is sooner

Blood Product	Storage Conditions	Transport Conditions	Shelf Life / Expiration
RBCs leukocytes reduced	1–6 °C	1–10 °C	ACD / CPD / CP2D: 21 days CPDA1: 35 days Additive solution: 42 days Open system: 24 hours
Rejuvenated RBCs	1–6 °C	1–10 °C	CPD, CPDA1: 24 hours AS1: freeze after rejuvenation
Deglycerolized rejuvenated RBCs	1–6 °C	1–10 °C	24 hours or as approved by FDA
Frozen rejuvenated RBCs	−65 °C or colder	Maintain frozen state	CPD, CPDA1: 10 years AS1: 3 years (a policy shall be developed if rare frozen units are to be retained beyond this time)
Washed RBCs	1–6 °C	1–10 °C	24 hours

Table 3. Whole blood storage temperature requirement and shelf life

Blood Product	Storage Conditions	Transport Conditions	Shelf Life / Expiration
Whole blood	1–6 °C	1–10 °C	CPD / CP2D: 21 days CPDA1: 35 days
Whole blood irradiated	1–6 °C	1–10 °C	Original expiration or 28 days from date of irradiation (whichever is sooner)
Whole blood leukocytes reduced	1–6 °C	1–10 °C	CPD / CP2D: 21 days CPDA1: 35 days Open system: 24 hours

Another effort underway involves expanding blood-sharing agreements, which remain in the early stages. Medical specialists within USINDOPACOM conduct blood-compatibility studies to compare US blood banking practices with those of partner nations. If compatibility is established, a memorandum allows non-US blood products to be safely transfused into US service members. This program presents challenges, particularly the requirement to track any service member who receives partner-nation blood at 3, 6, and 12 months. The United States currently maintains blood-sharing agreements with Japan and Korea and is pursuing additional agreements with Taiwan and Australia. The Philippines—categorized as "yellow" in its blood-sharing profile—currently has an active US proposal aimed at improving its blood safety standards. Once implemented, blood from the Philippines could also be transfused into US personnel.

Given ongoing joint training exercises with the Philippines, Japan, and Taiwan, establishing robust bloodsharing capabilities with these partners is essential. Naturally, heavy reliance on partner nations introduces challenges—chief among them reduced US control over the medical environment. However, enhanced training and improved readiness can mitigate these concerns.

Medical Training and Readiness

Effective medical training and readiness are foundational to sustaining combat power in a future Indo-Pacific conflict. The operational environment expected in a high-end fight against the PRC—marked by dispersed forces, contested logistics, and limited evacuation options—will challenge long-standing assumptions about the speed and availability of medical support. As the character of war evolves, so too must the preparation of medical personnel across all services. This section examines the shifting demands placed on military medicine, beginning with the implications of ACE for medical operations and extending through required changes in training, triage, and joint interoperability.

Medical Capabilities in ACE Operations

ACE is an initiative developed by the line components of the military to enable flexible and adaptable combat operations in highly contested environments. It was introduced to the USAF in 2013 with the creation of Rapid Raptor—a Pacific Air Forces concept designed for the rapid deployment of F-22 Raptors, along with all supporting logistics and maintenance, to a forward operating base with a "ready" status within 24 hours.[26] The ACE concept provides a theoretical framework for reacting and adapting to the changing landscape of modern warfare, which is "characterized by rapid technological advancements and the emergence of new, multifaceted threats."[27] Although many military documents outline ACE's development and components, the concept remains in its infancy and continues to be refined to meet the unique needs of individual squadrons. It has yet to be implemented on a large scale in real-world operations. Ultimately, ACE's effectiveness depends on a unit's ability to remain operationally ready, agile, and interoperable with joint forces and partner nations—capabilities that correlate directly with the level of training conducted prior to deployment.[28]

During WWII, medical units aligned themselves with line operations (Figure 1), and a future conflict will likely require a similar approach. ACE, however, introduces significant challenges by extending and thinning logistical supply lines, pushing them across greater distances and more contested areas. While ACE primarily focuses on enhancing operational flexibility and adaptability for combat units, these same principles must be applied to medical operations to ensure sufficient care in a resource-constrained battlespace.

Military medics across the services have long executed ACE-like concepts, operating in dispersed, embedded, and on-demand roles at forward locations. Each service places specially trained medics within units and squadrons, and some maintain mobile surgical and critical-care teams such as Special Operations Surgical Teams (SOST) and Critical Care Air Transport Teams (CCATT). However, given the changing character of war, current medical training models may no longer be practical, and the services are not adequately preparing their medical communities for the challenges of a vast and dispersed AOR. In recent conflicts, the military often relied on specialized providers capable of conducting complex surgeries in the field. In a future near-peer conflict, however, the cost of deploying such specialists is likely to outweigh the benefit. Their expertise will be required in far fewer scenarios, and they demand significant resources to remain mobile in environments where air superiority is not guaranteed.

Experts anticipate that the injuries medics are most likely to encounter include fractures, TBIs, sepsis, and light burns. These should be the primary focus for medical planning and for training at the lowest levels. Care beyond the capabilities of first responders will rarely be immediately available, and severe injuries are unlikely to survive the delays associated with contested evacuation or supply shortages. If surgeons are required to operate in the field, post-operative care would become highly resource intensive and time consuming. Many hesitate to acknowledge the harsh reality: preserving five lives with limited resources is strategically more advantageous than exhausting those resources to save one. Rather than concentrating solely on logistical limitations, the DOW should focus on attainable objectives that most directly enhance survivability, such as redesigning training to improve interoperability across services and investing in first-responder skills that maximize survival for treatable injuries in a resource-scarce environment.

This essay presents two key recommendations to support this shift. The first is to adopt reverse triage and integrate it into training platforms as soon as possible to prepare for a large-scale conflict. This change in medical priorities requires reassessing training models, interoperability expectations, and the ethical and strategic considerations that shape battlefield care—all with the goal of maximizing combat effectiveness. The second recommendation involves two training approaches. First, the services should expand joint and combined training exercises throughout the Indo-Pacific, focusing not on basic medical field skills but on understanding each service's operational roles to ease transitions during realworld joint operations. Second, the DOW should prioritize immediate readiness—investing resources in ensuring first responders on the front lines are trained to the highest possible standard for today's mission requirements. A future Indo-Pacific conflict will hinge on the strength of interoperability between joint forces, and joint doctrine alone cannot provide the real-world experience needed to achieve it.

Reverse Triage

Ideally, military medicine focuses on treating casualties to ensure they can return to duty and continue fighting. Rather than prioritizing lifesaving measures alone, military medicine should also be viewed as an extension of warfare aimed at salvaging and restoring soldiers to combat readiness.[29] According to sources, zones will allow for MEDEVAC and CCATT operations, but the ultimate goal remains delivering supplies to the fighting force to win. One of the most significant obstacles in military medical care stems from society's instinctive desire to provide unlimited care for service members; many argue that no expense should be spared when treating a Soldier. This raises a critical ethical question: is there a moral obligation guiding how scarce resources should be allocated on the battlefield?[30] In a resource-constrained environment, should manpower and supplies be directed toward treating the critically wounded, or should those resources be allocated elsewhere?[31] These questions shape how US forces perform triage in combat.

Triage, derived from the French word *trier* and originating during Napoleon's era, is defined as "the practical process of sorting casualties to rationally allocate limited resources."[32] The principles of triage have been applied throughout numerous historical conflicts and continue to guide both civilian and military responses to mass casualty incidents.

Reverse triage (RT) was introduced in 2005 to increase hospital surge capacity by identifying patients who could safely forego major medical interventions for at least 96 hours and who had minimal risk of complications from early discharge.[33] In 2006, 39 experts developed an American RT framework that used consequential medical events—events resulting from early discharge—and 28 critical interventions to determine which patients could be safely released versus those requiring close attention.[34] A systematic literature review by Pollaris et al. examined the use of RT in emergency and disaster medicine.[35] which reviewed the use of RT in emergency and disaster medicine events. Of the 21,259 records identified, 16 met inclusion criteria and demonstrated that "an overall surge capacity of 20–30% could be achieved by implementing RT and even more when combined with other strategies."[36] During the Ashmore Reef disaster in Australia, the Royal Darwin Hospital was asked to admit 30 casualties with blast injuries.[37] A multidisciplinary RT team identified early-discharge candidates, resulting in a 16-percent surge capacity increase.[38] During the COVID-19 pandemic, many civilian hospitals used RT informally, recognizing the severe resource constraints and the impossibility of saving every patient. To maximize survivability, resources were directed toward those with the highest likelihood of benefiting from care while preserving critical supplies. Although extensive civilian research demonstrates the effectiveness of RT and offers numerous tools and scoring systems for expanding surge capacity, these models do not easily translate to a contested military environment. Unfortunately, little objective data exists on the outcomes of RT in combat settings. Military triage requires unique adaptations to address the operational demands and resource limitations of warfare. The current US military triage system aligns with the NATO triage system, which is guided by the Geneva Convention.

Established in 1864 in Geneva, the first version of the Geneva Convention set international humanitarian laws designed to protect war casualties and noncombatants.[39] Following WWII, the 1949 revisions expanded these protections to include a broader set of populations, most notably civilians.[40] The NATO triage system recognized by the United States prioritizes casualties with the most severe wounds ahead of those with minor injuries—aligning with Geneva Convention principles.[41] The system was created to standardize medical care across militaries and enable international collaboration to provide the greatest benefit to the greatest number of casualties.[42]

RT, however, contradicts the Geneva Convention. The moral dilemma arises when deciding whether to treat those with minor injuries first instead of those with more urgent needs, effectively incorporating the idea of preserving the fighting force into medical decision-making.[43] In 2015, the US Defense Health Board advised the Secretary of Defense that "In the battlefield environment, line commanders might ask healthcare professionals to alter the triage conditions and treat the least injured first so that they can return to duty and protect the unit," aligning with a commander's obligation to win with the least loss of life.[44] Training units in RT does not render the current triage system obsolete; rather, it ensures the medical community is prepared to transition when required. However, three notable challenges must be addressed for successful implementation.

RT Challenges—Authority, Criteria, Psychological Impacts

The first challenge is determining who has the authority to initiate the transition to RT. The US Defense Health Board believes the responsibility lies with line commanders; however, the decision must be shared between the line commander and the medical director. Line commanders have a fiduciary responsibility to win battles and a moral obligation to their troops, granting them the authority to deviate from Geneva Convention protocols when the mission requires it.[45] While that responsibility is indisputable, the medical director is the only individual with comprehensive awareness of available resources and current patient conditions. Authority to activate RT must therefore be delegated to the lowest appropriate level. Requiring approval from higher headquarters would delay necessary action and cost lives.

The second challenge is establishing clearly defined criteria that must be met before RT activation. To develop such criteria, the Defense Health Board must consider several factors, including resource scarcity, the need to return casualties to duty to prevent mission failure, and whether a service member's occupation or instrumental value influences decision-making.[46] Military health leaders should convene an RT panel of experts—spanning military medicine, public health, and disaster management—to create a standardized framework identifying when RT becomes necessary. Artificial intelligence (AI) can also assist in rapid decision-making. In 2015, the University Hospital of Leuven developed the Reverse Triage Tool, Leuven (RTTL), to identify patients requiring critical interventions using the American framework as a benchmark.[47] Over the three-week study period, "the use of the RTTL reached a reduction of 63.9% of patients who needed a multidisciplinary evaluation for potential early discharge."[48]

A similar effort appears in a web-based simulation tool for emergency planners developed by the US National Center for the Study of Preparedness and Catastrophic Event Response, which uses a "Monte Carlo simulation algorithm [that] can forecast the hospital's surge capacity over a 7-day period."[49] To parallel civilian RT scenarios with military casualties, "early discharge" equates to minimal-care patients treated first, while those requiring more extensive intervention receive treatment when resources allow. With guidance from medical experts, the DOW should consider investing in AI-enabled tools that rely on objective data inputs and existing algorithms for predicting likely outcomes, rather than placing triage decisions solely on an overwhelmed or inexperienced combat medic. Such tools could also help forecast surge capacity within allied hospitals across the region in the event of high casualty influxes.

The final challenge—and arguably the most sensitive—is the psychological impact of implementing RT. The long-term mental health consequences of war are well documented; however, "reverse triage carries with it significant moral and ethical implications for the practice of medicine in that it entails treating as expectant casualties who may otherwise be able to survive."[50] During the Iraq and Afghanistan wars, of the 2.7 million US troops deployed between 2001 and 2011, approximately 20 to 30 percent returned with some form of psychological injury.[51] More sobering, "military veterans account for 10% of U.S. adults, yet 20% of suicides, with Pentagon figures showing active-duty suicides among U.S. troops exceeding U.S. combat deaths in 2012."[52] Although the prevalence and treatment of post-deployment psychological injuries are well studied, research remains limited on preventive measures, early identification of high-risk individuals, and field-appropriate mental health resources.

RT challenges long-standing medical ethics and adds psychological weight to an already demanding operational environment. The psychological toll will extend beyond medical personnel to entire units. While chaplains and mental health services could mitigate some of these effects, such support is difficult to guarantee in a contested AOR. Although psychological injury cannot be eliminated, preparation and clear communication can reduce its severity. Team-strengthening exercises and self-coping strategies should be included in pre-deployment training. Additionally, early identification of psychological symptoms enables faster intervention using available on-site resources and telehealth capabilities.

Simulation-Based Joint Training

The success of implementing new concepts in today's military for tomorrow's war depends on multiple factors, the most important being clear communication supported by a straightforward narrative. Preparing for an operational environment unlike any the United States has previously faced—particularly against a near-peer adversary—will require significant time dedicated to training. Joint training will be the cornerstone of preparing for an Indo-Pacific conflict. The current G3 planning function within the medical sphere at Fort Hood notes, "I can count on one hand the times Army trains with Navy or the Air Force." He emphasizes the need to understand each service's functions and operations and asks, "How do I get the Air Force to give up a cargo aircraft for the Army?" Often, the answer comes down to which service has the funding to pay for the aircraft, but this approach will not win a future conflict. The Army, Navy, and Air Force do not routinely train together—likely due, at least in part, to funding and logistical constraints.

All services must interact routinely in preparation for an Indo-Pacific conflict. With current technological advancements, establishing a simulation-based joint training doctrine is the most effective way to prepare, particularly for medical communities operating in resource-scarce environments under shared constraints. Simulation programs have existed in both military and civilian hospitals for many years, but they can be tailored to replicate mass-casualty scenarios that reflect available resources and anticipated resupply timelines. Medics from every service can navigate these scenarios together using the newly developed RT training guidelines. As one article notes, "Simulations and games are concentrations of reality and offer new opportunities to rehearse care patterns and save lives."[53]

The Army and Marines train at simulation centers that include scenarios such as recovering casualties from a downed aircraft and maneuvering through terrain while providing care.[54] While this represents the ideal form of training, it is not logistically or financially feasible for all first-responder medics. Skills can be practiced and refined locally; however, rehearsing full-scale mass-casualty scenarios—especially joint ones—is significantly more difficult. More recently, the Army invested $240,000 in a wound-trauma simulator capable of replicating blast injuries and using haptics technology to recreate tactile sensations in virtual reality.[55] Simulator-based scenarios are far less resource- and time-intensive than large-scale field exercises.

The Joint Trauma System (JTS) is responsible for ensuring trauma readiness and standardizing guidance across all services. JTS can develop Indo-Pacific-specific scenarios that account for limited logistics and restricted medical evacuation capabilities. These scenarios can be programmed into trauma simulators and practiced by all services without requiring large amounts of personnel, space, or funding.

Implications and Recommendations

As the United States shifts its strategic focus from the Middle East to the Indo-Pacific, the requirements for military medical preparedness must shift accordingly. The Indo-Pacific AOR presents significant logistical challenges due to its vast geography, limited infrastructure suitable for US force posturing, and the PRC's advanced A2/AD capabilities. Although the Air Force's ACE concept enhances operational agility and enables more forward-deployed and independently operating bases, it simultaneously highlights the vulnerability of already constrained supply chains. Multiple wargame iterations and historical data indicate that the United States could face substantially higher casualty rates in the first weeks of a conflict with the PRC than occurred during OIF and OEF. In such a scenario, the most critical medical resources will be reliable access to blood products and assured medical evacuation to higher levels of care. Without these, the DOW must rethink its medical strategies for confronting a near-peer adversary.

The future operational environment remains largely uncharted, and limited research exists to guide the necessary changes. Nevertheless, experts in the field, including myself, recommend several key actions. First, the United States should leverage longstanding regional partnerships to facilitate air and maritime movement essential for medevac and resupply operations. Positioning adequate blood supplies throughout the Indo-Pacific will be especially important. Because previous attempts at storing blood products in caches have been hindered by strict temperature-control requirements, future blood-coordination efforts should incorporate partner-nation facilities capable of storing and managing blood designated for US service members.

Second, medical training must be modernized by emphasizing first-responder skills needed for prolonged field care. In the anticipated operational environment, reliance on specialized providers and surgical teams will be less effective. Redirecting resources toward training first responders to treat the most likely injuries—fractures, TBIs, sepsis, and light burns—will improve survival outcomes across the force.

Third, simulation-based training offers opportunities for joint forces to rehearse complex scenarios together under resource-constrained conditions. The JTS should develop simulation modules that reflect Indo-Pacific logistical limitations and allow medical personnel to practice realistic triage, treatment, and evacuation procedures.

Finally, in a severely resource-constrained environment, RT may become necessary to maximize survivability by prioritizing the fighting force. While the DOW currently uses the NATO triage system, that system is most effective when medevac and resupply operations are relatively unobstructed. RT would conserve scarce resources for those with the highest likelihood of survival, helping maintain unit effectiveness.

Conclusion

For the medical community to effectively support combat operations in a future Indo-Pacific conflict, the DOW must strengthen regional partnerships, improve blood-product availability, refocus training strategies, and modernize triage systems. Without guaranteed air superiority, the challenges of prolonged operations in a contested environment will require a fundamental shift in how military medicine is managed. Ensuring an adequate and responsive blood supply, securing medical partnerships with regional allies, and restructuring medical training to emphasize first-responder skills, decision-making, and RT are critical for maximizing survival and enhancing combat effectiveness.

Lessons from past conflicts—from WWII through Iraq and Afghanistan—underscore the importance of rapid medical response and strong logistical foundations. In a future Indo-Pacific conflict, the greatest challenges will include restricted medical evacuation routes, disrupted supply chains, and a heavy reliance on host-nation support. To meet these demands, the DOW must prioritize prepositioning medical supplies in forward depots in appropriate quantities and strategic locations, continue strengthening partner relationships and expanding blood-sharing agreements, and ensure adequate funding and planning for joint and combined training exercises that reflect the Indo-Pacific operational landscape.

Notes

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14. Jeffrey T. Howard et al., "Reexamination of a Battlefield Trauma Golden Hour Policy," *Journal of Trauma and Acute Care Surgery* 84, no. 1 (2018): 11.

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capabilities, minor surgical interventions (generally reserved only for damage control), basic imaging with x-ray, basic labs, and a small amount of blood storage. At a Role 2, the patient can be held for short timeframes before MEDEVAC out of theater or to a higher level of care. Role 3 facilities provide the most medical capabilities. These facilities are fully functioning medical facilities with full surgical capabilities (Orthopedic Surgery, Neurosurgery, General Surgery), intensive care units, advanced diagnostics (CT imaging, extensive lab workups), a pharmacist, mental health services, dental, and long-term holding with physical therapy services.

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