Tri-services Holistic Health Tact and Sophistication: Advancements Interesting Workable with Artificial Intelligence

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Introduction

From heights of the sky to depths of the seas and all land terrains, health promotion, maintenance, and protection is desirable professionally. As warfare gets advanced with autonomous weapon systems, the complexities and challenges of human-machine teaming need solutions. With Indian Armed Forces' theaterisation and 'Integrated Theatre Commands' (ITC) shaping up, catalysing fitness and combat care favourable become important, with current progressive perspectives.

Defence Minister, Government of India, Rajnath Singh's energetic excellent expertise states, "We need to manage, regulate, and harness technology innovations and systems, ahead of worldwide militaries".[1]

India led the information technology revolution; Indian technologists are leading the Artificial Intelligence (AI) revolution, and Indian Armed Forces Medical Services (AFMS) should lead the war theatre wonders with AI.

Chief of Defence Staff, General Anil Chauhan's vision of resilience and self-reliance—values that are deeply embedded in India's civilisational ethos—is praiseworthy. Healthy troops serve as resilience, and holistic tact for sophistication robust will lead to self-reliance. The latest book *Ready, Relevant and Resurgent: A Blueprint for the Transformation of India's Military* perfectly states that resilience incorporates public health.[2]

Warfare is becoming more automated, with unmanned autonomous ships, submarines, fighter jets, weapon carriers, and fighters. The human-machine teaming has to be thoughtful and tactful. AFMS need to keep pace with promoting health of the men involved and with intelligent machines progress for autonomous healthcare. All this encompasses first aid, evacuation, and treatment, including remotely controlled robotic surgeries.

Chief of the Army Staff, General Upendra Dwivedi's important impetus towards automation and absorption of niche tech in the Indian Army is timely. This encompasses enhancing the technological threshold of all ranks, interestingly involving emerging technologies like big data analytics, AI, quantum and blockchain-based solutions, and acts as a critical and grand crusade.[3] In the medical world, 'Technology Proficiency' is pertinently fruitful, and recommended to be included as a definitive requirement and a distinct strategic plan worldwide.[4]

ITCs involve moving towards multi-domain operations and integrating emerging domains like space and cyberspace. Medical applications of AI are multiplying, with AI becoming multimodal. The latest generation of AI models, the foundation models, are

trained on massive, diverse datasets for varied tasks. These offer previously unseen abilities. There is a need to utilise all these for highest healthcare in tri-services.

It is alarming and alerting that in the recent Russia-Ukraine War, casualties increased to the tune of nearly 10 to 15 times of those seen in the 'Global War on Terror' in the United States' (US) operations in the Gulf and Afghanistan.[5] This points to advancing care preparedness and practice professionally, possibly with AI assistance.

AI functions on algorithms that enable machines to perform tasks and activities that generally require human intelligence, and its use offers innovative solutions in various fields. AI is among the most advanced technologies within the healthcare sector.[6]

Conceptual frameworks represent ways of thinking about a problem or a study, or ways of representing how complex things work. Conceptual frameworks can come from theories, models, or best practices.[7],[8] The author proposes a tri-services conceptual framework, modified from an earlier proposed one of 'Technology Proficiency' model.[9],[10],[11] The five components are:

- AI for promotion of health and prevention holistic;
- AI for proper assessment;
- AI for pertinent treatment;
- AI for progress monitoring;
- AI for professional standards.

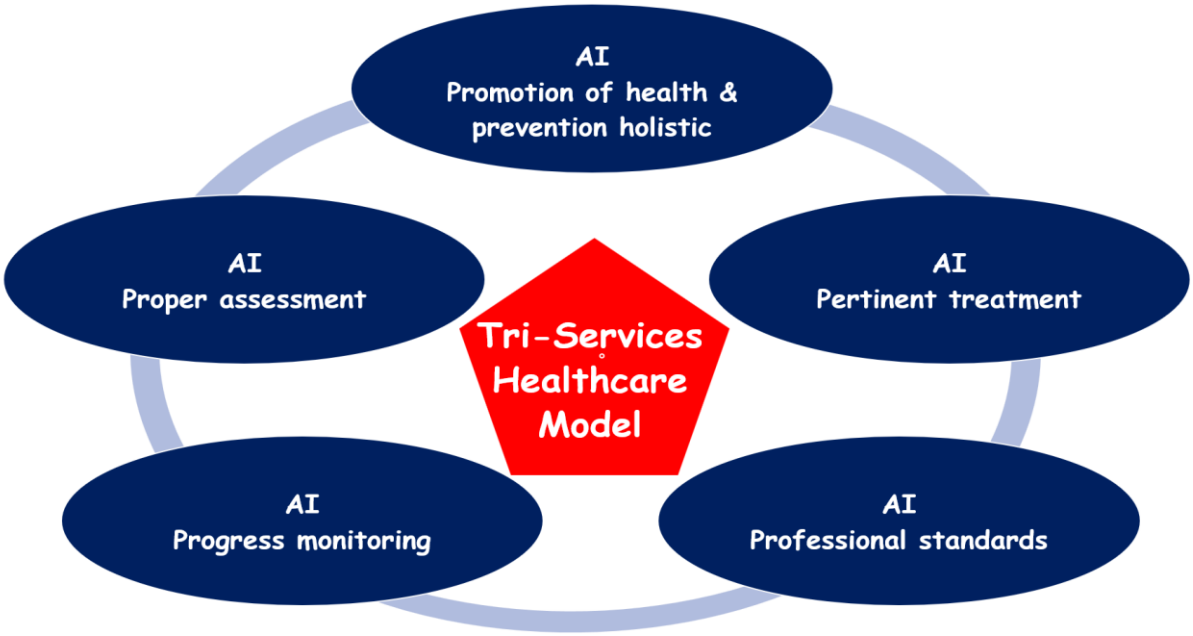

Figure 1: Five Components of Tri-services Conceptual Framework

Components of Proposed Tri-services Conceptual Framework

- **AI for Promotion of Health and Prevention Holistic**. Diet and exercise are distinctive and excellent for the highest level of health. Monitoring and maintenance are both possible with AI.

  Machine learning models can analyse and advice based on dietary and exercise data.

  Nutrition role in health promotion and disease prevention is important and well-established. However, traditional dietary planning often relies on generalised frameworks that overlook inter-individual variability.

  - **Personalised Nutrition**. The use of AI to provide tailored dietary recommendations by analysing vast amounts of data, including genomic and metabolic information, is helpful. Metabolomics involving study of an individual's unique metabolic profile and their responses to specific foods in real-time is useful. Data sources include Continuous Glucose Monitors (CGMs), blood lipid profiles, and gut microbiome composition. AI provides dynamic data-informed frameworks, tailored to individual needs. Currently, AI's role in nutrition is focussed on dietary assessment, and doctors can advise personally, based on individual and unit data.[12]
  - **Personalised Exercise**. AI acts as a guided trainer, based on machine learning and deep learning techniques.[13] AFMS doctors need to understand and ubiquitously energise this. This is important and obviates threats to health for personnel for air force, army, and navy, in control headquarters and battlefronts.

- **AI for Proper Assessment**. Triage identifies ill and injured combatants at high-risk and predicts their conditions. A recent Scoping Review has found that AI helps in proactively managing their evacuation flow and allocating critical resources more effectively.[14]

  Wearable sensors integrated with AI platforms can provide real-time, dynamic data, enabling a more comprehensive understanding of a patient's health status.[15] This is equally important from the highest echelons, from combined operation theatre control rooms to the fighting fronts.

  The recent the US Department of Defense obtaining FDA 510(k) clearance for Automated Processing of the Physiological Registry for Assessment of Injury Severity—Haemorrhage Risk Index (APPRAISE-HRI) is inspiring.[16] Sophisticated advanced assessment in emergencies is most needed.

  There is a need to start training for integrating AI tools into existing military and emergency medical workflows. Promoting explainable AI to ensure safe and effective use is pertinent.

- **AI for Pertinent Treatment**. Selecting right medications, rightly planned surgeries, and right counselling are benefitted by AI. Practice with evidence-based guidelines, prevention of treatment adverse effects, smooth information flow between multi-disciplinary clinical team members, and proactive engagement of personnel in their own care are required. AI has the potential to revolutionise healthcare, leading to more precise diagnoses, personalised treatment plans, and improved doctor-patient interactions.[17]

  Remote surgical systems need attention for life-saving 'Unmanned' surgery in battlefield, controlled by experts.

  Simulation has become a key tool in the training with the maintenance of patient's safety. Robotic simulators are increasingly used in surgical training programs.[18] Training with unmanned battlefield surgery perspective is pertinent currently.
- **AI for Progress Monitoring**. Energetic monitoring for management excellence is a pre-requisite. Holistic care requires comprehensive monitoring from many medical devices, simultaneously from sensors to mobiles, medical equipment, and video cameras. AI integration and analysis of all data is quite useful.

  Care of the injured and emergency patient is a dynamic process. Continuous monitoring is required for proper response.[19] Remotely done monitoring is advantageous. Technology is useful in this regard. Quick data transmission for favourable timely actions is the ultimate aim. AI can make this expertly efficient.[20]

- **AI for Professional Standards**. Excellence and competency ensures correct treatment, which is free from errors and side effects. AI augmentation of human performance is likely to be of widespread use.[21] AI technology can provide decision support to medical experts seeking to find the best diagnosis and treatment for patients. This, coupled with doctor's competence, should lead to professional standards and performance of the highest order.

  Medical education is a lifetime learning process, stretching from undergraduate to postgraduate, specialty training, and beyond.[22] In the context of Indian Armed Forces, it is imperative that war experiences are analysed for advancements of medical tactics. AI assistance is useful. Individually, AI offers personalised learning experiences and feedback for medical students, providing support speedily.[23]

  New interventions and technologies are constantly being developed and refined. Armed forces healthcare is critical and most professional. Establishing an 'AI Healthcare Academy' becomes important for robust advancements of the right applications. Academic excellence ensures evidence-based medicine applications.[24],[25]

- In ITCs, varying degrees of synergy and cross-service cooperation is necessary. Health is physical, mental, and social. Well-being of servicemen promotes well-functioning of ITCs. Physiological data of airmen, sailors, and soldiers in different and difficult heights, depths, and terrains, and their pathological variations should be compiled and interesting insights from AI should be ultimately used for the highest standards of professional risk amelioration. This will be useful for not only Indian Armed Forces, but also in adverse weather events which are becoming more intense and frequent worldwide.[26]

Conclusion

AI has potential to advance armed forces' healthcare to one that is comprehensive, convenient, and sophisticated, transcending time and physical boundaries. AI is a friend indeed, excellent for emergent needs. Advanced applications in ITCs is the best way forward.

Endnotes

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