Customized Athletic Shoe Midsole Development to Address Plantar Heel Pain

(Technical Report)

Tactical Medicine & Weaponry: The Impact of Assault Rifle Advancements on Emergency Medical Services in the United States

(STS Research Paper)

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SocioTechnical Synthesis

Plantar fasciitis is a degenerative foot condition involving inflammation of the plantar fascia ligament that can lead to significant locomotion-related discomfort and altered gait patterns in patients. Mass-produced footwear models are marketed to the average consumer, which do not account for the highly unique nature of patient's feet and locomotion patterns. In order to provide patient-specific treatment for footfall impairment conditions, such as plantar fasciitis, custom orthotic insoles are prescribed to patients and are fabricated using negative casting techniques, often with plaster. This approach, while providing bespoke therapies to patients, is not the optimal treatment method as fabrication is cost and time-inefficient and the resulting product is supplementary to the shoe. In order to combine the functionality of athletic shoe models and the therapeutic benefits of orthotic midsoles, a customization algorithm was constructed to guide the development of custom athletic shoe midsoles specifically designed to address plantar heel pain. The midsole customization algorithm utilizes patient-specific biometric data to inform the midsole design that minimizes hotspots through pressure redistribution, supports the medial longitudinal arch with medial posts, offers cushioning through varied infill percentages based on weight, and conforms to the patient's foot using a topographical contoured surface based on a 3D scan. These algorithm components produce a midsole that is designed to improve biomechanical function during the gait cycle and offer patients suffering from plantar heel pain a more cost-effective and personalized method of treatment.

Moving away from technical research, it is important to evaluate how technological advances impact society and social groups. The research paper topic for this thesis portfolio delves into the effect of assault weapon advancements in the post-World War II era on the development of Emergency Medical Services (EMS) in the United States.

Gun violence is a proliferating public safety issue in the United States that has garnered widespread media attention and triggered a fervid political debate on gun control and the gun-centric culture of the United States. Assault-style weaponry has become increasingly integrated into the civilian population of the U.S. since its inception in the combat theater of World War II, which has led to an increase in firearm-related injuries and fatalities. While national attention has been focused heavily on the victims and their families who feel the aftermath of gun violence daily, EMS personnel are on the frontlines of this public safety epidemic, yet their experiences are not publicly broadcast.

In order to have a fully informed public debate on the issue of gun violence, it is critical to consider all affected social groups, therefore, evaluating how assault weapons have influenced the development and standardization of the U.S. EMS system during the post-World War II era can provide insight into the experiences and evolving responsibilities of first responders. The framework of technological determinism was used as an analytical lens to evaluate assault weapons as a determinant technology that actively shaped the EMS system. Additionally, the framework of technological citizenship was used to analyze the existence of assault weapons in a democratic society in order to better understand how they have contributed to an evolution of citizen rights and duties for EMS personnel.

A parallel timeline of assault weapon advancement and EMS development and standardization was constructed to evaluate any causational overlaps. To evaluate public and presidential attention to gun violence and the EMS system as a relevant social group, keyword searches for related terms were conducted across search engines and presidential speeches. Additionally, the keyword search was conducted on a series of documents pertaining to hospital-based violence intervention programs to illustrate the overlap of violent crime and the evolving

role of the EMS system in combatting it. Lastly, a number of comparative numerical data sets on the number of firearm-related fatalities was analyzed for trends. Through this research, it was found that assault weapons played a key role in certain aspects of EMS development, particularly in the militarization of response protocol and adoption of combat casualty care techniques in a civilian setting. It was also found that national attention to the issue of gun violence has increased during the post-World War II era, coinciding with the increase in high-profile gun violence episodes, while legislative action on the issue has remained stagnant. Scrupulous analysis of assault weapons as a determinant technology reveal the social ramifications of widespread armament for numerous social groups that exist within a democratic society that expect a high level of public safety, particularly EMS professionals. These findings could have significant implications for the ongoing debate on gun violence in the U.S.