MITIGATION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL HAZARD MITIGATION

Optimization Of A Point-of-need Infectious Disease Diagnostic Through Human Factors And Usability Testing

Rebecca Blackwood Darwin Biosciences, Boulder, Colorado, USA **Michelle Hartman-Lane** Naval Health Research Center, San Diego, California, USA **Erin A. Hansen** Naval Health Research Center, San Diego, California, USA **Ruth Gastelum Valenzuela** Naval Health Research Center, San Diego, California, USA **Gloria L. Torres** Naval Health Research Center, San Diego, California, USA **Brenden S. Gregorio** Naval Health Research Center, San Diego, California, USA **Breanne A. Bash** Naval Health Research Center, San Diego, California, USA **Tessa Rowe** Tensentric, Boulder, Colorado, USA **Raiden Todd** Tensentric, Boulder, Colorado, USA **Allie Buccino** Tensentric, Boulder, Colorado, USA **Robert Klepper** Orthogonal Diagnostics Inc., San Diego, California, USA **Jon Avila** Orthogonal Diagnostics Inc., San Diego, California, USA **Camille Paige** Darwin Biosciences, Boulder, Colorado, USA **Stephen K. Clark** Darwin Biosciences, Boulder, Colorado, USA **Adam Nekimken** Darwin Biosciences, Boulder, Colorado, USA **Amy Emerman** Darwin Biosciences, Boulder, Colorado, USA **Nicholas Meyerson** Darwin Biosciences, Boulder, Colorado, USA

Background information: SickStick is a nonpowered, point-of-need, handheld diagnostic device for the detection of infectious diseases. Implementation of SickStick will reduce disease burden by serving as a screening tool to determine if warfighters are mission-ready, or by testing military units to aid in quarantine decisions to prevent the spread of potentially serious pathogens. By intercepting transmission chains, we can improve warfighter health and readiness, and prevent loss of training time due to illness. Purpose and objective: This research aims to discover human factors requirements for point-of-need diagnostics, with the intention of developing a highly intuitive and easy to use diagnostic device that can be utilized in austere environments. Rationale of research: Having an easy to use, broadly applicable diagnostic enables warfighters and military installments to make well-informed health decisions on disease transmission. Enhancing the usability of SickStick minimizes the risk of user-related errors, thus increasing the utility of the device. Relationship to other areas of study: The human factors field is relatively new, and often accompanies biomedical, software, and mechanical engineering to obtain user feedback on real-world products. Evaluating human factors is relevant in any instance where users have direct interaction with a product to ensure the product is safe and effective. Methods:
Two distinct prototypes of SickStick have been developed and undergone human factors testing, including two distinct formative usability studies, rapid industrial design prototyping, and an operational usability assessment. SickStick Prototype #1 underwent robust human factors testing to receive user feedback for implementation into SickStick Prototype #2. These changes were evaluated during an operational assessment of SickStick aboard an active USNS Mercy humanitarian mission. SickStick was tested by 49 personnel aboard the ship to receive real-world feedback on the functionality of the device in a field environment. Preliminary results: Marked improvements were observed between SickStick Prototype #1 and Prototype #2 from implementation of usability testing findings. Key device failure modes observed in Prototype #1 were mitigated, thus making SickStick functional for field use. When SickStick Prototype #2 underwent usability testing aboard the USNS Mercy, the vessel was traveling in a rough sea state experiencing significant pitching and rolling. All participants were able to successfully use SickStick in a challenging maritime environment, while reporting generally favorable opinions of the device. Preliminary conclusions: Human factors testing provides insight into diagnostic device design requirements for a highly intuitive and functional device. Proper implementation of human factors testing discoveries enables the creation of a device that can be utilized in challenging field environments. Conversely, failure to include human factors testing in the design process may allow user-related failure modes to go unnoticed until real-world implementation of the device when failures can be detrimental to human health. Impact to JSTO mission: SickStick responds to changes in host biomarkers of infection rather than utilizing direct pathogen detection. As such, SickStick is pathogen agnostic and aims to detect novel pathogens, therefore aligning with JSTO's mission of anticipating the threats of tomorrow.

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