

Ranking of Medical Conditions by Probability

Background

This Data Request Report was prepared using information solely from iMED v5.0 on October 23, 2014. The iMED contains data from multiple references including terrestrial, analog, and in-flight sources, as well as incidence value estimates from event-driven numerical simulations when space and terrestrial data are insufficient. While a complete description of assumptions and limitations associated with the data contained in the iMED is documented (2) and available on request, the list below highlights assumptions and limitations pertinent to this report:

- Terrestrial and analog data are an approximation of the data expected from the medically flight-qualified astronaut corps.
- In-flight data are only from United States (US) National Aeronautics and Space Administration (NASA) crew members from Apollo, Skylab, Mir, Space Transportation System (STS, *i.e.* Shuttle), and International Space Station (ISS) Expedition (Exp) missions.
- In-flight data are known to represent a sampling of information from published and/or available sources (*i.e.* they are incomplete); Shuttle data are primarily from STS-1 through STS-114; ISS data are primarily from Exp 1-13.
- If a space adaptation condition occurs during a mission for a given astronaut, it occurs only once.
- iMED medical data and resources are baselined to the ISS environment, which includes low earth orbit, no gravity transitions, and vehicle ambient atmosphere equal to approximately 14.7 psi terrestrial ambient atmosphere. (*During exploration missions, this has potential impact to the incidence values for the following medical conditions: including Acute Radiation Syndrome, Altitude Sickness, Barotrauma, Decompression Sickness Secondary to Extravehicular Activity (EVA), bone fracture conditions, as well as potentially space adaptation conditions.*)
- Incidence rates of Burns Secondary to Fire, Smoke Inhalation, and Toxic Exposure: Ammonia are derived from the ISS Fire Model (*i.e.* an event-driven numerical simulation) versus actual in-flight events. (*This is an import consideration for putting these data in context.*)

Methods

Twelve design reference missions (DRMs) were used in the calculation of medical condition probabilities. DRM parameters are described in Table 1 below.

Table 1: DRM Parameters

DRM	Crew	Duration	EVAs
Low Earth Orbit	1 male	6 months	1
Low Earth Orbit	1 female	6 months	1
Low Earth Orbit	1 male	12 months	2
Low Earth Orbit	1 female	12 months	2
Deep Space Sortie	1 male	1 month	5
Deep Space Sortie	1 female	1 month	5
Lunar Visit/Habitation	1 male	12 months	50
Lunar Visit/Habitation	1 female	12 months	50
Deep Space Journey/Habitation	1 male	12 months	5
Deep Space Journey/Habitation	1 female	12 months	5

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DRM	Crew	Duration	EVAs
Planetary	1 male	36 months	50
Planetary	1 female	36 months	50

All crew members were assigned coronary artery calcium (CAC) scores of zero. None of the crew members had crowns, wore contacts, or had a history of abdominal surgery. For each of the DRMs above, the probability of at least one event occurring was calculated for each of the applicable ninety-eight of the one hundred listed medical conditions (Appendix A) using condition-specific incidence data from iMED and mission-specific parameters. The non-applicable medical conditions were Small Bowel Obstruction and Dental: Crown Loss.

Results

Table 2 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a six month Low Earth Orbit mission with 1 EVA. The left two columns show the probability rankings with a single male crew member DRM; the right two columns show the probability rankings with a single female crew member DRM. If a medical condition has occurred in-flight, the medical condition name is bolded in small capital letters. Zero probability is indicative of a sex-specific medical condition. Space adaptation (SA) medical conditions are indicated, as are conditions that have onset not associated with space adaptation (late).

Table 2: Six month Low Earth Orbit with 1 EVA

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
LATE INSOMNIA	9.12E-01	LATE INSOMNIA	9.12E-01
SKIN ABRASION	8.21E-01	SKIN ABRASION	8.21E-01
SKIN RASH	8.21E-01	SKIN RASH	8.21E-01
SPACE MOTION SICKNESS (SA)	7.30E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
EYE ABRASION (FOREIGN BODY)	7.22E-01	EYE ABRASION (FOREIGN BODY)	7.22E-01
HEADACHE (LATE)	5.92E-01	HEADACHE (LATE)	5.92E-01
NASAL CONGESTION (SA)	5.86E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	BACK PAIN (SA)	5.25E-01
DIARRHEA	4.53E-01	URINARY TRACT INFECTION	4.90E-01
RESPIRATORY INFECTION	4.53E-01	DIARRHEA	4.53E-01
INSOMNIA (SA)	4.50E-01	RESPIRATORY INFECTION	4.53E-01
BACK INJURY	4.43E-01	INSOMNIA (SA)	4.50E-01
BAROTRAUMA (EAR/SINUS BLOCK)	4.33E-01	BACK INJURY	4.43E-01
HEADACHE (SA)	3.51E-01	BAROTRAUMA (EAR/SINUS BLOCK)	4.33E-01
VIIP (SA)	3.41E-01	HEADACHE (SA)	3.51E-01
SHOULDER SPRAIN/STRAIN	3.40E-01	VIIP (SA)	3.41E-01
HEADACHE (CO ₂ INDUCED)	3.06E-01	SHOULDER SPRAIN/STRAIN	3.40E-01
SKIN INFECTION	2.11E-01	HEADACHE (CO ₂ INDUCED)	3.06E-01
ELBOW SPRAIN/STRAIN	2.03E-01	SKIN INFECTION	2.11E-01
ANKLE SPRAIN/STRAIN	1.88E-01	ELBOW SPRAIN/STRAIN	2.03E-01

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
ALLERGIC REACTION (MILD TO MODERATE)	1.82E-01	ANKLE SPRAIN/STRAIN	1.88E-01
PHARYNGITIS	1.82E-01	ALLERGIC REACTION (MILD TO MODERATE)	1.82E-01
CONSTIPATION (SA)	1.70E-01	PHARYNGITIS	1.82E-01
NECK INJURY	1.56E-01	CONSTIPATION (SA)	1.70E-01
MOUTH ULCER	1.52E-01	NECK INJURY	1.56E-01
Dental Caries	1.39E-01	MOUTH ULCER	1.52E-01
KNEE SPRAIN/STRAIN	1.24E-01	Dental Caries	1.39E-01
PARESTHESIAS	1.05E-01	KNEE SPRAIN/STRAIN	1.24E-01
ACUTE SINUSITIS	1.04E-01	PARESTHESIAS	1.05E-01
EYE CHEMICAL BURN	1.04E-01	ACUTE SINUSITIS	1.04E-01
INDIGESTION	1.04E-01	EYE CHEMICAL BURN	1.04E-01
HEARING LOSS	9.37E-02	INDIGESTION	1.04E-01
WRIST SPRAIN/STRAIN	9.02E-02	HEARING LOSS	9.37E-02
EYE INFECTION	8.73E-02	WRIST SPRAIN/STRAIN	9.02E-02
URINARY TRACT INFECTION	8.11E-02	EYE INFECTION	8.73E-02
HIP SPRAIN/STRAIN	7.28E-02	URINARY TRACT INFECTION	8.11E-02
GASTROENTERITIS	7.05E-02	HIP SPRAIN/STRAIN	7.28E-02
FINGERNAIL DELAMINATION	6.48E-02	GASTROENTERITIS	7.05E-02
CHOKING/OBSTRUCTED AIRWAY	5.33E-02	FINGERNAIL DELAMINATION	6.48E-02
OTITIS EXTERNA	5.33E-02	URINARY INCONTINENCE (SA)	5.56E-02
OTITIS MEDIA	5.33E-02	URINARY RETENTION (SA)	5.56E-02
HEMORRHOIDS	3.59E-02	CHOKING/OBSTRUCTED AIRWAY	5.33E-02
MEDICATION OVERDOSE/ADVERSE REACTION	3.59E-02	OTITIS EXTERNA	5.33E-02
Lower Extremity Stress Fracture	2.08E-02	OTITIS MEDIA	5.33E-02
FINGER DISLOCATION	1.81E-02	HEMORRHOIDS	3.59E-02
HERPES ZOSTER REACTIVATION (SHINGLES)	1.81E-02	MEDICATION OVERDOSE/ADVERSE REACTION	3.59E-02
INFLUENZA	1.81E-02	Lower Extremity Stress Fracture	3.29E-02
SKIN LACERATION	1.81E-02	Vaginal Yeast Infection	3.17E-02
Decompression Sickness Secondary to EVA	1.16E-02	Abnormal Uterine Bleeding	2.57E-02
Dental: Abscess	1.14E-02	FINGER DISLOCATION	1.81E-02
SMOKE INHALATION	1.12E-02	HERPES ZOSTER REACTIVATION (SHINGLES)	1.81E-02
Dental : Exposed Pulp	1.00E-02	INFLUENZA	1.81E-02
NOSE BLEED (SA)	9.04E-03	SKIN LACERATION	1.81E-02
URINARY RETENTION (SA)	6.97E-03	Decompression Sickness Secondary to EVA	1.16E-02
		Dental: Abscess	1.14E-02

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Burns Secondary to Fire	5.26E-03	SMOKE INHALATION	1.12E-02
Hypertension	3.22E-03	Dental : Exposed Pulp	1.00E-02
Dental: Filling Loss	2.55E-03	NOSE BLEED (SA)	9.04E-03
Acute Prostatitis	2.45E-03	Burns Secondary to Fire	5.26E-03
Nephrolithiasis	1.82E-03	Anxiety	3.54E-03
Dental: Avulsion (tooth loss)	1.46E-03	Hypertension	3.22E-03
Depression	1.45E-03	Dental: Filling Loss	2.55E-03
Acute Radiation Syndrome	1.41E-03	Acute Arthritis	1.88E-03
Sepsis	1.20E-03	Nephrolithiasis	1.82E-03
Wrist Fracture	1.18E-03	Depression	1.80E-03
Anxiety	9.50E-04	Dental: Avulsion (tooth loss)	1.46E-03
Acute Arthritis	7.65E-04	Acute Radiation Syndrome	1.41E-03
Acute Diverticulitis	7.10E-04	Sepsis	1.20E-03
Stroke (Cerebrovascular Accident)	4.90E-04	Wrist Fracture	1.18E-03
Appendicitis	4.67E-04	Acute Diverticulitis	7.10E-04
Acute Cholecystitis/Biliary Colic	3.84E-04	Acute Cholecystitis/Biliary Colic	6.35E-04
Atrial Fibrillation/Atrial Flutter	3.55E-04	Appendicitis	4.67E-04
Traumatic Hypovolemic Shock	3.20E-04	Stroke (Cerebrovascular Accident)	3.40E-04
Angina/Myocardial Infarction	3.15E-04	Traumatic Hypovolemic Shock	3.20E-04
Anaphylaxis	2.45E-04	Anaphylaxis	2.45E-04
Abdominal Wall Hernia	2.25E-04	Angina/Myocardial Infarction	2.35E-04
Head Injury	2.11E-04	Abdominal Wall Hernia	2.25E-04
Hip/Proximal Femur Fracture	2.09E-04	Head Injury	2.11E-04
Acute Pancreatitis	1.54E-04	Acute Pancreatitis	1.54E-04
Seizures	1.35E-04	Seizures	1.35E-04
Chest Injury	1.28E-04	Chest Injury	1.28E-04
Lumbar Spine Fracture	1.00E-04	Atrial Fibrillation/Atrial Flutter	1.17E-04
Abdominal Injury	8.22E-05	Lumbar Spine Fracture	8.64E-05
Eye Corneal Ulcer	7.00E-05	Abdominal Injury	8.22E-05
Retinal Detachment	5.95E-05	Eye Corneal Ulcer	7.00E-05
Acute Compartment Syndrome	3.65E-05	Hip/Proximal Femur Fracture	5.61E-05
Altitude Sickness	2.71E-05	Retinal Detachment	3.27E-05
Elbow Dislocation	2.60E-05	Acute Glaucoma	2.84E-05
Shoulder Dislocation	1.86E-05	Altitude Sickness	2.71E-05
Acute Glaucoma	1.35E-05	Elbow Dislocation	2.60E-05
Sudden Cardiac Arrest	7.50E-06	Shoulder Dislocation	1.86E-05
Behavioral Emergency	7.15E-06	Sudden Cardiac Arrest	7.50E-06
Eye Penetration (foreign body)	4.67E-06	Behavioral Emergency	7.15E-06
Cardiogenic Shock Secondary to Myocardial Infarction	3.74E-06	Eye Penetration (foreign body)	4.67E-06

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Neurogenic Shock	2.49E-06	Acute Compartment Syndrome	3.50E-06
Toxic Exposure: Ammonia	7.25E-07	Cardiogenic Shock Secondary to Myocardial Infarction	2.64E-06
Abnormal Uterine Bleeding	0	Neurogenic Shock	2.49E-06
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	7.25E-07
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

The probabilities associated with the top ten medical conditions listed for a male versus a female crew member during a six month low earth orbit DRM are identical until the number nine ranking for the female, urinary tract infection (Table 2). All have occurred previously in-flight, and three of these top ten medical conditions are SA-related conditions (Table 2).

Table 3 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a twelve month Low Earth Orbit mission with 2 EVAs. The content of Table 3 is similarly displayed as the content of Table 2 (please see the Table 2 description above for further details).

Table 3: Twelve month Low Earth Orbit with 2 EVAs

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
LATE INSOMNIA	9.92E-01	LATE INSOMNIA	9.92E-01
SKIN ABRASION	9.68E-01	SKIN ABRASION	9.68E-01
SKIN RASH	9.68E-01	SKIN RASH	9.68E-01
EYE ABRASION (FOREIGN BODY)	9.23E-01	EYE ABRASION (FOREIGN BODY)	9.23E-01
HEADACHE (LATE)	8.33E-01	HEADACHE (LATE)	8.33E-01
SPACE MOTION SICKNESS (SA)	7.30E-01	URINARY TRACT INFECTION	7.40E-01
DIARRHEA	7.01E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
RESPIRATORY INFECTION	7.01E-01	DIARRHEA	7.01E-01
BACK INJURY	6.90E-01	RESPIRATORY INFECTION	7.01E-01
BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01	BACK INJURY	6.90E-01
NASAL CONGESTION (SA)	5.86E-01	BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01
SHOULDER SPRAIN/STRAIN	5.65E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	SHOULDER SPRAIN/STRAIN	5.65E-01
HEADACHE (CO ₂ INDUCED)	5.19E-01	BACK PAIN (SA)	5.25E-01
INSOMNIA (SA)	4.50E-01	HEADACHE (CO ₂ INDUCED)	5.19E-01
SKIN INFECTION	3.78E-01	INSOMNIA (SA)	4.50E-01
ELBOW SPRAIN/STRAIN	3.65E-01	SKIN INFECTION	3.78E-01
HEADACHE (SA)	3.51E-01	ELBOW SPRAIN/STRAIN	3.65E-01
VIIP (SA)	3.41E-01	HEADACHE (SA)	3.51E-01
ANKLE SPRAIN/STRAIN	3.40E-01	VIIP (SA)	3.41E-01

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01	ANKLE SPRAIN/STRAIN	3.40E-01
PHARYNGITIS	3.31E-01	ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01
NECK INJURY	2.88E-01	PHARYNGITIS	3.31E-01
MOUTH ULCER	2.80E-01	NECK INJURY	2.88E-01
Dental Caries	2.59E-01	MOUTH ULCER	2.80E-01
KNEE SPRAIN/STRAIN	2.33E-01	Dental Caries	2.59E-01
PARESTHESIAS	1.99E-01	KNEE SPRAIN/STRAIN	2.33E-01
ACUTE SINUSITIS	1.97E-01	PARESTHESIAS	1.99E-01
EYE CHEMICAL BURN	1.97E-01	ACUTE SINUSITIS	1.97E-01
INDIGESTION	1.97E-01	EYE CHEMICAL BURN	1.97E-01
HEARING LOSS	1.79E-01	INDIGESTION	1.97E-01
WRIST SPRAIN/STRAIN	1.72E-01	HEARING LOSS	1.79E-01
CONSTIPATION (SA)	1.70E-01	WRIST SPRAIN/STRAIN	1.72E-01
EYE INFECTION	1.67E-01	CONSTIPATION (SA)	1.70E-01
URINARY TRACT INFECTION	1.56E-01	EYE INFECTION	1.67E-01
HIP SPRAIN/STRAIN	1.40E-01	HIP SPRAIN/STRAIN	1.40E-01
GASTROENTERITIS	1.36E-01	GASTROENTERITIS	1.36E-01
FINGERNAIL DELAMINATION	1.25E-01	FINGERNAIL DELAMINATION	1.25E-01
CHOKING/OBSTRUCTED AIRWAY	1.04E-01	CHOKING/OBSTRUCTED AIRWAY	1.04E-01
OTITIS EXTERNA	1.04E-01	OTITIS EXTERNA	1.04E-01
OTITIS MEDIA	1.04E-01	OTITIS MEDIA	1.04E-01
HEMORRHOIDS	7.05E-02	HEMORRHOIDS	7.05E-02
MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02	MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02
Lower Extremity Stress Fracture	4.11E-02	Lower Extremity Stress Fracture	6.48E-02
FINGER DISLOCATION	3.59E-02	Vaginal Yeast Infection	6.25E-02
HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02	URINARY INCONTINENCE (SA)	5.56E-02
INFLUENZA	3.59E-02	URINARY RETENTION (SA)	5.56E-02
SKIN LACERATION	3.59E-02	Abnormal Uterine Bleeding	5.07E-02
Decompression Sickness Secondary to EVA	2.30E-02	FINGER DISLOCATION	3.59E-02
Dental: Abscess	2.27E-02	HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02
SMOKE INHALATION	2.22E-02	INFLUENZA	3.59E-02
Dental : Exposed Pulp	1.99E-02	SKIN LACERATION	3.59E-02
Burns Secondary to Fire	1.05E-02	Decompression Sickness Secondary to EVA	2.30E-02
NOSE BLEED (SA)	9.04E-03	Dental: Abscess	2.27E-02

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Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
URINARY RETENTION (SA)	6.97E-03	SMOKE INHALATION	2.22E-02
Hypertension	6.44E-03	Dental : Exposed Pulp	1.99E-02
Dental: Filling Loss	5.10E-03	Burns Secondary to Fire	1.05E-02
Acute Prostatitis	4.89E-03	NOSE BLEED (SA)	9.04E-03
Nephrolithiasis	3.64E-03	Anxiety	7.07E-03
Dental: Avulsion (tooth loss)	2.92E-03	Hypertension	6.44E-03
Depression	2.90E-03	Dental: Filling Loss	5.10E-03
Acute Radiation Syndrome	2.83E-03	Acute Arthritis	3.75E-03
Sepsis	2.40E-03	Nephrolithiasis	3.64E-03
Wrist Fracture	2.36E-03	Depression	3.59E-03
Anxiety	1.90E-03	Dental: Avulsion (tooth loss)	2.92E-03
Acute Arthritis	1.53E-03	Acute Radiation Syndrome	2.83E-03
Acute Diverticulitis	1.42E-03	Sepsis	2.40E-03
Stroke (Cerebrovascular Accident)	9.80E-04	Wrist Fracture	2.36E-03
Appendicitis	9.35E-04	Acute Diverticulitis	1.42E-03
Acute Cholecystitis/Biliary Colic	7.69E-04	Acute Cholecystitis/Biliary Colic	1.27E-03
Atrial Fibrillation/Atrial Flutter	7.10E-04	Appendicitis	9.35E-04
Traumatic Hypovolemic Shock	6.41E-04	Stroke (Cerebrovascular Accident)	6.80E-04
Angina/Myocardial Infarction	6.30E-04	Traumatic Hypovolemic Shock	6.41E-04
Anaphylaxis	4.91E-04	Anaphylaxis	4.91E-04
Abdominal Wall Hernia	4.50E-04	Angina/Myocardial Infarction	4.70E-04
Head Injury	4.22E-04	Abdominal Wall Hernia	4.50E-04
Hip/Proximal Femur Fracture	4.18E-04	Head Injury	4.22E-04
Acute Pancreatitis	3.07E-04	Acute Pancreatitis	3.07E-04
Seizures	2.70E-04	Seizures	2.70E-04
Chest Injury	2.56E-04	Chest Injury	2.56E-04
Lumbar Spine Fracture	2.01E-04	Atrial Fibrillation/Atrial Flutter	2.34E-04
Abdominal Injury	1.64E-04	Lumbar Spine Fracture	1.73E-04
Eye Corneal Ulcer	1.40E-04	Abdominal Injury	1.64E-04
Retinal Detachment	1.19E-04	Eye Corneal Ulcer	1.40E-04
Acute Compartment Syndrome	7.30E-05	Hip/Proximal Femur Fracture	1.12E-04
Altitude Sickness	5.43E-05	Retinal Detachment	6.55E-05
Elbow Dislocation	5.21E-05	Acute Glaucoma	5.68E-05
Shoulder Dislocation	3.72E-05	Altitude Sickness	5.43E-05
Acute Glaucoma	2.70E-05	Elbow Dislocation	5.21E-05
Sudden Cardiac Arrest	1.50E-05	Shoulder Dislocation	3.72E-05
Behavioral Emergency	1.43E-05	Sudden Cardiac Arrest	1.50E-05
Eye Penetration (foreign body)	9.33E-06	Behavioral Emergency	1.43E-05
Cardiogenic Shock Secondary to Myocardial Infarction	7.49E-06	Eye Penetration (foreign body)	9.33E-06

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Neurogenic Shock	4.98E-06	Acute Compartment Syndrome	7.00E-06
Toxic Exposure: Ammonia	1.45E-06	Cardiogenic Shock Secondary to Myocardial Infarction	5.29E-06
Abnormal Uterine Bleeding	0	Neurogenic Shock	4.98E-06
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	1.45E-06
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

Even with an additional six months in-flight, the top three conditions listed in Table 3 are the same as those in Table 2. Similarly, the probabilities for the top ten conditions listed for a male versus a female crew member during a twelve month low earth orbit DRM are identical until the number six ranking for the female, urinary tract infection (Table 3). There is only one SA condition in the top ten ranking (Table 3) and all have occurred before during spaceflight.

Table 4 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a one month Deep Space Sortie mission with 5 EVAs. The content of Table 4 is shown in the manner described for the content of Table 2 (please see the Table 2 description above for further details).

Table 4: One month Deep Space Sortie with 5 EVAs

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
SPACE MOTION SICKNESS (SA)	7.30E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
NASAL CONGESTION (SA)	5.86E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	BACK PAIN (SA)	5.25E-01
INSOMNIA (SA)	4.50E-01	INSOMNIA (SA)	4.50E-01
PARESTHESIAS	4.27E-01	PARESTHESIAS	4.27E-01
HEADACHE (SA)	3.51E-01	HEADACHE (SA)	3.51E-01
VIIP (SA)	3.41E-01	VIIP (SA)	3.41E-01
LATE INSOMNIA	3.33E-01	LATE INSOMNIA	3.33E-01
FINGERNAIL DELAMINATION	2.85E-01	FINGERNAIL DELAMINATION	2.85E-01
SKIN ABRASION	2.49E-01	SKIN ABRASION	2.49E-01
SKIN RASH	2.49E-01	SKIN RASH	2.49E-01
EYE ABRASION (FOREIGN BODY)	1.92E-01	EYE ABRASION (FOREIGN BODY)	1.92E-01
CONSTIPATION (SA)	1.70E-01	CONSTIPATION (SA)	1.70E-01
HEADACHE (LATE)	1.39E-01	HEADACHE (LATE)	1.39E-01
DIARRHEA	9.56E-02	URINARY TRACT INFECTION	1.06E-01
RESPIRATORY INFECTION	9.56E-02	DIARRHEA	9.56E-02
BACK INJURY	9.31E-02	RESPIRATORY INFECTION	9.56E-02
BAROTRAUMA (EAR/SINUS BLOCK)	9.01E-02	BACK INJURY	9.31E-02
SHOULDER SPRAIN/STRAIN	6.70E-02	BAROTRAUMA (EAR/SINUS BLOCK)	9.01E-02
HEADACHE (CO ₂ INDUCED)	5.91E-02	SHOULDER SPRAIN/STRAIN	6.70E-02

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Decompression Sickness Secondary to EVA	5.65E-02	HEADACHE (CO₂ INDUCED)	5.91E-02
SKIN INFECTION	3.88E-02	Decompression Sickness Secondary to EVA	5.65E-02
ELBOW SPRAIN/STRAIN	3.71E-02	URINARY INCONTINENCE (SA)	5.56E-02
ANKLE SPRAIN/STRAIN	3.41E-02	URINARY RETENTION (SA)	5.56E-02
ALLERGIC REACTION (MILD TO MODERATE)	3.29E-02	SKIN INFECTION	3.88E-02
PHARYNGITIS	3.29E-02	ELBOW SPRAIN/STRAIN	3.71E-02
NECK INJURY	2.80E-02	ANKLE SPRAIN/STRAIN	3.41E-02
MOUTH ULCER	2.70E-02	ALLERGIC REACTION (MILD TO MODERATE)	3.29E-02
Dental Caries	2.47E-02	PHARYNGITIS	3.29E-02
KNEE SPRAIN/STRAIN	2.18E-02	NECK INJURY	2.80E-02
ACUTE SINUSITIS	1.81E-02	MOUTH ULCER	2.70E-02
EYE CHEMICAL BURN	1.81E-02	Dental Caries	2.47E-02
INDIGESTION	1.81E-02	KNEE SPRAIN/STRAIN	2.18E-02
HEARING LOSS	1.63E-02	ACUTE SINUSITIS	1.81E-02
WRIST SPRAIN/STRAIN	1.56E-02	EYE CHEMICAL BURN	1.81E-02
EYE INFECTION	1.51E-02	INDIGESTION	1.81E-02
URINARY TRACT INFECTION	1.40E-02	HEARING LOSS	1.63E-02
HIP SPRAIN/STRAIN	1.25E-02	WRIST SPRAIN/STRAIN	1.56E-02
GASTROENTERITIS	1.21E-02	EYE INFECTION	1.51E-02
CHOKING/OBSTRUCTED AIRWAY	9.10E-03	HIP SPRAIN/STRAIN	1.25E-02
OTITIS EXTERNA	9.10E-03	GASTROENTERITIS	1.21E-02
OTITIS MEDIA	9.10E-03	CHOKING/OBSTRUCTED AIRWAY	9.10E-03
NOSE BLEED (SA)	9.04E-03	OTITIS EXTERNA	9.10E-03
URINARY RETENTION (SA)	6.97E-03	OTITIS MEDIA	9.10E-03
HEMORRHOIDS	6.07E-03	NOSE BLEED (SA)	9.04E-03
MEDICATION OVERDOSE/ADVERSE REACTION	6.07E-03	HEMORRHOIDS	6.07E-03
Lower Extremity Stress Fracture	3.49E-03	MEDICATION OVERDOSE/ADVERSE REACTION	6.07E-03
FINGER DISLOCATION	3.04E-03	Lower Extremity Stress Fracture	5.57E-03
HERPES ZOSTER REACTIVATION (SHINGLES)	3.04E-03	Vaginal Yeast Infection	5.36E-03
INFLUENZA	3.04E-03	Abnormal Uterine Bleeding	4.32E-03
SKIN LACERATION	3.04E-03	FINGER DISLOCATION	3.04E-03
Dental: Abscess	1.91E-03	HERPES ZOSTER REACTIVATION (SHINGLES)	3.04E-03
SMOKE INHALATION	1.87E-03	INFLUENZA	3.04E-03
Dental : Exposed Pulp	1.67E-03	SKIN LACERATION	3.04E-03

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Burns Secondary to Fire	8.78E-04	Dental: Abscess	1.91E-03
Hypertension	5.38E-04	SMOKE INHALATION	1.87E-03
Dental: Filling Loss	4.26E-04	Dental : Exposed Pulp	1.67E-03
Acute Prostatitis	4.08E-04	Burns Secondary to Fire	8.78E-04
Nephrolithiasis	3.04E-04	Anxiety	5.91E-04
Dental: Avulsion (tooth loss)	2.43E-04	Hypertension	5.38E-04
Depression	2.42E-04	Dental: Filling Loss	4.26E-04
Acute Radiation Syndrome	2.36E-04	Acute Arthritis	3.13E-04
Sepsis	2.00E-04	Nephrolithiasis	3.04E-04
Wrist Fracture	1.97E-04	Depression	3.00E-04
Anxiety	1.58E-04	Dental: Avulsion (tooth loss)	2.43E-04
Acute Arthritis	1.27E-04	Acute Radiation Syndrome	2.36E-04
Acute Diverticulitis	1.18E-04	Sepsis	2.00E-04
Stroke (Cerebrovascular Accident)	8.17E-05	Wrist Fracture	1.97E-04
Appendicitis	7.79E-05	Acute Diverticulitis	1.18E-04
Acute Cholecystitis/Biliary Colic	6.41E-05	Acute Cholecystitis/Biliary Colic	1.06E-04
Atrial Fibrillation/Atrial Flutter	5.92E-05	Appendicitis	7.79E-05
Traumatic Hypovolemic Shock	5.34E-05	Stroke (Cerebrovascular Accident)	5.67E-05
Angina/Myocardial Infarction	5.25E-05	Traumatic Hypovolemic Shock	5.34E-05
Anaphylaxis	4.09E-05	Anaphylaxis	4.09E-05
Abdominal Wall Hernia	3.75E-05	Angina/Myocardial Infarction	3.92E-05
Head Injury	3.52E-05	Abdominal Wall Hernia	3.75E-05
Hip/Proximal Femur Fracture	3.48E-05	Head Injury	3.52E-05
Acute Pancreatitis	2.56E-05	Acute Pancreatitis	2.56E-05
Seizures	2.25E-05	Seizures	2.25E-05
Chest Injury	2.14E-05	Chest Injury	2.14E-05
Lumbar Spine Fracture	1.67E-05	Atrial Fibrillation/Atrial Flutter	1.95E-05
Abdominal Injury	1.37E-05	Lumbar Spine Fracture	1.44E-05
Eye Corneal Ulcer	1.17E-05	Abdominal Injury	1.37E-05
Retinal Detachment	9.92E-06	Eye Corneal Ulcer	1.17E-05
Acute Compartment Syndrome	6.08E-06	Hip/Proximal Femur Fracture	9.35E-06
Altitude Sickness	4.52E-06	Retinal Detachment	5.46E-06
Elbow Dislocation	4.34E-06	Acute Glaucoma	4.73E-06
Shoulder Dislocation	3.10E-06	Altitude Sickness	4.52E-06
Acute Glaucoma	2.25E-06	Elbow Dislocation	4.34E-06
Sudden Cardiac Arrest	1.25E-06	Shoulder Dislocation	3.10E-06
Behavioral Emergency	1.19E-06	Sudden Cardiac Arrest	1.25E-06
Eye Penetration (foreign body)	7.78E-07	Behavioral Emergency	1.19E-06
Cardiogenic Shock Secondary to Myocardial Infarction	6.24E-07	Eye Penetration (foreign body)	7.78E-07

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Neurogenic Shock	4.15E-07	Acute Compartment Syndrome	5.83E-07
Toxic Exposure: Ammonia	1.21E-07	Cardiogenic Shock Secondary to Myocardial Infarction	4.41E-07
Abnormal Uterine Bleeding	0	Neurogenic Shock	4.15E-07
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	1.21E-07
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

As expected for the shorter one month Deep Space Sortie DRM, the majority of the top ten conditions listed are associated with adaptation to the spaceflight environment; all have occurred previously in-flight (Table 4). The probabilities of the top ten medical conditions are identical for a male versus female crew member (Table 4).

Table 5 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a twelve month Lunar visit and habitation mission with 50 EVAs. The content of Table 5 is displayed as described for the content of Table 2 (please see the Table 2 description above for further details).

Table 5: Twelve month Lunar Visit and Habitation with 50 EVAs

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
PARESTHESIAS	9.96E-01	PARESTHESIAS	9.96E-01
LATE INSOMNIA	9.92E-01	LATE INSOMNIA	9.92E-01
SKIN ABRASION	9.68E-01	SKIN ABRASION	9.68E-01
SKIN RASH	9.68E-01	SKIN RASH	9.68E-01
FINGERNAIL DELAMINATION	9.65E-01	FINGERNAIL DELAMINATION	9.65E-01
EYE ABRASION (FOREIGN BODY)	9.23E-01	EYE ABRASION (FOREIGN BODY)	9.23E-01
HEADACHE (LATE)	8.33E-01	HEADACHE (LATE)	8.33E-01
SPACE MOTION SICKNESS (SA)	7.30E-01	URINARY TRACT INFECTION	7.40E-01
DIARRHEA	7.01E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
RESPIRATORY INFECTION	7.01E-01	DIARRHEA	7.01E-01
BACK INJURY	6.90E-01	RESPIRATORY INFECTION	7.01E-01
BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01	BACK INJURY	6.90E-01
NASAL CONGESTION (SA)	5.86E-01	BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01
SHOULDER SPRAIN/STRAIN	5.65E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	SHOULDER SPRAIN/STRAIN	5.65E-01
HEADACHE (CO2 INDUCED)	5.19E-01	BACK PAIN (SA)	5.25E-01
INSOMNIA (SA)	4.50E-01	HEADACHE (CO2 INDUCED)	5.19E-01
Decompression Sickness Secondary to EVA	4.41E-01	INSOMNIA (SA)	4.50E-01
SKIN INFECTION	3.78E-01	Decompression Sickness Secondary to EVA	4.41E-01

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
ELBOW SPRAIN/STRAIN	3.65E-01	SKIN INFECTION	3.78E-01
HEADACHE (SA)	3.51E-01	ELBOW SPRAIN/STRAIN	3.65E-01
VIIP (SA)	3.41E-01	HEADACHE (SA)	3.51E-01
ANKLE SPRAIN/STRAIN	3.40E-01	VIIP (SA)	3.41E-01
ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01	ANKLE SPRAIN/STRAIN	3.40E-01
PHARYNGITIS	3.31E-01	ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01
NECK INJURY	2.88E-01	PHARYNGITIS	3.31E-01
MOUTH ULCER	2.80E-01	NECK INJURY	2.88E-01
Dental Caries	2.59E-01	MOUTH ULCER	2.80E-01
KNEE SPRAIN/STRAIN	2.33E-01	Dental Caries	2.59E-01
ACUTE SINUSITIS	1.97E-01	KNEE SPRAIN/STRAIN	2.33E-01
EYE CHEMICAL BURN	1.97E-01	ACUTE SINUSITIS	1.97E-01
INDIGESTION	1.97E-01	EYE CHEMICAL BURN	1.97E-01
HEARING LOSS	1.79E-01	INDIGESTION	1.97E-01
WRIST SPRAIN/STRAIN	1.72E-01	HEARING LOSS	1.79E-01
CONSTIPATION (SA)	1.70E-01	WRIST SPRAIN/STRAIN	1.72E-01
EYE INFECTION	1.67E-01	CONSTIPATION (SA)	1.70E-01
URINARY TRACT INFECTION	1.56E-01	EYE INFECTION	1.67E-01
HIP SPRAIN/STRAIN	1.40E-01	URINARY TRACT INFECTION	1.56E-01
GASTROENTERITIS	1.36E-01	HIP SPRAIN/STRAIN	1.40E-01
CHOKING/OBSTRUCTED AIRWAY	1.04E-01	GASTROENTERITIS	1.36E-01
OTITIS EXTERNA	1.04E-01	CHOKING/OBSTRUCTED AIRWAY	1.04E-01
OTITIS MEDIA	1.04E-01	OTITIS EXTERNA	1.04E-01
HEMORRHOIDS	7.05E-02	OTITIS MEDIA	1.04E-01
MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02	HEMORRHOIDS	7.05E-02
Lower Extremity Stress Fracture	4.11E-02	MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02
FINGER DISLOCATION	3.59E-02	Lower Extremity Stress Fracture	6.48E-02
HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02	Vaginal Yeast Infection	6.25E-02
INFLUENZA	3.59E-02	URINARY INCONTINENCE (SA)	5.56E-02
SKIN LACERATION	3.59E-02	URINARY RETENTION (SA)	5.56E-02
Dental: Abscess	2.27E-02	Abnormal Uterine Bleeding	5.07E-02
SMOKE INHALATION	2.22E-02	FINGER DISLOCATION	3.59E-02
Dental : Exposed Pulp	1.99E-02	HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02
Burns Secondary to Fire	1.05E-02	INFLUENZA	3.59E-02
NOSE BLEED (SA)	9.04E-03	SKIN LACERATION	3.59E-02
URINARY RETENTION (SA)	6.97E-03	Dental: Abscess	2.27E-02
		SMOKE INHALATION	2.22E-02

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Hypertension	6.44E-03	Dental : Exposed Pulp	1.99E-02
Dental: Filling Loss	5.10E-03	Burns Secondary to Fire	1.05E-02
Acute Prostatitis	4.89E-03	NOSE BLEED (SA)	9.04E-03
Nephrolithiasis	3.64E-03	Anxiety	7.07E-03
Dental: Avulsion (tooth loss)	2.92E-03	Hypertension	6.44E-03
Depression	2.90E-03	Dental: Filling Loss	5.10E-03
Acute Radiation Syndrome	2.83E-03	Acute Arthritis	3.75E-03
Sepsis	2.40E-03	Nephrolithiasis	3.64E-03
Wrist Fracture	2.36E-03	Depression	3.59E-03
Anxiety	1.90E-03	Dental: Avulsion (tooth loss)	2.92E-03
Acute Arthritis	1.53E-03	Acute Radiation Syndrome	2.83E-03
Acute Diverticulitis	1.42E-03	Sepsis	2.40E-03
Stroke (Cerebrovascular Accident)	9.80E-04	Wrist Fracture	2.36E-03
Appendicitis	9.35E-04	Acute Diverticulitis	1.42E-03
Acute Cholecystitis/Biliary Colic	7.69E-04	Acute Cholecystitis/Biliary Colic	1.27E-03
Atrial Fibrillation/Atrial Flutter	7.10E-04	Appendicitis	9.35E-04
Traumatic Hypovolemic Shock	6.41E-04	Stroke (Cerebrovascular Accident)	6.80E-04
Angina/Myocardial Infarction	6.30E-04	Traumatic Hypovolemic Shock	6.41E-04
Anaphylaxis	4.91E-04	Anaphylaxis	4.91E-04
Abdominal Wall Hernia	4.50E-04	Angina/Myocardial Infarction	4.70E-04
Head Injury	4.22E-04	Abdominal Wall Hernia	4.50E-04
Hip/Proximal Femur Fracture	4.18E-04	Head Injury	4.22E-04
Acute Pancreatitis	3.07E-04	Acute Pancreatitis	3.07E-04
Seizures	2.70E-04	Seizures	2.70E-04
Chest Injury	2.56E-04	Chest Injury	2.56E-04
Lumbar Spine Fracture	2.01E-04	Atrial Fibrillation/Atrial Flutter	2.34E-04
Abdominal Injury	1.64E-04	Lumbar Spine Fracture	1.73E-04
Eye Corneal Ulcer	1.40E-04	Abdominal Injury	1.64E-04
Retinal Detachment	1.19E-04	Eye Corneal Ulcer	1.40E-04
Acute Compartment Syndrome	7.30E-05	Hip/Proximal Femur Fracture	1.12E-04
Altitude Sickness	5.43E-05	Retinal Detachment	6.55E-05
Elbow Dislocation	5.21E-05	Acute Glaucoma	5.68E-05
Shoulder Dislocation	3.72E-05	Altitude Sickness	5.43E-05
Acute Glaucoma	2.70E-05	Elbow Dislocation	5.21E-05
Sudden Cardiac Arrest	1.50E-05	Shoulder Dislocation	3.72E-05
Behavioral Emergency	1.43E-05	Sudden Cardiac Arrest	1.50E-05
Eye Penetration (foreign body)	9.33E-06	Behavioral Emergency	1.43E-05
Cardiogenic Shock Secondary to Myocardial Infarction	7.49E-06	Eye Penetration (foreign body)	9.33E-06
Neurogenic Shock	4.98E-06	Acute Compartment Syndrome	7.00E-06

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Toxic Exposure: Ammonia	1.45E-06	Cardiogenic Shock Secondary to Myocardial Infarction	5.29E-06
Abnormal Uterine Bleeding	0	Neurogenic Shock	4.98E-06
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	1.45E-06
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

Of note for the twelve month Lunar visit and habitation mission, the order of magnitude increase in the number of EVAs compared with DRMs of five or less EVAs has moved Paresthesias associated with EVAs and Fingernail Delamination to the top five of the ranked medical condition lists for both the male and female DRMs shown (Table 5). Probabilities associated with the top ten medical conditions listed for a male versus a female crew member were identical until the number eight ranking of urinary tract infection for the female (Table 5). All top ten medical conditions listed have occurred before during spaceflight.

Table 6 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a twelve month Deep Space journey and habitation mission with 5 EVAs. The content of Table 6 is similarly displayed as the content of Table 2 (please see the Table 2 description above for further details).

Table 6: Twelve month Deep Space Journey and Habitation with 5 EVAs

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
LATE INSOMNIA	9.92E-01	LATE INSOMNIA	9.92E-01
SKIN ABRASION	9.68E-01	SKIN ABRASION	9.68E-01
SKIN RASH	9.68E-01	SKIN RASH	9.68E-01
EYE ABRASION (FOREIGN BODY)	9.23E-01	EYE ABRASION (FOREIGN BODY)	9.23E-01
HEADACHE (LATE)	8.33E-01	HEADACHE (LATE)	8.33E-01
SPACE MOTION SICKNESS (SA)	7.30E-01	URINARY TRACT INFECTION	7.40E-01
DIARRHEA	7.01E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
RESPIRATORY INFECTION	7.01E-01	DIARRHEA	7.01E-01
BACK INJURY	6.90E-01	RESPIRATORY INFECTION	7.01E-01
BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01	BACK INJURY	6.90E-01
NASAL CONGESTION (SA)	5.86E-01	BAROTRAUMA (EAR/SINUS BLOCK)	6.78E-01
SHOULDER SPRAIN/STRAIN	5.65E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	SHOULDER SPRAIN/STRAIN	5.65E-01
HEADACHE (CO ₂ INDUCED)	5.19E-01	BACK PAIN (SA)	5.25E-01
INSOMNIA (SA)	4.50E-01	HEADACHE (CO ₂ INDUCED)	5.19E-01
PARESTHESIAS	4.27E-01	INSOMNIA (SA)	4.50E-01
SKIN INFECTION	3.78E-01	PARESTHESIAS	4.27E-01
ELBOW SPRAIN/STRAIN	3.65E-01	SKIN INFECTION	3.78E-01
HEADACHE (SA)	3.51E-01	ELBOW SPRAIN/STRAIN	3.65E-01

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
VIIP (SA)	3.41E-01	HEADACHE (SA)	3.51E-01
ANKLE SPRAIN/STRAIN	3.40E-01	VIIP (SA)	3.41E-01
ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01	ANKLE SPRAIN/STRAIN	3.40E-01
PHARYNGITIS	3.31E-01	ALLERGIC REACTION (MILD TO MODERATE)	3.31E-01
NECK INJURY	2.88E-01	PHARYNGITIS	3.31E-01
FINGERNAIL DELAMINATION	2.85E-01	NECK INJURY	2.88E-01
MOUTH ULCER	2.80E-01	FINGERNAIL DELAMINATION	2.85E-01
Dental Caries	2.59E-01	MOUTH ULCER	2.80E-01
KNEE SPRAIN/STRAIN	2.33E-01	Dental Caries	2.59E-01
ACUTE SINUSITIS	1.97E-01	KNEE SPRAIN/STRAIN	2.33E-01
EYE CHEMICAL BURN	1.97E-01	ACUTE SINUSITIS	1.97E-01
INDIGESTION	1.97E-01	EYE CHEMICAL BURN	1.97E-01
HEARING LOSS	1.79E-01	INDIGESTION	1.97E-01
WRIST SPRAIN/STRAIN	1.72E-01	HEARING LOSS	1.79E-01
CONSTIPATION (SA)	1.70E-01	WRIST SPRAIN/STRAIN	1.72E-01
EYE INFECTION	1.67E-01	CONSTIPATION (SA)	1.70E-01
URINARY TRACT INFECTION	1.56E-01	EYE INFECTION	1.67E-01
HIP SPRAIN/STRAIN	1.40E-01	HIP SPRAIN/STRAIN	1.40E-01
GASTROENTERITIS	1.36E-01	GASTROENTERITIS	1.36E-01
CHOKING/OBSTRUCTED AIRWAY	1.04E-01	CHOKING/OBSTRUCTED AIRWAY	1.04E-01
OTITIS EXTERNA	1.04E-01	OTITIS EXTERNA	1.04E-01
OTITIS MEDIA	1.04E-01	OTITIS MEDIA	1.04E-01
HEMORRHOIDS	7.05E-02	HEMORRHOIDS	7.05E-02
MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02	MEDICATION OVERDOSE/ADVERSE REACTION	7.05E-02
Decompression Sickness Secondary to EVA	5.65E-02	Lower Extremity Stress Fracture	6.48E-02
Lower Extremity Stress Fracture	4.11E-02	Vaginal Yeast Infection	6.25E-02
FINGER DISLOCATION	3.59E-02	Decompression Sickness Secondary to EVA	5.65E-02
HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02	URINARY INCONTINENCE (SA)	5.56E-02
INFLUENZA	3.59E-02	URINARY RETENTION (SA)	5.56E-02
SKIN LACERATION	3.59E-02	Abnormal Uterine Bleeding	5.07E-02
Dental: Abscess	2.27E-02	FINGER DISLOCATION	3.59E-02
SMOKE INHALATION	2.22E-02	HERPES ZOSTER REACTIVATION (SHINGLES)	3.59E-02
Dental : Exposed Pulp	1.99E-02	INFLUENZA	3.59E-02
Burns Secondary to Fire	1.05E-02	SKIN LACERATION	3.59E-02

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
NOSE BLEED (SA)	9.04E-03	Dental: Abscess	2.27E-02
URINARY RETENTION (SA)	6.97E-03	SMOKE INHALATION	2.22E-02
Hypertension	6.44E-03	Dental : Exposed Pulp	1.99E-02
Dental: Filling Loss	5.10E-03	Burns Secondary to Fire	1.05E-02
Acute Prostatitis	4.89E-03	NOSE BLEED (SA)	9.04E-03
Nephrolithiasis	3.64E-03	Anxiety	7.07E-03
Dental: Avulsion (tooth loss)	2.92E-03	Hypertension	6.44E-03
Depression	2.90E-03	Dental: Filling Loss	5.10E-03
Acute Radiation Syndrome	2.83E-03	Acute Arthritis	3.75E-03
Sepsis	2.40E-03	Nephrolithiasis	3.64E-03
Wrist Fracture	2.36E-03	Depression	3.59E-03
Anxiety	1.90E-03	Dental: Avulsion (tooth loss)	2.92E-03
Acute Arthritis	1.53E-03	Acute Radiation Syndrome	2.83E-03
Acute Diverticulitis	1.42E-03	Sepsis	2.40E-03
Stroke (Cerebrovascular Accident)	9.80E-04	Wrist Fracture	2.36E-03
Appendicitis	9.35E-04	Acute Diverticulitis	1.42E-03
Acute Cholecystitis/Biliary Colic	7.69E-04	Acute Cholecystitis/Biliary Colic	1.27E-03
Atrial Fibrillation/Atrial Flutter	7.10E-04	Appendicitis	9.35E-04
Traumatic Hypovolemic Shock	6.41E-04	Stroke (Cerebrovascular Accident)	6.80E-04
Angina/Myocardial Infarction	6.30E-04	Traumatic Hypovolemic Shock	6.41E-04
Anaphylaxis	4.91E-04	Anaphylaxis	4.91E-04
Abdominal Wall Hernia	4.50E-04	Angina/Myocardial Infarction	4.70E-04
Head Injury	4.22E-04	Abdominal Wall Hernia	4.50E-04
Hip/Proximal Femur Fracture	4.18E-04	Head Injury	4.22E-04
Acute Pancreatitis	3.07E-04	Acute Pancreatitis	3.07E-04
Seizures	2.70E-04	Seizures	2.70E-04
Chest Injury	2.56E-04	Chest Injury	2.56E-04
Lumbar Spine Fracture	2.01E-04	Atrial Fibrillation/Atrial Flutter	2.34E-04
Abdominal Injury	1.64E-04	Lumbar Spine Fracture	1.73E-04
Eye Corneal Ulcer	1.40E-04	Abdominal Injury	1.64E-04
Retinal Detachment	1.19E-04	Eye Corneal Ulcer	1.40E-04
Acute Compartment Syndrome	7.30E-05	Hip/Proximal Femur Fracture	1.12E-04
Altitude Sickness	5.43E-05	Retinal Detachment	6.55E-05
Elbow Dislocation	5.21E-05	Acute Glaucoma	5.68E-05
Shoulder Dislocation	3.72E-05	Altitude Sickness	5.43E-05
Acute Glaucoma	2.70E-05	Elbow Dislocation	5.21E-05
Sudden Cardiac Arrest	1.50E-05	Shoulder Dislocation	3.72E-05
Behavioral Emergency	1.43E-05	Sudden Cardiac Arrest	1.50E-05
Eye Penetration (foreign body)	9.33E-06	Behavioral Emergency	1.43E-05
Cardiogenic Shock Secondary to	7.49E-06	Eye Penetration (foreign body)	9.33E-06

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Myocardial Infarction			
Neurogenic Shock	4.98E-06	Acute Compartment Syndrome	7.00E-06
Toxic Exposure: Ammonia	1.45E-06	Cardiogenic Shock Secondary to Myocardial Infarction	5.29E-06
Abnormal Uterine Bleeding	0	Neurogenic Shock	4.98E-06
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	1.45E-06
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

The top ten medical conditions and probability values for a twelve month Deep Space journey and habitation mission with 5 EVAs (Table 6) are identical to those of the twelve month Low Earth Orbit mission with 2 EVAs (Table 3) for both the male and female DRMs, respectively. The probabilities for the top ten conditions listed for a male versus a female crew member during a twelve month Deep Space journey and habitation mission DRM are identical until the number six ranking for the female, urinary tract infection (Table 6). There is only one SA condition in the top ten ranking (Table 6) and all have occurred before during spaceflight.

Table 7 lists medical conditions by rank, from highest to lowest probability of at least one event occurring during a thirty-six month Planetary mission with 50 EVAs. The content of Table 7 is shown in the manner described for the content of Table 2 (please see the Table 2 description above for further details).

Table 7: Thirty-six month Planetary mission with 50 EVAs

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
LATE INSOMNIA	>9.99E-01	LATE INSOMNIA	>9.99E-01
SKIN ABRASION	>9.99E-01	SKIN ABRASION	>9.99E-01
SKIN RASH	>9.99E-01	SKIN RASH	>9.99E-01
EYE ABRASION (FOREIGN BODY)	>9.99E-01	EYE ABRASION (FOREIGN BODY)	>9.99E-01
PARESTHESIAS	9.96E-01	PARESTHESIAS	9.96E-01
HEADACHE (LATE)	9.95E-01	HEADACHE (LATE)	9.95E-01
DIARRHEA	9.73E-01	URINARY TRACT INFECTION	9.82E-01
RESPIRATORY INFECTION	9.73E-01	DIARRHEA	9.73E-01
BACK INJURY	9.70E-01	RESPIRATORY INFECTION	9.73E-01
BAROTRAUMA (EAR/SINUS BLOCK)	9.67E-01	BACK INJURY	9.70E-01
FINGERNAIL DELAMINATION	9.65E-01	BAROTRAUMA (EAR/SINUS BLOCK)	9.67E-01
SHOULDER SPRAIN/STRAIN	9.18E-01	FINGERNAIL DELAMINATION	9.65E-01
HEADACHE (CO₂ INDUCED)	8.88E-01	SHOULDER SPRAIN/STRAIN	9.18E-01
SKIN INFECTION	7.60E-01	HEADACHE (CO₂ INDUCED)	8.88E-01
ELBOW SPRAIN/STRAIN	7.44E-01	SKIN INFECTION	7.60E-01
SPACE MOTION SICKNESS (SA)	7.30E-01	ELBOW SPRAIN/STRAIN	7.44E-01
ANKLE SPRAIN/STRAIN	7.13E-01	SPACE MOTION SICKNESS (SA)	7.30E-01
ALLERGIC REACTION (MILD TO	7.01E-01	ANKLE SPRAIN/STRAIN	7.13E-01

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
MODERATE)			
PHARYNGITIS	7.01E-01	ALLERGIC REACTION (MILD TO MODERATE)	7.01E-01
NECK INJURY	6.40E-01	PHARYNGITIS	7.01E-01
MOUTH ULCER	6.27E-01	NECK INJURY	6.40E-01
Dental Caries	5.93E-01	MOUTH ULCER	6.27E-01
NASAL CONGESTION (SA)	5.86E-01	Dental Caries	5.93E-01
KNEE SPRAIN/STRAIN	5.48E-01	NASAL CONGESTION (SA)	5.86E-01
BACK PAIN (SA)	5.25E-01	KNEE SPRAIN/STRAIN	5.48E-01
ACUTE SINUSITIS	4.82E-01	BACK PAIN (SA)	5.25E-01
EYE CHEMICAL BURN	4.82E-01	ACUTE SINUSITIS	4.82E-01
INDIGESTION	4.82E-01	EYE CHEMICAL BURN	4.82E-01
INSOMNIA (SA)	4.50E-01	INDIGESTION	4.82E-01
HEARING LOSS	4.46E-01	INSOMNIA (SA)	4.50E-01
Decompression Sickness Secondary to EVA	4.41E-01	HEARING LOSS	4.46E-01
WRIST SPRAIN/STRAIN	4.33E-01	Decompression Sickness Secondary to EVA	4.41E-01
EYE INFECTION	4.22E-01	WRIST SPRAIN/STRAIN	4.33E-01
URINARY TRACT INFECTION	3.98E-01	EYE INFECTION	4.22E-01
HIP SPRAIN/STRAIN	3.65E-01	HIP SPRAIN/STRAIN	3.65E-01
GASTROENTERITIS	3.55E-01	GASTROENTERITIS	3.55E-01
HEADACHE (SA)	3.51E-01	HEADACHE (SA)	3.51E-01
VHPP (SA)	3.41E-01	VHPP (SA)	3.41E-01
CHOKING/OBSTRUCTED AIRWAY	2.80E-01	CHOKING/OBSTRUCTED AIRWAY	2.80E-01
OTITIS EXTERNA	2.80E-01	OTITIS EXTERNA	2.80E-01
OTITIS MEDIA	2.80E-01	OTITIS MEDIA	2.80E-01
HEMORRHOIDS	1.97E-01	HEMORRHOIDS	1.97E-01
MEDICATION OVERDOSE/ADVERSE REACTION	1.97E-01	MEDICATION OVERDOSE/ADVERSE REACTION	1.97E-01
CONSTIPATION (SA)	1.70E-01	Lower Extremity Stress Fracture	1.82E-01
Lower Extremity Stress Fracture	1.18E-01	Vaginal Yeast Infection	1.76E-01
FINGER DISLOCATION	1.04E-01	CONSTIPATION (SA)	1.70E-01
HERPES ZOSTER REACTIVATION (SHINGLES)	1.04E-01	Abnormal Uterine Bleeding	1.44E-01
INFLUENZA	1.04E-01	FINGER DISLOCATION	1.04E-01
SKIN LACERATION	1.04E-01	HERPES ZOSTER REACTIVATION (SHINGLES)	1.04E-01
Dental: Abscess	6.67E-02	INFLUENZA	1.04E-01
SMOKE INHALATION	6.51E-02	SKIN LACERATION	1.04E-01
Dental : Exposed Pulp	5.85E-02	Dental: Abscess	6.67E-02

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Burns Secondary to Fire	3.11E-02	SMOKE INHALATION	6.51E-02
Hypertension	1.92E-02	Dental : Exposed Pulp	5.85E-02
Dental: Filling Loss	1.52E-02	URINARY INCONTINENCE (SA)	5.56E-02
Acute Prostatitis	1.46E-02	URINARY RETENTION (SA)	5.56E-02
Nephrolithiasis	1.09E-02	Burns Secondary to Fire	3.11E-02
NOSE BLEED (SA)	9.04E-03	Anxiety	2.11E-02
Dental: Avulsion (tooth loss)	8.72E-03	Hypertension	1.92E-02
Depression	8.66E-03	Dental: Filling Loss	1.52E-02
Acute Radiation Syndrome	8.45E-03	Acute Arthritis	1.12E-02
Sepsis	7.17E-03	Nephrolithiasis	1.09E-02
Wrist Fracture	7.05E-03	Depression	1.07E-02
URINARY RETENTION (SA)	6.97E-03	NOSE BLEED (SA)	9.04E-03
Anxiety	5.68E-03	Dental: Avulsion (tooth loss)	8.72E-03
Acute Arthritis	4.58E-03	Acute Radiation Syndrome	8.45E-03
Acute Diverticulitis	4.25E-03	Sepsis	7.17E-03
Stroke (Cerebrovascular Accident)	2.94E-03	Wrist Fracture	7.05E-03
Appendicitis	2.80E-03	Acute Diverticulitis	4.25E-03
Acute Cholecystitis/Biliary Colic	2.30E-03	Acute Cholecystitis/Biliary Colic	3.80E-03
Atrial Fibrillation/Atrial Flutter	2.13E-03	Appendicitis	2.80E-03
Traumatic Hypovolemic Shock	1.92E-03	Stroke (Cerebrovascular Accident)	2.04E-03
Angina/Myocardial Infarction	1.89E-03	Traumatic Hypovolemic Shock	1.92E-03
Anaphylaxis	1.47E-03	Anaphylaxis	1.47E-03
Abdominal Wall Hernia	1.35E-03	Angina/Myocardial Infarction	1.41E-03
Head Injury	1.27E-03	Abdominal Wall Hernia	1.35E-03
Hip/Proximal Femur Fracture	1.25E-03	Head Injury	1.27E-03
Acute Pancreatitis	9.22E-04	Acute Pancreatitis	9.22E-04
Seizures	8.10E-04	Seizures	8.10E-04
Chest Injury	7.69E-04	Chest Injury	7.69E-04
Lumbar Spine Fracture	6.03E-04	Atrial Fibrillation/Atrial Flutter	7.03E-04
Abdominal Injury	4.93E-04	Lumbar Spine Fracture	5.18E-04
Eye Corneal Ulcer	4.20E-04	Abdominal Injury	4.93E-04
Retinal Detachment	3.57E-04	Eye Corneal Ulcer	4.20E-04
Acute Compartment Syndrome	2.19E-04	Hip/Proximal Femur Fracture	3.37E-04
Altitude Sickness	1.63E-04	Retinal Detachment	1.96E-04
Elbow Dislocation	1.56E-04	Acute Glaucoma	1.70E-04
Shoulder Dislocation	1.12E-04	Altitude Sickness	1.63E-04
Acute Glaucoma	8.10E-05	Elbow Dislocation	1.56E-04
Sudden Cardiac Arrest	4.50E-05	Shoulder Dislocation	1.12E-04
Behavioral Emergency	4.29E-05	Sudden Cardiac Arrest	4.50E-05
Eye Penetration (foreign body)	2.80E-05	Behavioral Emergency	4.29E-05

Ranking of Medical Conditions by Probability

Medical Condition (male)	Probability Male (occurrence)	Medical Condition (female)	Probability Female (occurrence)
Cardiogenic Shock Secondary to Myocardial Infarction	2.25E-05	Eye Penetration (foreign body)	2.80E-05
Neurogenic Shock	1.50E-05	Acute Compartment Syndrome	2.10E-05
Toxic Exposure: Ammonia	4.35E-06	Cardiogenic Shock Secondary to Myocardial Infarction	1.59E-05
Abnormal Uterine Bleeding	0	Neurogenic Shock	1.50E-05
URINARY INCONTINENCE (SA)	0	Toxic Exposure: Ammonia	4.35E-06
Vaginal Yeast Infection	0	Acute Prostatitis	0

Table details described in text above.

The top ten listed medical conditions and probability values for a thirty-six month Planetary mission are identical in male versus female DRMs with the exception of urinary tract infection, which is ranked seven in the female DRM (Table 7). All top ten conditions have occurred previously during spaceflight. Although there are 50 EVAs associated with the thirty-six month Planetary DRMs, Paresthesias associated with EVA is ranked fifth in the top ten medical conditions listed (Table 7), similar in ranking to a one month Deep Space Sortie mission with 5 EVAs (Table 4), although over twice as likely.

Summary

Ninety-eight medical conditions were ranked in order of probability that at least one event occurs during a specified DRM. Six DRMs were examined with a single male or single female crew member, resulting in twelve DRMs assessed (Table 1). DRMs ranged in duration from one to thirty-six months. For shorter duration DRMs, more SA medical conditions were ranked in the top ten conditions listed. With the exception of urinary tract infection in the female DRMs, the top ten conditions and probability values were identical in male versus female DRMs, and all top ten conditions listed for all DRMs have occurred previously in-flight. Of note, the top ten medical conditions and probability values for a twelve month Deep Space journey and habitation mission with 5 EVAs (Table 6) are identical to those of the twelve month Low Earth Orbit mission with 2 EVAs (Table 3) for both the male and female DRMs, respectively. The similarities between the top ten medical conditions and probability values in both DRMs are a result of identical mission length having a greater parameter influence than other mission parameter differences given the current assumptions and limitations. Most of the reported conditions in these two mission scenarios are generated based on time (Tables 3 and 6). These results highlight the importance of ensuring that the assumptions and limitations provided are used to provide appropriate context for interpreting these data.

iMED Medical Conditions List by Category

ENVIRONMENTAL

Acute Radiation Syndrome
Altitude Sickness
Barotrauma (ear/sinus block)
Burns secondary to Fire
Decompression Sickness Secondary to Extravehicular Activity
Eye Chemical Burn
Headache (CO₂ induced)
Smoke Inhalation
Toxic Exposure: Ammonia

INJURY/TRAUMA

Abdominal Injury
Acute Compartment Syndrome
Ankle Sprain/Strain
Back Injury
Chest Injury
Dental: Avulsion (tooth loss)
Elbow Dislocation
Elbow Sprain/Strain
Eye Abrasion (foreign body)
Eye Penetration (foreign body)
Finger Dislocation
Fingernail Delamination (EVA)
Head Injury
Hip Sprain/Strain
Hip/Proximal Femur Fracture
Knee Sprain/Strain
Lower Extremity (LE) Stress Fracture
Lumbar Spine Fracture
Neck Injury
Neurogenic Shock
Paresthesias
Shoulder Dislocation
Shoulder Sprain/Strain
Skin Abrasion
Skin Laceration
Traumatic Hypovolemic Shock
Wrist Fracture
Wrist Sprain/Strain

MEDICAL ILLNESS

Abdominal Wall Hernia
Abnormal Uterine Bleeding
Acute Arthritis
Acute Cholecystitis/Biliary Colic
Acute Diverticulitis
Acute Glaucoma
Acute Pancreatitis
Acute Prostatitis
Acute Sinusitis
Allergic Reaction (mild to moderate)
Anaphylaxis
Angina/Myocardial Infarction

MEDICAL ILLNESS (continued)

Anxiety
Appendicitis
Atrial Fibrillation/Atrial Flutter
Back Pain (space adaptation)
Behavioral Emergency
Cardiogenic Shock secondary to Myocardial infarction
Choking (foreign body inhalation)
Constipation (space adaptation)
Dental: Exposed Pulp
Dental Caries
Dental: Abscess
Dental: Crown Loss
Dental: Filling Loss
Depression
Diarrhea
Eye Corneal Ulcer
Eye Infection
Gastroenteritis
Headache (Late)
Headache (space adaptation)
Hearing Loss
Hemorrhoids
Herpes Zoster Reactivation (shingles)
Hypertension
Indigestion
Influenza
Insomnia (space adaptation)
Late Insomnia
Medication Overdose/Adverse Reaction
Mouth Ulcer
Nasal Congestion (space adaptation)
Nephrolithiasis
Nose bleed (space adaptation)
Otitis Externa
Otitis Media
Pharyngitis
Respiratory Infection
Retinal Detachment
Seizures
Sepsis
Skin Infection
Skin Rash
Small Bowel Obstruction
Space Motion Sickness (space adaptation)
Stroke
Sudden Cardiac Arrest
Urinary Incontinence (space adaption)
Urinary Retention (space adaptation)
Urinary Tract Infection
Vaginal Yeast Infection
Visual Impairment and Intracranial Pressure

Reference List

1. Integrated Medical Model Project. Assumptions and Limitations for Clinical Findings Form Content Listed in the Integrated Medical Evidence Database. 2014. Houston, TX, NASA JSC. *Ref Type: Report* [**Updated document in progress.**]