PHM Applications in Emergency and Aerospace Medicine

Daniel M Buckland MD PhD
Assistant Professor, Duke University
Division of Emergency Medicine
Department of Mechanical Engineering and Materials Science

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How can PHM concepts and methods be applied to the human system?

**Aerospace Medicine**
- Identified Risks
- PHM value add
- Larger Context
  - Medical Data Architecture
  - Medical Systems Engineering
  - Vehicle and Mission Integration
- Limitations and Challenges
  - Data
  - Program Expectation and System Integration
  - Lack of Evidence Base

**Emergency Medicine**
- Current landscape
- PHM value add
- Larger Context
  - Medical Data Formats
  - System Engineering
  - System Integration
- Limitations and Challenges
  - Data
  - Healthcare System Expectation and Integration
  - Lack of Evidence Base
PHM Applications in Aerospace Medicine
<table>
<thead>
<tr>
<th>Major Organ Systems Affected by Spaceflight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone</td>
</tr>
<tr>
<td>Muscle</td>
</tr>
<tr>
<td>Vision</td>
</tr>
<tr>
<td>Heart and Blood Vessels</td>
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<tr>
<td>Immune</td>
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<tr>
<td>Brain</td>
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</tbody>
</table>
Crew Health and Performance System

• Environmental Hazard Protection
  • Radiation
  • Noise
  • Vibration
  • Gases

• Keep Healthy Crew Well
  • Exercise
  • Food
  • Behavioral Health

• Acute Care

• Longitudinal Health Maintenance
  • Data System
    • Data Capture
    • Training
  • Device Lifecycle
  • Consumable Supplies
    • Medications
  • Crew Activities
    • Procedures
    • Training
    • User interfaces
Making the medical risk outputs integrate with existing engineering models of risk so the models can interact with each other.
Changing Paradigms

- Preventative -> Reactive -> Predictive
- Improving the ability to predict rather than react can mean the difference between mission success and mission failure
Limitations and Challenges

- Medical Data formats
- Expectations when dealing with Engineer/MD teams
- What data are the models based off of?
PHM Applications in Emergency Medicine
# Current Uses of Modeling

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Flow</th>
</tr>
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<tbody>
<tr>
<td>• Sepsis</td>
<td>• Rules of Thumb</td>
</tr>
<tr>
<td>• Simple decision rules</td>
<td>• Quality Improvement</td>
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</tbody>
</table>
PHM Applications in Emergency Medicine

• Current context
  • Diagnostic accuracy is not a useful metric
  • Data sources are not ideal
  • Databases are not standardized
  • Data formats/timepoints are irregular
  • Data points are not replicated
  • MDCalc.com
Changing Paradigms

• Preventative -> Reactive -> Predictive
• Improving the ability to predict rather than react can mean the difference between living and dying
• Outcomes: acuity of illness, amount of resources needed
  • Diagnosis if I can get it, but less important than the rest
Changing Paradigms

• Preventative -> Reactive -> Predictive
• Improving the ability to predict rather than react can mean the difference between living or dying, high or low cost, and minor or invasive interventions.
• Outcomes: acuity of illness, amount of resources needed
  • Diagnosis if I can get it, but less important than the rest
Limitations and Challenges

• Medical Data formats
• Expectations when dealing with patients and multiple specialties?
• What data are the models based off of?
Questions and a Plea

dan.buckland@duke.edu

Bring me your mature models