**INTRODUCTION**

The goal of space medicine is to optimize both crew health and performance.
- Currently, expert opinion is primarily relied upon for decision-making regarding medical equipment and supplies flown in space.
- Evidence-based decisions are preferred due to mass and volume limitations and the expense of space flight.
- The Integrated Medical Model (IMM) is an attempt to move us in that direction!

**What is IMM?**

- Software based tool used to forecast risk of medical conditions in space flight.
- Utilizes evidence-based information as inputs to establish a defensible position for making decisions to optimize crew health and mission success.
- Multiple conditions are modeled at once.
- Best used when comparing the risk of two or more mission profiles, not as a tool for predicting absolute risk.
- If a “mission” is simulated 50-100,000 times with a given set of medical capabilities (risk mitigations), an estimation of the most probable outcomes can be generated.

<table>
<thead>
<tr>
<th>ClIFF for Fingernail Injuries</th>
<th>Mission information</th>
<th>Incidence (events/EVA)</th>
<th>Incidence (events/person-year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apollo (5), STS (3), ISS</td>
<td></td>
<td>0.046</td>
<td>0.395</td>
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</table>

10 cases occurred during 216 EVAs by US astronauts.
10 cases occurred during 27.85 person-years of space flight.

**Cases of Reported Nail Trauma While in Space**

**Space Transportation System (STS):**

1. Some tender nails post-EVA.
2. Subungual bruising/bleeding.
3. Nail tip trauma.
4. Sore cuticles, subungual bruising.
5. Fingertips bruised/dry, a lot of manual handling.

**International Space Station (ISS):**

1. Mild-moderate crush injury to R index finger while on orbit. A small amount of subungual contusion remains and a new nail is growing in. Nail will slough in short order. (Extracted from postflight PEX)

**Contribution**

- Many potential injuries are now prevented with the use of available countermeasures and improved fitting of the suits.
- However, improvements can still be made in glove design to reduce fingertip loading and to improve gas flow around fingertips.
- An average of six months is needed for the injured nail to fully re-grow, therefore, prevention is key:
  - Hand strengthening & ergonomics training
  - Optimize arm length, elbow convolute, glove fit
  - Improved moisture wicking comfort gloves
  - Keep fingernails clipped as short as possible
  - Utilize available countermeasures:
    - Sally Hansens nail hardener,
    - Dermabond, Tegaderm, Moleskin, Band-aids, tape, etc.