An Evidence Base for Human Spaceflight Risks in Wikipedia

Aerospace Medical Association
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I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation.
The goal of HRP is to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration.
1. Risk Factor of Inadequate Nutrition
2. Risk of Acute and Late Central Nervous System Effects from Radiation Exposure
3. Risk of Acute Radiation Syndromes Due to Solar Particle Events (SPEs)
4. Risk of Adverse Behavioral Conditions and Psychiatric Disorders
5. Risk of Adverse Health Effects Due to Alterations in Host-Microorganism Interactions
6. Risk of Adverse Health Effects of Exposure to Dust and Volatiles During Exploration of Celestial Bodies
7. Risk of an Incompatible Vehicle/Habitat Design
8. Risk of Bone Fracture
9. Risk of Cardiac Rhythm Problems
10. Risk of Clinically Relevant Unpredicted Effects of Medication
11. Risk of Compromised EVA Performance and Crew Health Due to Inadequate EVA Suit Systems
12. Risk of Crew Adverse Health Event Due to Altered Immune Response
13. Risk of Decompression Sickness
14. Risk of Degenerative Tissue Or Other Health Effects From Radiation Exposure
15. Risk Of Early Onset Osteoporosis Due To Spaceflight
16. Risk of Impaired Control of Spacecraft, Associated Systems and Immediate Vehicle Egress Due to Vestibular/Sensorimotor Alterations Associated with Space Flight
17. Risk of Impaired Performance Due to Reduced Muscle Mass, Strength and Endurance
18. Risk of Inadequate Critical Task Design
19. Risk of Inadequate Design of Human and Automation/Robotic Integration
20. Risk of Inadequate Human-Computer Interaction
21. Risk of Injury from Dynamic Loads
22. Risk of Intervertebral Disk Damage
23. Risk of Orthostatic Intolerance During Re-Exposure to Gravity
24. Risk of Performance Decrement and Crew Illness Due to an Inadequate Food System
25. Risk of Performance Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team
26. Risk of Performance Errors Due to Fatigue Resulting from Sleep Loss, Circadian Desynchronization, Extended Wakefulness, and Work Overload
27. Risk of Performance Errors Due to Training Deficiencies
28. Risk of Radiation Carcinogenesis
29. Risk of Reduced Physical Performance Capabilities Due to Reduced Aerobic Capacity
30. Risk of Renal Stone Formation
31. Risk of Spaceflight-Induced Intracranial Hypertension/Vision Alterations
32. Risk of Unacceptable Health and Mission Outcomes Due to Limitations of In-flight Medical Capabilities
First Generation Evidence Base

- 2008 Evidence Book
  - One volume
  - One chapter for each HRP risk
  - Review paper format
  - Aimed at scientifically-educated, non-specialist reader
  - Current state of knowledge from both research and operations.
  - Authors
    - Human Research Program
    - National Space Biomedical Research Institute

- Chapters linked to their risk on HRP website
  - humanresearchroadmap.nasa.gov/Evidence/
• The February 2008 versions of the Evidence-Based Risk Reports were reviewed by members of a committee on NASA’s Research on Human Health Risks, established by the Institute of Medicine.

• The resulting thorough *Review of NASA’s Human Research Program Evidence Books: A Letter Report (2008)* provided outstanding guidance for both the revision of the current risk reports and for the development of future versions.
  
  • humanresearchroadmap.nasa.gov/reviews/IOM%20Review.pdf

• This review also offered excellent suggestions to improve public access to the information in these reports.
Limited authorship
- NASA and NSBRI
- Missing ISS international partners
- Missing researchers studying related terrestrial issues

Laborious update process
- Resulting in “all or none” updates

Infrequent updates
The Second Generation Evidence Base- Wikipedia

• The Gene Wiki precedent
  - Enable the creation of a collaboratively written, continuously updated, high quality review article for all (~25,000) human genes.
  - Wikipedia
    • “Stub” articles for each gene in standardized format
    • Users add and refine content
    • en.wikipedia.org/wiki/Gene_Wiki

• The HRP implementation
  - Portal page in Wikipedia
  - Main article for each Risk
    • Subarticles as needed
    • Links to related Wikipedia content
    • Summary of HRP-approved Evidence Report

A review article for every gene is powerful

References to the literature

The Gene Wiki project – 2010 stats

Value of service
10,300 articles
1.2 million words
67MB text
• (about 1,000 journal articles)

Number of contributors
3,500 editors
17,000 edits

Number of users
55 million page views

15 May 2013
Portal:Human Health and Performance in Space

Welcome

The Human Health and Performance in Space Portal is an informal collection of articles, sites and pages discussing the effects of space flight, travel and habitation on astronauts and other space flight participants. The topics presented within these articles are based upon the evidence work provided by the National Aeronautics and Space Administration's Human Research Program which is essentially a brief review article written for a scientifically literate, non-specialist reader.

Contributions and participation by medical professionals, scientists, researchers, students and the public at large are greatly encouraged.

Topics

- Fatigue and Sleep Loss During Spaceflight
- Treating an Ill or Injured Crew Member in Space
- Spaceflight Radiation Carcinogenesis
- Visual Impairment and Intracranial Pressure
- Risk of Portal Venous Formation
- Trauma, Composition and Debris in Spaceflight Missions
- Interstitial Disc Damage and Spaceflight
- Inadequate Food Systems on Space Exploration Missions

How you can help

- Use this link to make changes to this section: edit
- Contribute to Fatigue and sleep loss during spaceflight article
- Contribute to Treating an Ill or Injured Crew Member in Space article
- Contribute to Visual Impairment and Intracranial Pressure article
- Contribute to Spaceflight radiation carcinogenesis article


15 May 2013
Visual impairment due to intracranial pressure

From Wikipedia, the free encyclopedia

Spaceflight induced visual impairment is hypothesized to be a result of increased intracranial pressure. The study of visual changes and intracranial pressure (ICP) in astronauts on long-duration flights is a relatively recent topic of interest to Space Medicine professionals. Although reported signs and symptoms have not appeared to be severe enough to cause blindness in the near term, long term reoccurrence of chronically elevated intracranial pressure is unknown.14 NASA has reported that fifteen long-duration male astronauts (45–55 years of age) have experienced confirmed visual and anatomical changes during or after long-duration flights.13 A wide range of symptoms such as, dizziness, headache, fatigue, unusual visual sensations, changes in visual acuity, floaters, double vision, and other visual disturbances have been documented in these astronauts. Some individuals experienced transient changes post-flight while others reported persistent changes with varying degrees of severity.13

Although the exact cause is not known at this time, it is suggested that microgravity-induced capillary fluid shift and comparable physiological changes play a significant role in these changes.13 Other contributing factors may include percent of increased CO2 and an increase in protein intake. It seems unlikely that restorative or aerobic exercise are contributing factors, but they may be potential countermeasures to reduce intravascular pressure (ICP) or intracranial pressure (ICP) in-flight.17

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1 Causes and current theories
  1.1 O₂₂
  1.2 Sodium intake
  1.3 Barotrauma
  1.4 Hemorrhage
  1.5 Chronic Carbon Dioxide (Hypercarbia)
  1.6 Space Neurological Symptoms
  1.7 Overview of ICP and IOP Monitoring
  2 ICP Measurement
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    2.2 ICP Monitoring
  3 Existing long duration flight oculars
  4 Brief definition of clinical practice guidelines
    4.1 Glaucoma
    4.2 Hypertension
  5 Medical history and in-flight medications
  6 Roles of vision and other long-term actions
  7 Other related topics
  8 External links
  9 References
Strengths of the Wikipedia approach

- Extremely accessible
  - Reading
  - Contributing
- Many “hits”
Weaknesses of the Wikipedia approach

• Wikipedia rules for content
  - Cannot copy Evidence Reports
  - Must summarize Evidence Reports
    • The result article is a summary of a review

• Few contributions
  - Net loss of content
  - Workload to maintain thriving articles is unknown

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The Third Generation Evidence Base

• Wiki based
• Editorially controlled
  - Editorial Board for each Evidence Report
• Initial content = HRP-approved Evidence Reports
  - Verbatim
• Contributions
  - Default: pre-screened by editorial board
  - Pre-approved contributors: screen post facto by editorial board
• Coming Fall 2013

humanresearchroadmap.nasa.gov/Evidence
• NASA’s Human Research Program seeks to understand and mitigate risks to crew health and performance in exploration missions
• HRP’s evidence base consists of an Evidence Report for each HRP risk
• Three generations of Evidence Reports
  1) Review articles
     + Good content
     - Limited authorship, infrequent updates
  2) Wikipedia articles
     + Viewed often, very open to contributions
     - Summary of reviews, very few contributions
  3) HRP-controlled wiki articles
     + Incremental additions to review articles with editorial control
     - ?

humanresearchroadmap.nasa.gov/Evidence