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## Abstract

The U.S. military was confronted with a new and unusual disease during the Korean War (1950-1953). This disease was known as epidemic hemorrhagic fever (EHF), and it was characterized by the acute onset of headache and nausea that progressed to blood leakage, neurological impairment, and kidney failure. The cause of this epidemics was not to be discovered until 1976. However, several dedicated teams of Army researchers deployed to Korea where they determined the epidemiological and geographic features of the disease and were largely successful in defining the key features of the EHF pathology. The goal of this project was to identify lessons that can be drawn from the experience of these teams that may be applied to future epidemic and pandemic scenarios.



**Figure 1:** CPL Don Feeney of the Walter Reed Surgical Research Team at the 48<sup>th</sup> MASH in Korea examines a specimen in 1954. Photo: courtesy of the Donald J. Feeney Photo Collection.

## Disease and Treatment

UN troops in Korea saw roughly 3,200 cases of EHF during the war and faced a mortality rate of up to 20%.<sup>1</sup> Most fatalities were due to vascular collapse and shock. The illness's premier symptoms are fever, hemorrhage, and cardiovascular, gastrointestinal, renal, and neurological manifestations. Renal failure is also common in EHF patients. Hemorrhage begins at roughly the third day of illness and can last for up to eight days and is best treated with transfusions. Both shock and renal disease can occur between the third and sixth day. Shock is generally more severe if initial medical care is delayed.<sup>2,3</sup>



**Figure 2:** Hemorrhagic manifestation of the conjunctiva. Epidemic Hemorrhagic Fever in Korea, 1952. National Museum of Health and Medicine (MIS 52-902-1).

## Hemorrhagic fevers in the USSR

Throughout the early 20<sup>th</sup> century, the Soviet Union encountered various hemorrhagic fever outbreaks in Crimea, the Central Asian Steppe, and the Primorye district in the far eastern region of Russia, bordering the Korean Peninsula.<sup>4</sup> By the end of WWII, the USSR had compiled a significant body of research on hemorrhagic fevers including Korean EHS.<sup>5</sup> American scientists took advantage of the existing literature, using it as a starting point to learn more about the new and puzzling illness.<sup>6</sup> This serves as another lesson that we can learn from the US Army's Korean War experience—foreign language knowledge and cross-cultural fluency should be valued talents for epidemiology teams to best prevent, predict, and mitigate future disease outbreaks in deployed settings.

## Determining Etiology

EHF's etiology was not determined until 1976. Before then, researchers were unable to identify its etiology. Rodent-borne mites were presumed to be the vector by 8228<sup>th</sup> MASH researchers; this was most likely based on Japanese experimental research which came to a similar conclusion.<sup>5</sup> In fact, as a result of this assumption, the Eighth Army began soaking all clothing in miticide—this had no impact on the spread of this disease.<sup>3</sup> It is important to ensure that researchers should not assume the etiology based on prior research, but rather, intensive contemporary studies and experiments should be done to determine etiology.



**Figure 3:** Surgical Research Team at 48<sup>th</sup> MASH in Korea, 1954. Photo: courtesy of the Donald J. Feeney Photo Collection.

## Impact of Biodiversity

The species which carried and transmitted the virus (known as the virus's reservoir) was the striped field mouse, *Apodemus agrarius*.<sup>7</sup> Biodiversity limits the prevalence of any particular species in an environment by competition, meaning the likelihood that any rodent will be a transmitter of hantavirus is lower in regions of high biodiversity—this is known as the dilution effect.<sup>8</sup> The 1910-1945 Japanese occupation of Korea and subsequent American war saw rodent biodiversity plummet due to the massive deforestation caused by strategic bombing and military construction (80% of Korean forests were destroyed just between 1950 and 1953).<sup>9</sup> Thus, a significant lesson learned from the US Army's experience with hemorrhagic fever in the Korean Peninsula was the importance of monitoring external environmental factors which can impact disease transmission.



**Figure 4:** Entomologist, Stan Hoyt examines rodents for chiggers which were investigated as potential vectors of EHF in the early 1950s. Photo: courtesy of the Donald J. Feeney Photo Collection

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