

# **ENHANCING INTERDISCIPLINARY HUMAN SYSTEM RISK RESEARCH THROUGH MODELING AND NETWORK APPROACHES**

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## **INTRODUCTION:**

NASA's Human Research Program (HRP) supports research to reduce human health and performance risks inherent in future human space exploration missions. Understanding risk outcomes and contributing factors in an integrated manner allows HRP research to support development of efficient and effective mitigations from cross-disciplinary perspectives, and to enable resilient human and engineered systems for spaceflight. The purpose of this work is to support scientific collaborations and research portfolio management by utilizing modeling for analysis and visualization of current and potential future interdisciplinary efforts.

## **METHODS:**

An existing taxonomy of human spaceflight contributing factors and risk outcomes was applied as a common language across disciplines. It provided a qualitative structural model of an integrated system spanning human, space vehicle, and mission operations aspects. Relationships between factors and risks in this model were informed by analysis of a subset of publications in the HRP publication database. Relationship information was also gleaned from content created by subject matter experts summarizing the status of human health and performance risks for NASA's Human System Risk Board. These inputs were used to create network visualizations of risks and contributing factors.

## **RESULTS:**

The visualizations supported characterization of current HRP work focus areas (e.g., publication subset focused on radiation risk topics) and revealed current emphases on relationships between factors (e.g., relationship between radiation exposure and cellular changes). The visualizations also provided insight into relationships identified by subject matter experts that could be targets for future collaborative research.

## **DISCUSSION:**

A modeling framework for capturing risk and contributing factor relationships informed by sources such as the HRP publication database and subject matter experts has been created. Visualizations using the model content were developed. The modeling framework and visualizations enable future application of network science techniques to identify topics to highlight for increased cross-disciplinary research supporting risk reduction.

## **Learning objectives:**

A cross-disciplinary modeling approach to support integrated human health and performance risk research for spaceflight is described.