

Directed Acyclic Graph – DAG (Narrative)

- ❖ The **Micro host Risk** centers around the possibility for microbial contamination leading to **Infections** that if left inadequately treated could become **Sepsis**. Both **Infections** and **Sepsis** can lead to deterioration of **Individual Readiness** and **Crew Capability** which affects **Task Performance**, likelihood of **Evacuation** for medical reasons, and in severe cases can contribute to **Loss of Crew Life**. They can also lead to **Long Term Health Outcomes** if inadequately treated and post-mission/career **Surveillance** enables **Detection of Long-Term Health Outcomes** to understand the magnitude of the problem.
- ❖ The cause of infections can come from various sources:
 - **Microbial Virulence Factors** – evidence that the virulence of certain microbes changes in response to spaceflight environment.
 - This may lead to an increased risk of infections
 - Can indirectly lead to infections through changes in the **Microbiome**
 - **Immune (Risk)** - the strength of the immune system determines how well individuals fight off infections
 - **Human Waste Contamination** - human waste-associated microbes (such as could be found in waste from urine, menses, emesis, etc.) increases risk for infection among crew
 - **Surface Contamination** - microbes on surfaces are found regularly on ISS, cleaning procedures can decrease impact on crew
 - **Air Contamination** – good air quality and filtration can limit likelihood of airborne and droplet-based infections among crew
 - **Water Contamination** - water quality monitoring and cleaning helps limit infections in crew.
 - **Pharmaceutical Contamination** - repackaged pharmaceuticals are susceptible to contamination increasing risk for infection among crew
 - **Food Contamination** – inadequate packaging and storage conditions for crew food could lead to infections including gastroenteritis
- ❖ Countermeasures that affect microbial levels must be included in the **Crew Health and Performance System** and accommodated in **Vehicle Design**. These are affected by the **EIHSO (Risk)** and include: Countermeasures include adequate the **Storage Conditions** which if compromised could increase contamination of food and pharmaceuticals; the storage conditions are also impacted by the food system available which is represented in the DAG by the **Food and Nutrition Risk**
 - **Preventive Source control** includes monitoring, regular cleaning, filtration, and other modes of limiting spread of microbes
 - **Hygiene** includes personal hygiene such as regular showers, dental hygiene, and other personal cleaning that limits the development of **Infection**.
 - **Environmental Monitoring Capability** is necessary to **Detect Contamination** levels in the air, water, and surfaces. This enables **Intervention Source Control** measures like cleaning or maintenance of filtration systems.
 - **Medical Treatment Capability** includes antibiotics, antifungal, and antiviral medications, as well as other supportive care, intended to minimize consequence of infection and prevent the development of sepsis. **Pharmaceutical Contamination (or Degradation)** - from repackaged pharmaceuticals are susceptible to contamination, or to degradation due to added environmental conditions, such as radiation, which could lead to interference with medical treatment capability leading to increase in infection.
- ❖ **Infections** and **Sepsis** affect cognitive function, mood and performance and therefore affect **Behavioral Health (Risk)** and **Team (Risk)** which negatively impacts **crew capability**

