The Space Medicine Exploration Medical Condition List

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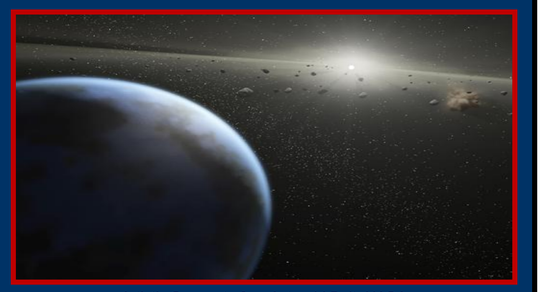
ABSTRACT

Exploration Medical Capability (ExMC) is an element of NASA's Human Research Program (HRP). ExMC's goal is to address the risk of the "*Inability to Adequately Recognize or Treat an Ill or Injured Crewmember*." This poster highlights the approach ExMC has taken to address this risk.

The Space Medicine Exploration Medical Condition List (SMEMCL) was created to define the set of medical conditions that are most likely to occur during exploration space flight missions. The list was derived from the International Space Station Medical Checklist, the Shuttle Medical Checklist, in-flight occurrence data from the Lifetime Surveillance of Astronaut Health, and NASA subject matter experts. The list of conditions was further prioritized for eight specific design reference missions with the assistance of the ExMC Advisory Group.

The purpose of the SMEMCL is to serve as an evidence-based foundation for the conditions that could affect a crewmember during flight. This information is used to ensure that the appropriate medical capabilities are available for exploration missions.



Artist's Concept of an Asteroid Belt, NASA

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THE HUMAN RESEARCH PROGRAM

NASA's Human Research Program (HRP) conducts research and develops technologies that allow humans to travel safely and productively in the environment of space.

The HRP is comprised of six Elements
- •International Space Station Medical Project
- •Space Radiation
- •Human Health Countermeasures
- •Exploration Medical Capability
- •Behavioral Health and Performance
- •Space Human Factors and Habitability

The National Space Biomedical Research Institute (NSBRI) is a partner with the HRP in developing a successful human research program.

EXPLORATION MEDICAL CAPABILITY (ExMC)

The Exploration Medical Capability (ExMC) Element is tasked with reducing the risk of the "*Inability to Adequately Recognize or Treat an Ill or Injured Crewmember*" during an exploration mission.

To address this risk, the Element must
- •Define requirements for crew health maintenance
- •Develop treatment scenarios
- •Extrapolate from the scenarios to health management modalities
- •Evaluate the feasibility of these modalities
- •Develop technology and informatics that will enable the availability of medical care and decision systems

APPROACH

To address the broad risk of the inability to adequately recognize or treat an ill or injured crewmember, the Element identified medical conditions of concern for exploration missions.

The conditions were gathered from several sources
- •Space flight medical incidents
- •The Shuttle Medical Checklist
- •The International Space Station Medical Checklist
- •Subject matter expert opinion

BACKGROUND AND PURPOSE

There are approximately eighty conditions on the condition list approved by the NASA's Space Medicine Division.

For each design reference mission, conditions on the list were prioritized by the ExMC Advisory Group, which includes flight surgeons, physician astronauts, engineers, and scientists. The clinical priority of each condition is based on incidence, consequence, and mitigation capability.

The condition list is a "living document." New conditions can be added to the list, and the priority of conditions on the list can be adjusted as screening, diagnosis, or treatment capabilities change.

The purpose of the SMEMCL is to serve as an evidence-based foundation for the conditions that could affect a crewmember during flight. This information is used to ensure that the appropriate medical capabilities are available for exploration missions.

DEFINITIONS

The SMEMCL uses the following clinical priority scale describing which medical conditions will be given resources for diagnosis and treatment.

Shall – Diagnostic and treatment capability must be provided

Should – Diagnostic and treatment capability should be provided if mass/power/volume allow.

Not Addressed – No specific diagnostic and/or treatment capability will be manifested, but diagnostic and treatment resources manifested for other medical conditions may be used if needed. A condition was listed as being of no medical concern if it is highly unlikely to occur, is expected to be engineered out, or the limitations in the medical training, hardware, or consumables precludes its treatment.

THE NEAR-EARTH ASTEROID (NEA) DESIGN REFERENCE MISSION

Mission duration – 13 months
(6 months on the outbound journey, 1 month of surface or proximity operations, and 6 months on the return journey)
Crew size – 3 crewmembers (2 male, 1 female)
Extravehicular Activities (EVA)
No planned EVAs during the transit phase
Tethered EVAs during the surface/proximity operations

ADDITIONAL INFORMATION

Human Research Program: http://humanresearch.jsc.nasa.gov
HRP Roadmap: http://humanresearchroadmap.nasa.gov
For a copy of the SMEMCL, please contact us.

NEA CONDITION LIST

Priority	Condition
Shall	Altitude Sickness
Shall	Back Pain (Space Adaptation)
Shall	Burns
Shall	De Novo Cardiac Arrhythmia
Shall	Decompression Sickness
Shall	Dental - Cavity/Temporary Filling
Shall	Dental - Crown Replacement
Shall	Dental - Exposed Pulp/Pulpitis/Periapical abscess
Shall	Dental - Total Avulsion/ Complete Tooth Loss
Shall	Dental - Toothache
Shall	Dysfunctional Uterine Bleeding
Shall	Eye Chemical Burn
Shall	Eye Penetration (Foreign Body)
Shall	Fingernail Delamination (EVA)
Shall	Intra-abdominal Infection (diverticulitis, appendicitis, other)
Shall	Nephrolithiasis
Shall	Osteoporosis
Shall	Palliative Treatment
Shall	Paresthesias (post-EVA)
Shall	Radiation Sickness
Shall	Seizure
Shall	Sepsis
Shall	Skin Rash
Shall	Smoke Inhalation
Shall	Sprain/Strain/Overuse Syndromes
Shall	Surgical Treatment
Shall	Toxic Exposure
Shall	Visual Impairment/ Intracranial Hypertension
Shall	Barotrauma (Ear/Sinus Block)
Shall	Allergic Reaction (Mild to Moderate)
Shall	Anaphylaxis
Shall	Anxiety
Shall	Back Injury
Shall	Behavioral Emergency
Shall	Cellulitis
Shall	Choking/Obstructed Airway
Shall	Constipation (Space Adaptation)
Shall	Cough (URI/Bronchitis/Pneumonia)
Shall	Depression
Shall	Diarrhea
Shall	Eye Abrasion (Foreign Body)
Shall	Eye Corneal Ulcer
Shall	Eye Infection (bacterial/viral/fungal)
Shall	Finger Dislocation
Shall	Headache (CO2, SAS, other)
Shall	Herpes Zoster Reactivation (shingles)/ Herpes Simplex Reactivation (cold sore)
Shall	Indigestion
Shall	Insomnia (Early/Late)
Shall	Medication Overdose / Misuse
Shall	Nasal Congestion (Space Adaptation)
Shall	Nausea / Vomiting
Shall	Nosebleed (Space Adaptation)
Shall	Otitis Externa
Shall	Otitis Media
Shall	Pharyngitis
Shall	Prostatitis
Shall	Sinusitis
Shall	Skin Abrasion
Shall	Skin Laceration
Shall	Space Motion Sickness (Space Adaptation)
Shall	Urinary Retention (Space Adaptation)
Shall	Urinary Tract Infection
Shall	Vaginal Yeast Infection
Should	Chest Pain/Angina
Should	Sudden Cardiac Arrest
Should	De Novo Hypertension
Should	Hemorrhoids
Should	Urinary Incontinence (Space Adaptation)
Should	Upper Extremity Fracture
Should	Abdominal Injury
Should	Chest Injury/Pneumothorax
Not Addressed	Aphthous Ulcer
Not Addressed	Cardiogenic Shock
Not Addressed	Compartment Syndrome
Not Addressed	Elbow Dislocation
Not Addressed	Glaucoma - Acute
Not Addressed	Head Injury
Not Addressed	Hip/Lower Extremity Fracture
Not Addressed	Hypovolemic Shock
Not Addressed	Lumbar Spine Fracture
Not Addressed	Malignancy
Not Addressed	Neck Injury
Not Addressed	Neurogenic Shock
Not Addressed	Shoulder Dislocation