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Constructing a prolonged field care echeloned system for interrupted casualty evacuation chains

Изградња ешелонираног система продужене теренске неге за прекинуте ланце евакуације повређених

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SUMMARY

Introduction/Objective To analyze the evolution of modern combat casualty care from the Golden Hour and Tactical Combat Casualty Care (TCCC) to Prolonged Field Care (PFC) and Prolonged Casualty Care (PCC), and to construct an Echelon P model for situations in which casualty evacuation is delayed or interrupted.

Methods A structured literature analysis, conceptual differentiation, and model-construction approach was used. Foreign military guidelines, position statements, operational reports, and peer-reviewed studies on prolonged casualty care were reviewed, with priority given to literature from 2022 to 2026. PFC and PCC were compared by origin, target users, operational scenario, capability requirements, time frame, and interface with traditional echelons of care.

Results The evidence indicates a shift from evacuation-dependent care toward sustained forward care under contested conditions. PFC is primarily a clinical continuation of TCCC by advanced-trained personnel, whereas PCC is a system-level framework for all Role 1 responders when timely evacuation is limited or denied. The proposed Echelon P model includes activation triggers, P0-P3 capability tiers, and medical, blood/resuscitation, data, and command interfaces.

Conclusion Institutionalizing prolonged care as an independent capability layer may improve medical resilience in future high-intensity operations. Implementation should focus on doctrine, training, equipment modularization, telemedicine-enabled support, documentation, and quality assessment.

Keywords: combat casualty care; golden hour; tactical combat casualty care; prolonged field care; prolonged casualty care; military medical resilience

САЖЕТАК

Увод/циљ Циљ је анализа еволуције модерне неге борбених жртава од Златног сата и Тактичке неге борбених жртава (TCCC) до Продужене неге на терену (PFC) и Продужене неге жртава (PCC), и израда „Echelon P" модела за ситуације у којима је евакуација жртава одложена или прекинута.

Методе Примењена је анализа литературе, концептуално разграничење и конструкција модела. Размотрене су војномедицинске смернице, позициони документи, оперативни извештаји и новије студије о продуженом збрињавању, уз приоритет литератури објављеној у периоду 2022–2026.

Резултати Савремено бојиште помера тежиште са брзе евакуације ка одрживом збрињавању на предњем ешелону. PFC представља клинички наставак збрињавања који спроводе посебно обучени кадрови, док PCC означава системски оквир за све Role 1 одговоре. Предложени модел обухвата услове активирања, нивое способности P0-P3 и интерфејсе са медицинским, ресусцитационим, податковним и командним системом.

Закључак Увођење продуженог збрињавања као посебног слоја способности може повећати отпорност војномедицинске подршке у сложеним и оспораваним условима.

Кључне речи: збрињавање борбених повреда; златни сат; TCCC; продужена теренска нега; продужено збрињавање повређених; војномедицинска отпорност

INTRODUCTION

Traditional combat casualty care has been organized around echeloned care and the Golden Hour. In this model, life-threatening problems are controlled at or near the point of injury, the casualty is moved rapidly through Role 1 and Role 2 care, and progressively more specialized treatment is provided at rear facilities. The model achieved major success when tactical

conditions, transport assets, air superiority, and medical infrastructure enabled rapid evacuation. Its hidden assumption, however, is that the evacuation chain remains available and predictable. Once this assumption fails, the clinical burden carried by forward providers expands from short stabilization to sustained monitoring, resuscitation, and decision-making [1,2].

Tactical Combat Casualty Care (TCCC) was developed to reduce preventable deaths before hospital arrival by integrating medical interventions with tactical realities. Its emphasis on massive hemorrhage control, airway support, respiration, circulation, hypothermia prevention, and documentation made forward care more executable under fire. The institutional mechanism of the Committee on Tactical Combat Casualty Care also allowed the guidelines to be updated as battlefield evidence changed, including recent updates to casualty care and resuscitation recommendations [3–7]. Nevertheless, TCCC was designed primarily for the acute phase and cannot by itself define how to maintain a casualty for many hours or days when evacuation is delayed.

Future large-scale combat operations challenge the evacuation-dependent model. Long-range fires, contested airspace, drone surveillance, electronic warfare, difficult terrain, limited communications, and mass casualty surges can delay or deny movement to higher roles of care. Reports from the Russia-Ukraine conflict describe relocation of field hospitals farther from the front, delayed movement windows, severe fragmentation injuries, and rapid degradation of Role 2+ capabilities under sustained pressure [8, 9, 10]. These conditions create a practical gap between completing TCCC interventions and reaching definitive care.

This gap has both clinical and organizational consequences. Clinically, the casualty may require repeated assessment, blood or fluid decisions, analgesia adjustment, infection prevention, hypothermia control, respiratory monitoring, and preparation for deterioration

rather than simple packaging for transport. Organizationally, the forward team must decide how long available supplies will last, how to divide personnel across casualties, when to request remote consultation, and how to communicate medical risk to commanders. Therefore, prolonged care should be regarded as a planned capability with defined boundaries rather than an accidental waiting period.

Prolonged Field Care (PFC) and Prolonged Casualty Care (PCC), emerged to address this gap, but the two terms are often used interchangeably, which can obscure the difference between a clinical practice package and a system capability. PFC was initially shaped by special operations and austere medicine experience, where small teams in remote areas expected delayed but eventual evacuation. PCC has evolved into a broader system-level concept for conventional forces operating when timely evacuation cannot be assumed. This distinction is important because the solution cannot be limited to teaching individual procedures; it must also define triggers, equipment, documentation, authority, consultation pathways, and quality assessment.

The present study restructures this topic as an Original Article using a literature-based model-construction approach. Its objectives are to distinguish PFC from PCC, identify the operational logic behind prolonged care, and propose an Echelon P model that can be inserted into traditional echeloned care without treating prolonged care as an improvised extension of TCCC alone. The intended contribution is not to replace the traditional Role system, but to make the prolonged interval between Role 1 and higher echelons visible, trainable, resourced, and assessable.

METHODS

This study used a structured narrative review and conceptual model-construction method. The source pool included military medical guidelines, position statements, clinical practice guidelines, operational reports, and peer-reviewed studies related to TCCC, PFC, PCC, delayed evacuation, far-forward resuscitation, austere wound care, prolonged monitoring, training, equipment configuration, documentation, and team resilience. Priority was given to sources published from 2022 to 2026, while foundational publications were retained when they introduced concepts that remain central to the development of the Golden Hour, TCCC, PFC, or PCC.

Documents were selected when they met at least one of four criteria: they defined TCCC, PFC, or PCC; described delayed or disrupted evacuation in combat or austere environments; provided clinical or system requirements for prolonged care; or offered evidence relevant to training, equipment, data capture, telemedicine, ethics, or resilience. Sources focused only on routine civilian trauma systems were excluded unless they informed the military prolonged-care problem. Serbian military medical literature was also checked, and a Serbian-authored source relevant to military medical evacuation and deployment stress was retained where appropriate [11].

Conceptual differentiation was performed by comparing PFC and PCC across six dimensions: origin, intended users, typical scenario, clinical and system capabilities, duration, and relationship to traditional echelons of care. This comparison was used to clarify whether prolonged care should be treated as a temporal delay, a clinical skill set, or a system layer. The Echelon P model was then developed by answering two implementation questions: when prolonged care should be activated, and how prolonged care should interface with higher medical, logistic, data, and command systems.

Data extraction focused on recurring operational and clinical requirements rather than on pooled statistical estimation. For each source, relevant information was grouped into the following categories: evacuation assumptions, care duration, provider level, resuscitation needs, wound and infection management, equipment burden, documentation, telemedicine, command decision support, and resilience or ethical concerns. This approach was selected because the available literature is heterogeneous, combining guidelines, reports, reviews, qualitative studies, and model papers. The goal was therefore to synthesize an implementable framework rather than to calculate a single effect size.

Model construction followed a pragmatic logic. First, operational triggers were identified from delayed evacuation, mission constraints, environmental limitations, and casualty-volume mismatch. Second, the minimum-better-best concept used in prolonged-care guidance was translated into a P0-P3 stratification that links time after injury with resource density and clinical complexity. Third, interface mechanisms were defined so that prolonged care would not become an open-ended responsibility isolated from the evacuation, resuscitation, documentation, and command chain. The resulting model was checked against recent guideline and operational evidence for conceptual consistency.

Ethics: An ethics statement was not required for this study type, no human or animal subjects or materials were used. The authors declare that the article was written in accordance with ethical standards of the Serbian Archives of Medicine as well as ethical standards of medical facilities for each author involved.

RESULTS

The first finding is that the evolution from the Golden Hour to TCCC and then to PFC/PCC reflects a shift in the dominant assumption of battlefield medicine. The Golden Hour and traditional echeloned care assume that rapid movement to more capable facilities is normally available. TCCC improved survival within this framework by reducing preventable death during the immediate tactical phase. In contrast, PFC and PCC begin from the opposite premise: evacuation may be delayed, denied, or interrupted for reasons beyond the control of medical personnel. The problem is therefore not only how to perform early life-saving interventions, but how to sustain a casualty when the system that usually removes that casualty from the forward area is no longer reliable.

The second finding is that PFC and PCC have overlapping but distinct meanings. PFC originated in special operations and remote austere settings. It emphasizes advanced clinical tasks after TCCC has been completed, including serial reassessment, airway and respiratory support, circulation management, analgesia and sedation, infection prevention, hypothermia control, wound monitoring, nursing care, and preparation for delayed evacuation [1, 12]. PFC is usually delivered by advanced-trained personnel and is therefore close to a clinical module or practice set. PCC, by contrast, is broader. Recent JTS and CoTCCC materials position PCC as a Role 1 system capability for all responders when timely or optimal medical care is limited by the tactical situation [13, 14, 15]. It includes clinical skills but also doctrine, training, equipment, capacity planning, telemedicine, documentation, ethical decision-making, and command integration.

The distinction between capability and capacity is central to PCC. Capability refers to what a team can do, such as start antibiotics, maintain an airway, monitor vital signs, perform wound care, or request teleconsultation. Capacity refers to how many casualties can be supported, for

how long, and under what resource constraints. A team may have the capability to monitor one casualty for 24 hours but lack the capacity to care for several casualties during a mass casualty event. PCC therefore requires planners to connect clinical tasks with supply depth, manpower, rest cycles, communication reliability, and evacuation probability.

The third finding is that prolonged care is increasingly relevant to conventional operations, not only special operations. Evidence from Ukraine indicates that pre-hospital and forward care can be extended by battlefield geometry, drone threat, nighttime movement requirements, limited routes, damage to facilities, and attrition of Role 2+ capabilities [8, 9, 10]. In such circumstances, the forward echelon may face patients with severe blast or fragmentation injuries, ongoing hemorrhage risk, infection risk, hypothermia, pain, psychological distress, and delayed surgical access. The medical task therefore migrates from a short TCCC episode to a prolonged period of physiologic maintenance and resource management. This migration also increases the importance of blood availability, antibiotic timing, nursing tasks, communication, documentation, and triage decisions.

Based on these findings, this study proposes Echelon P as an independent capability layer rather than a new fixed facility. Echelon P is activated when specific triggers are met and then provides a structured pathway for sustained care until transfer to an appropriate level of care becomes possible. The first category of triggers is evacuation delay beyond doctrinal or operational thresholds, for example more than two hours, more than six hours, or more than 24 hours. The second category is mission constraint, such as concealment requirements, ongoing contact, electronic suppression, inability to move during daylight, or lack of secure transport. The third category is capability or capacity mismatch, such as mass casualty events, extreme cold or altitude, depletion of blood or oxygen, limited communications, or simultaneous care for multiple unstable casualties.

The proposed P0-P3 stratification translates the time dimension into capability requirements. P0, from injury to approximately two hours, remains the acute preventable-death phase. Its core is TCCC execution: hemorrhage control, airway positioning or adjuncts, chest injury management, circulation assessment, hypothermia prevention, analgesia when appropriate, and rapid documentation. The expected output of P0 is not definitive recovery but stabilization, prioritization, and transport readiness.

P1, approximately 2–6 hours, is the sustained resuscitation and monitoring phase. At this point, the provider must repeat examinations, track vital signs, reassess tourniquets and dressings, continue hypothermia prevention, maintain analgesia and sedation safety, and determine whether the casualty is improving, deteriorating, or consuming resources faster than anticipated. P1 also requires an early estimate of available consumables, blood, oxygen, battery power, and personnel endurance. Failure at this level often occurs not because a single procedure is unknown, but because reassessment, documentation, and handover discipline decline under fatigue.

P2, approximately 6–24 hours, is the multidimensional management phase. Infection prevention, wound care, sepsis awareness, pressure injury prevention, nutrition and hydration decisions, pain and anxiety control, urine output or perfusion monitoring, and communication with remote consultants become increasingly important [12, 14, 16]. If telemedicine is available, the forward team should transmit structured information rather than informal impressions. If evacuation remains uncertain, the team must also update triage categories and explain resource implications to commanders.

P3, approximately 24–72 hours, is the systematic maintenance phase. It requires a more formal rhythm of care, including shift organization, medication and supply accounting, serial documentation, remote consultation, end-of-life decision preparation, and team resilience

management. PFAK studies are particularly relevant at this level because they attempt to define a portable package capable of supporting prolonged objectives under weight and volume constraints [17, 18, 19]. The function of P3 is to prevent prolonged care from degrading into unmeasured improvisation; it turns sustained management into a documented, supervised, and logistically supported activity.

The P0-P3 structure should not be interpreted as rigid time compartments. A casualty can enter P2-level complexity before 6 hours if severe shock, sepsis concern, airway compromise, or environmental exposure develops early. Conversely, a stable casualty may remain within a lower capability demand for longer. The practical value of the stratification lies in its forcing function: as time passes, teams are reminded to reassess whether their clinical tasks, supplies, documentation, and consultation mechanisms have kept pace with the increasing risk profile.

Echelon P must also define interfaces. The medical interface determines which clinical findings require urgent evacuation or higher-level consultation, such as suspected sepsis, uncontrolled hemorrhage, airway failure, shock requiring blood products, or deterioration despite initial stabilization. The blood and resuscitation interface links forward providers to whole blood, component therapy, walking blood bank procedures, calcium replacement, and resuscitation priorities. The data interface uses TCCC cards, after-action review, registry-compatible documentation, and automated or simplified records to support quality improvement. The command interface translates medical risk into operational language, including expected resource consumption, likelihood of deterioration, evacuation priority, and ethical constraints. These interfaces are essential because prolonged care without defined boundaries can create unlimited expectations for forward teams.

Finally, the model highlights four support conditions. Equipment support should be modular, portable, environment-resistant, and aligned with P0-P3 needs. Training support should move

beyond individual procedures toward scenario-based management, communication, team leadership, documentation, and resource allocation [20, 21]. Technical support should include remote consultation, decision prompts, and documentation tools that reduce cognitive burden during long care intervals. Resilience support should address fatigue, moral injury, grief, team cohesion, and end-of-life care, because prolonged casualty holding may expose small teams to repeated loss and ethically difficult decisions [22, 23, 24]. The integrated relationships among activation triggers, P0-P3 capability tiers, prolonged-care concepts, and the four interface mechanisms are summarized in Figure 1.

DISCUSSION

This study makes three contributions. First, it separates PFC and PCC in a way that is useful for implementation. PFC should be understood as the advanced clinical continuation of care under austere conditions, whereas PCC should be understood as the broader capability framework that prepares the force for delayed or denied evacuation. This distinction matters because a military medical system can possess several PFC-trained providers and still lack a PCC capability if doctrine, equipment, blood supply, communication, documentation, and command interfaces are absent.

Second, the proposed Echelon P model converts prolonged care from a vague duration into an operational structure. The P0-P3 sequence shows that time itself changes the task. During the first minutes and hours, failure is dominated by preventable death and transport readiness. As the delay lengthens, the dominant risks shift toward physiologic deterioration, infection, hypothermia, pain, resource exhaustion, documentation loss, team fatigue, and ethical complexity. This view helps explain why simply adding more supplies or teaching more

procedures is not enough. A prolonged-care system must know when to activate, what capability to bring forward, what information to record, and when to request help.

Third, Echelon P offers a way to connect prolonged care with the traditional Role system. It does not propose a separate hospital echelon or a replacement for evacuation. Instead, it formalizes the interval in which evacuation is not yet possible and prevents this interval from being invisible in planning. The model therefore supports resilience: it allows forward teams to continue care in a structured way, while still treating evacuation and definitive care as the final objective. This is especially important in high-intensity conflicts, where forward facilities may need to displace frequently and casualty movement may be governed by enemy fires rather than medical preference.

The model also has implications for training. TCCC training should remain the foundation, but prolonged-care training should start after TCCC mastery and should use longer scenarios that force teams to reassess, document, communicate, ration, hand over, and explain medical risk to commanders. Existing data on incomplete adherence to analgesia and tranexamic acid guidelines suggest that even relatively defined TCCC tasks are difficult to execute consistently [25, 26]. PCC tasks are more complex and therefore require repeated simulation, checklists, and objective assessment rather than lectures alone.

Equipment planning should also follow the P0-P3 logic. A first-line kit optimized for P0 cannot support P3 care by itself, while a full prolonged-care package may be too heavy for dismounted teams. PFAK development studies show the need to balance portability with meaningful capability, including medication, monitoring, wound care, documentation, and environmental protection [17, 18, 19]. The correct solution may be layered: individual TCCC equipment for P0, team-level modules for P1-P2, and mission-specific augmentation for P3 or extreme environments.

Implementation should be incremental. A practical starting point is to define activation thresholds and minimum documentation standards, because these two elements require relatively little equipment but immediately change behavior. The next step is to build modular equipment lists for likely missions and to train teams in prolonged scenarios that last long enough to expose fatigue, communication gaps, and supply depletion. Higher-level medical authorities should then review after-action data to refine triggers, revise kits, and identify training deficiencies. This cycle would turn Echelon P from a theoretical construct into a quality-improvement mechanism.

This study has limitations. It is primarily based on foreign military guidelines, published studies, and operational reports, especially from U.S. and Ukraine-related sources. Applicability to another military medical system depends on differences in doctrine, equipment, evacuation assets, command relationships, personnel structure, and operating environment. The Echelon P model is also conceptual and has not yet been validated in field exercises or real operations. In addition, ethical issues such as end-of-life care, resource allocation, and communication with commanders require local cultural and institutional adaptation.

Future research should test the model through table-top exercises, simulation, and field training. Evaluation indicators could include time to activation, documentation completeness, appropriateness of evacuation requests, ability to maintain vital sign monitoring, blood and medication use, team fatigue, and casualty outcomes. Equipment studies should compare PFAK configurations under weight and volume constraints. Training studies should determine whether P0-P3 scenarios improve performance compared with TCCC-only instruction. Finally, registry-compatible documentation should be designed before implementation so that prolonged care can be measured and improved rather than remembered only through anecdote.

Local adaptation will be necessary before direct application. Different forces may have different evacuation platforms, blood-product policies, telemedicine access, and training pipelines. Therefore, the model should be used as a framework rather than a fixed checklist. Units can map their current assets against P0-P3 requirements, identify the point at which care becomes unsafe, and then decide whether the gap should be closed through additional supplies, training, communication support, or changes in evacuation planning. This mapping process may be the most immediate practical use of Echelon P.

CONCLUSION

Modern combat casualty care is entering a phase in which rapid evacuation can no longer be assumed. TCCC remains the foundation for preventable death control, but prolonged evacuation demands additional clinical, logistical, ethical, and command capabilities. PFC provides the clinical continuation of care by advanced-trained personnel, whereas PCC provides the broader system framework for all Role 1 responders when evacuation is delayed or denied.

The proposed Echelon P model translates prolonged care into an operational structure built on activation triggers, P0-P3 capability tiers, and medical, blood/resuscitation, data, and command interfaces. This model can help prevent prolonged care from being treated as an improvised exception and instead make it a planned, trainable, assessable, and resource-supported part of military medical resilience. Future implementation should proceed through doctrine refinement, modular equipment design, scenario-based training, telemedicine and documentation support, and standardized quality assessment.

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REFERENCES

1. Keenan S, Riesberg JC. Prolonged Field Care: Beyond the "Golden Hour". Wilderness Environ Med. 2017;28(2S):S135-S139. [DOI: 10.1016/j.wem.2017.02.001] [PMID: 28601206]
2. Rund TJ. Casualty evacuation in arctic and extreme cold environments: A paradigm shifts for traumatic hypothermia management in tactical combat casualty care. Int J Circumpolar Health. 2023;82(1):2196047. [DOI: 10.1080/22423982.2023.2196047] [PMID: 37161378]
3. Butler FK Jr. Tactical Combat Casualty Care: Beginnings. Wilderness Environ Med. 2017;28(2S):S12-S17. [DOI: 10.1016/j.wem.2016.12.004] [PMID: 28284483]
4. Giebner SD. The Transition to the Committee on Tactical Combat Casualty Care. Wilderness Environ Med. 2017;28(2S):S18-S24. [DOI: 10.1016/j.wem.2016.11.005] [PMID: 28279652]
5. Butler FK. Two Decades of Saving Lives on the Battlefield: Tactical Combat Casualty Care Turns 20. Mil Med. 2017;182(3):e1563-e1568. [DOI: 10.7205/MILMED-D-16-00214] [PMID: 28290925]
6. Deaton TG, Drew B, Montgomery HR, Butler FK. Tactical Combat Casualty Care (TCCC) Guidelines: 25 January 2024. J Spec Oper Med. 2024;24(1):100–8. [DOI: 10.55460/QT3B-XK5B] [PMID: 38364091]
7. Deaton TG, Auten JD, Betzold R, et al. Fluid Resuscitation in Tactical Combat Casualty Care; TCCC Guidelines Change 21-01. J Spec Oper Med. 2021 Winter;21(4):126–37. [DOI: 10.55460/JYLU-4OZ8] [PMID: 34969143]
8. Olsen S. Medical Evacuation Operations in Ukraine: Field Assessment Report. Stratagem. 2025 [cited 2026 Jun 11]. Available from: https://www.stratagem.no/medical-evacuation-operations-in-ukraine-field-assessment-report/.
9. Epstein A, Lim R, Johannigman J, Fox CJ, Inaba K, Vercruysse GA, et al. Putting Medical Boots on the Ground: Lessons from the War in Ukraine and Applications for Future Conflict with Near-Peer Adversaries. J Am Coll Surg. 2023;237(2):364–73. [DOI: 10.1097/XCS.0000000000000707] [PMID: 37459197]
10. Lawry LL, Korona-Bailey J, Kanagaratnam A, Maddox J, Hamm TE, Janvrin M, et al. Qualitative assessment of point of injury to Role 2+ combat casualty care in Ukraine. Trauma Surg Acute Care Open. 2025;10(2):e001674. [DOI: 10.1136/tsaco-2024-001674] [PMID: 40575542]
11. Jokovic DB, Krstic D, Stojanovic Z, Spiric Z. Experience of the Air Medical Evacuation Team of Serbian Armed Forces in the United Nations Mission in the Democratic Republic of Congo--Deployment stress and psychological adaptation. Vojnosanit Pregl. 2016;73(2):188–91. [DOI: 10.2298/VSP140114145J] [PMID: 27071287]
12. Rapp J, Keenan S, Taylor D, Rapp A, Turconi M, Maves R, et al. Sepsis Management in Prolonged Field Care: 28 October 2020. J Spec Oper Med. 2020 Winter;20(4):27–39. [DOI: 10.55460/I18B-1ZQM] [PMID: 33320310]
13. Joint Trauma System. Prolonged Casualty Care Guidelines (PCC 2.0) [Internet]. San Antonio: Joint Trauma System; 2025 [cited 2026 Jun 11]. Available from: https://jts.health.mil/.
14. Joint Trauma System. Nursing Interventions, Wound Care, and Splint Management in Prolonged Casualty Care [Internet]. San Antonio: Joint Trauma System; 2025 Jul 8 [cited 2026 Jun 11]. Available from: https://jts.health.mil/.
15. Remley MA, Mosley D, Keenan S, Deaton TG, Montgomery HR, Kotwal RS, et al. Committee on Tactical Combat Casualty Care (CoTCCC) Position Statement on Prolonged Casualty Care (PCC): 01 May 2024. J Spec Oper Med. 2024;24(2):111–3. [DOI: 10.55460/RWAU-AVBM] [PMID: 38872235]
16. Causbie JM, Wisniewski P, Maves RC, Mount CA. Prophylactic antibiotic use for penetrating trauma in prolonged casualty care: A review of the literature and current guidelines. J Trauma Acute Care Surg. 2024;97(2S Suppl 1):S126-S137. [DOI: 10.1097/TA.0000000000004355] [PMID: 38689405]
17. Dawood ZS, Keeney-Bonthrone TP, Russo RM, Ho JW, Liggett MR, Gurney J, et al. Designing the Prolonged Field Care Kit (PFAK) to Address the Logistical Challenges of Future Combat Casualty Care. Mil Med. 2024;189(Suppl 3):366–72. [DOI: 10.1093/milmed/usae132] [PMID: 39160819]
18. Dawood ZS, Liggett MR, Keeney-Bonthrone TP, Russo RM, Ho JW, Couchenour DC, et al. Development of a prolonged field care kit using a modified Delphi survey approach. J Trauma Acute Care Surg. 2025;99(3S Suppl 1):S106-S113. [DOI: 10.1097/TA.0000000000004625] [PMID: 40208095]
19. Dawood ZS, Liggett MR, Keeney-Bonthrone TP, Russo RM, Ho JW, Gurney J, et al. Fielding an Expeditionary Prolonged Casualty Care Kit: What We Carry Matters. Mil Med. 2025;190(9-10):e2032-e2038. [DOI: 10.1093/milmed/usaf129] [PMID: 40504494]
20. Eker J, Hiller H, Hill G, Brillhart D, Hannick V. Preparing Emergency Physicians for the Next War: Residency Capstone Training in Prolonged Casualty Care. Med J (Ft Sam Houst Tex). 2022 Apr-Jun;(Per 22-04/05/06):10–6. [PMID: 35373315]
21. Mould-Millman NK, Keenan S, Dixon J, Steyn E, Lategan HJ, de Vries S, et al. An Innovative Civilian Research Model to Inform Combat-Relevant Prolonged Casualty Care. Med J (Ft Sam Houst Tex). 2022 Apr-Jun;Per 22-04-05-06(Per 22-04-05-06):62-72. [PMID: 35373323]

22. Joint Trauma System. About JTS [Internet]. San Antonio: Joint Trauma System; 2026 [cited 2026 Jun 11]. Available from: https://jts.health.mil/.
23. Flores-Carrera A, Ong A. Team-centered resilience in healthcare teams within LSCO environments: Building collective strength for modern combat challenges. Mil Psychol. 2025:1-15. [DOI: 10.1080/08995605.2025.2584753] [PMID: 41190877]
24. David J, Fairburn S, Fogle H, Dulin N, Day R. End-of-Life Care in the Austere Military Environment. Mil Med. 2026;191(3-4):e563-e570. [DOI: 10.1093/milmed/usaf436] [PMID: 41013916]
25. Schauer SG, Fisher AD, April MD, Carter R 3rd, Cunningham CW, Aden JK 3rd, et al. Battlefield Analgesia: Adherence to Tactical Combat Casualty Care Guidelines. J Spec Oper Med. 2019 Spring;19(1):70–4. [DOI: 10.55460/KDHW-QBQZ] [PMID: 30859531]
26. Fisher AD, Carius BM, April MD, Naylor JF, Maddry JK, Schauer SG. An Analysis of Adherence to Tactical Combat Casualty Care Guidelines for the Administration of Tranexamic Acid. J Emerg Med. 2019;57(5):646–52. [DOI: 10.1016/j.jemermed.2019.08.027] [PMID: 31629577]

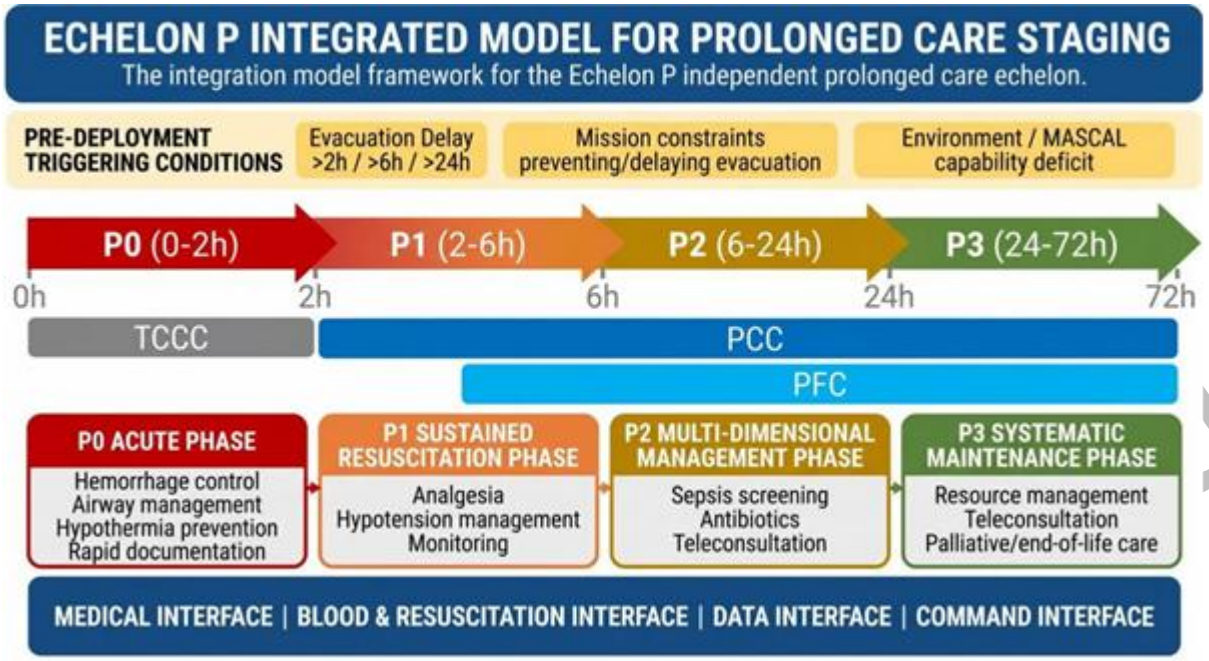

Figure 1. The Echelon P integrated model for prolonged care staging. The model links activation triggers, P0-P3 capability tiers, and four interface mechanisms. TCCC covers the immediate P0 phase, PCC covers the broader Role 1 prolonged-care framework, and PFC represents the continuation of PCC by advanced-trained personnel until transfer to an appropriate level of care becomes possible; MASCAL – mass casualty; h – hours; TCCC – tactical combat casualty care; PCC – prolonged casualty care; PFC – prolonged field care; P0 – acute phase (0–2 h); P1 – sustained resuscitation phase (2–6 h); P2 – multidimensional management phase (6–24 h); P3 – systematic maintenance phase (24–72 h)

