

**Understanding exertional heat illness in the military:
Using Haddon's Matrix**

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PURPOSE/AIMS: Understanding the predictors of exertional heat illness (EHI) is essential to the safety of military service members and the overall mission, especially in wartime and homeland disaster response. This study used Haddon's Matrix epidemiological model to examine risk factors for EHI in National Guard (NG) service members participating in disaster response operations requiring personal protective equipment (PPE). Specific aims were: (1) Identify EHI risk factors for NG service members during pre-event, event, and post-event disaster response operations that necessitate PPE. (2) Categorize findings from AIM 1 into Haddon's Matrix conceptual framework reflecting four key areas where injury prevention can be implemented: human (host), agent (energy transfer), environmental, and workplace/social conditions.

BACKGROUND: Heat injuries affect over 2,500 U.S. military personnel each year with costs exceeding over \$1 billion over a ten year period. Altogether, heat injuries account for: lost duty time, medical treatment, medical evacuations, and have negative implications for mission readiness. EHI presents significant risks for NG disaster response teams, especially when NG service members are performing search and rescue operations in full-body impermeable PPE complete with powered air-purifying respirators. While EHI prevention and management strategies for athletes and military trainees are well-documented, these strategies do not account for the additional heat-related risks NG service members confront when responding to disasters requiring 'all-hazards' PPE.

METHODS: Informed by a conceptual framework reflecting Haddon's Matrix epidemiological model for injury prevention, a qualitative descriptive study was conducted to identify EHI-related risk factors in NG service members during disaster response operations requiring PPE. We conducted three focus groups with enlisted and officer NG service members, civilian health professionals, and athletic trainers experienced with EHI conditions and treatment (n = 27). Thematic analysis was used to categorize focus group data into pre-event, event, and post-event disaster response operations indicating four conceptual groups: human (host), agent (energy transfer), environmental, and workplace/social conditions.

RESULTS: Human elements reflecting risk-taking behaviors, hyper-motivation, and alcohol use were key factors putting NG service members at risk for EHI. Prescription medications, nutritional supplements, and PPE emerged as noteworthy EHI-related agents. Environmental factors conducive to EHI centered around hot/humid conditions. Workplace/social factors were prominent in focus group conversations with policies/procedures, medical personnel readiness, and differing military cultures being important factors related to EHI in NG disaster response teams.

IMPLICATIONS: This study reveals crucial elements placing NG service members at risk for EHI in disaster response operations where PPE is required. Findings provide a strong foundation for best practices pertaining to pre-event, event, and post-event assessments administered by NG medical personnel.

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