

The following document contains data and analyses developed by the NASA Human Research Program Integrated Medical Model (IMM) v3.0, which has undergone rigorous testing and review within the NASA medical community per NASA Procedural Requirement 7150.2 and NASA Standard 7009, but still requires review by the external space flight medical community. Outstanding elements for review include: assessing the applicability of the IMM v3.0 outcomes, the relevance of stated assumptions, and clearly defining limitations. Given this, it is strongly recommended that care be taken when using the results of the simulation and the output should be weighted appropriately for its level of credibility with respect to informing any decision making. If you have questions regarding remaining review activities, please contact the IMM team. The scheduled release of IMM V4.0 in FY2015 follows completion of a full internal review against NASA standards as well as the successful external review from the appropriate medical and modeling communities.

Executive Summary

The Integrated Medical Model (IMM) is a probabilistic risk assessment tool used to aid in the evaluation of in-flight crew health requirements as well as mission impacts due to medical events. The objective of this data package is to:

- Quantify Crew Health Index (CHI) (via Quality-Adjusted Mission Time Lost), risk of evacuation (EVAC), and Probability of Medical Event Occurrence for ISS 6 and 12 month missions with 5 crewmembers.
- Identify resources required to treat medical events that occur in the simulation.

This request utilized 2 different crew profiles for two, 5-crew DRMs. The crew profiles are the same for each DRM with the exception of the extravehicular activity (EVA) schedule. The first DRM had a duration of 6 months and had 3 scheduled EVAs performed by 2 crew members. The second DRM had a duration of 12 months and had 6 scheduled EVAs performed by 2 crew members. (See Tables 1 and 2 in the methods section of this report.) Results shown include Fully Treated Average Quality-Adjusted Mission Time Lost (QAMTL) due to in-flight medical events per Trial top 20 Influential Conditions for both DRMs (Tables 3 and 5); Fully Treated EVAC top 20 Influential Conditions for both DRMs (Tables 4 and 6); and Probability of Occurrence of 1 or more events for both DRMs (Tables 7 and 8). Also included in this report is a list of medical resources utilized in the simulations for both DRMs (in descending order of utilization). Resources in the list that may require additional crew training are highlighted in yellow for ease of reference.

Background

The IMM is a stochastic model that uses Monte Carlo methodology to simulate medical outcomes during spaceflight missions. The IMM consists of a three-step process. First, mission and crew member characteristics are specified to define a particular mission profile, or design reference mission (DRM). Next, medical events and outcomes during the space flight mission are randomly generated based on pre-defined incidence values and probability distributions. Finally, total crew health and mission impact outcomes are summarized. For this report, the primary outcomes of interest are crew health index (CHI), need for evacuation (EVAC) and loss of crew life (LOCL).

The IMM is most useful for comparing risks across multiple mission profiles based on probable events and resource availability. Biased results may be incurred due to limitations of the model, but the bias will be consistent across mission profiles within the same service request.

Methods

Crew and Mission Parameters

The DRMs were configured using the crew profiles shown in Tables 1 and 2. The outcomes of certain IMM medical conditions are influenced by pre-existing medical history including: coronary artery calcium score (CAC), dental crowns, contact lenses, and history of prior abdominal surgery. Pre-existing conditions, as defined here, are consistent with historical U.S. crew data.

Table 1: Crew for DRM1 – ISS 6 month

	Sex	CAC	Crowns	Contacts	Prior Abdominal Surgery	EVA
Crew 1	male	no	no	no	no	no
Crew 2	female	no	yes	yes	no	yes (3)
Crew 3	male	no	no	no	no	no
Crew 4	male	no	no	no	no	no
Crew 5	male	no	no	no	no	yes (3)

Table 2: Crew for DRM2 – ISS 12 month

	Sex	CAC	Crowns	Contacts	Prior Abdominal Surgery	EVA
Crew 1	male	no	no	no	no	no
Crew 2	female	no	yes	yes	no	yes (6)
Crew 3	male	no	no	no	no	no
Crew 4	male	no	no	no	no	no
Crew 5	male	no	no	no	no	yes (6)

Medical Conditions and Resources

The one hundred medical conditions currently included in the IMM are shown in Appendix A. The incidence of IMM medical events occurring during simulated missions are based on historical mission and cohort data contained within the iMED. For each condition the percentage of “best case” and “worst case” scenarios are specified, as well as a defined set of medical resources that are used to treat the condition. The iMED entry for each condition details the specific medical resources and quantity necessary for treatment in both the best and worst-case scenarios. In-flight medical treatment is assumed to follow a specified protocol [5] or clinical practice guidelines for each medical condition and is constrained by resource availability on the ISS (i.e. the ISS medical capabilities (MedCap)). Model outcomes can be given for the all-treated (continuous resupply, e.g. ISS in low earth orbit), all-untreated (no Medkit) and baseline MedCap (ISS Medkit without resupply). For longer duration missions the MedCap state should most closely resemble a real world deep space mission where resupply is not possible but where utilization of partial and alternative treatment can occur.

Main Outcomes

Some of the IMM primary medical outcomes include: crew health index (CHI), probability of Evacuation (EVAC), and required resources.

CHI is a calculated percentage using the quality-adjusted mission time lost (QAMTL) due to in-flight medical events and resources available to treat those conditions [2].

$$\text{CHI} = (1 - (\text{QAMTL} \div \text{Mission Length})) \times 100$$

For a given condition, QAMTL is determined by summing the product of functional impairment and duration for all three clinical phases of that condition: i) diagnosis and initial treatment, ii) ongoing

treatment, and iii) end-state. CHI percent values range from 0-100, where zero represents complete crew impairment and one hundred represents a completely functional crew.

EVAC in the context of IMM means that medical evacuation from the ISS would be considered for definitive treatment of the afflicted crew member(s). EVAC is considered an end state result if any of the following criteria are met: 1) potential Loss of Crew Life (LOCL); 2) potential significant permanent impairment; or 3) potential intractable pain. When EVAC is calculated by the IMM, no consideration has been given to the availability of a return vehicle or the likelihood of a successful clinical outcome should a return vehicle be available.

In version 4.1 of the IMM, crew members are usually only assigned one end state of EVAC. In rare instances a crewmember can get a condition that will go to EVAC and then develop another condition that will also go to EVAC in the time between the onset of first condition and the EVAC time. Both events are recorded as EVAC outcomes. These assumptions should result in more accurate IMM forecasts for the occurrence of EVAC as compared to the prior versions of the model.

Required resources for treatment are tracked for each simulated mission trial. The number of each resource that is used to treat a given condition is decremented from available resources. If more of any particular resource is used than is available, then that resource is considered “depleted” in the MedCap scenario. Events that require a “depleted” resource are considered “partially treated” if only a portion of the required resources are available. If there are sufficient available alternate resources in the MedCap, the event is considered “fully treated.” If there are not enough resources available to treat the event, the event is considered “untreated.” The initial quantities for medical resources are baselined to a fully stocked ISS medical kit (MedCap). Note that when an event is partially treated, its outcomes are based on a weighted average of the treated and untreated values. For example, if a condition has a 0% chance of going to EVAC in the best case treated scenario and a 0-100% chance of going to EVAC in the best case untreated scenario, then under best case partial treatment, it is possible the condition will go to EVAC.

Modeling Approach

Simulations were run for 6 month and 12 month (ISS) missions with 5 crewmembers. One hundred thousand (100,000) trials were run for each DRM where each trial can be considered an individual “mission”. This ensures that the distribution of outcomes meet convergence criteria. Convergence criteria are met when there is less than or equal to a 5% change in the average standard deviation of the CHI, EVAC, and LOCL primary model outcomes in the last 2 - 1,000 mission increments. This last step is performed manually by the modelers using the IMMV4ConvergenceReport.

IMM outcomes were determined for the DRMs using the ISS MedCap scenario where all conditions are treated, partially treated or untreated based on the available resources of the ISS MedCap. CHI is calculated as a percentage, with 95% confidence intervals (CIs) for the associated distributions. EVAC and LOCL are probabilities, with 95% CI for EVAC and LOCL obtained using bootstrap resampling of the simulation output [3]. In this report, CHI, EVAC, and probabilities of event occurrence results, as well as pertinent influential conditions, are described. IMM version 4.1 has certain features, assumptions and limitations that impact modeled outcomes. IMM 4.1 represents a significant advance over IMM 3.0. Improvements in IMM 4.1 include inclusion of a timeline, and alternate or partial treatment capability. Features, assumptions and limitations pertinent to this report are described below.

Features, Assumptions and Limitations of IMM Version 4.1 [3]

1. All non-SA and non-extravehicular activity (EVA) related conditions have a uniform likelihood of occurring throughout the mission duration. Space Adaptation Syndrome conditions occur in the first 5 days of the mission, with a peak occurrence at 48 hours.
2. Individuals cannot get the same condition for which they are currently being treated (i.e. during Clinical Phase (CP) I and II).
3. EVAC and LOCL are generated for each medical event, and then the timing of the EVAC or LOCL is generated according to a specified distribution.
4. Individuals are no longer at risk for further conditions once their status changes to either EVAC or LOCL. From the start time of the EVAC or LOCL, the functional impairment of the crew member is assumed to be 100%.
5. When the status of a crew member changes to EVAC, only one crew member is evacuated.
6. The IMM assumes that, per crew member, the first condition requiring a specific therapy utilizes all resources required for treating that condition before a second condition has access to those resources.
7. Most medical conditions, with exceptions including acute radiation syndrome and EVA-linked conditions, occur independently of the occurrence of mission events and other medical conditions. Currently there is no correlation or association within or between crew members for most medical conditions.
8. The model assumes another crew member is available to act as caregiver but does not track the time impact of providing this care.
9. Medical procedures are accurately followed and successful; no mistakes occur in executing medical procedures.
10. Crew medical skill level and preflight/inflight training is not modeled.
11. All diagnoses are 100% accurate.

12. All pharmaceuticals maintain maximum efficacy.
13. All medical events receive the appropriate treatment.
14. All medical events respond to the treatment as expected terrestrially.
15. All medical equipment is 100% reliable.
16. For each of the medical conditions specified in iMED, all crew members with the same characteristics (sex, presence of CAC, crowns, contacts, history of abdominal surgery) have the same likelihood distribution of experiencing the condition.
17. All crew members are assumed to have all intrinsic body parts intact (i.e. appendix, gall bladder, and uterus or prostate, etc.).
18. IMM assumes ISS power, potable water and oxygen resources are always available in unlimited supply.
19. No Russian medical capabilities aboard the ISS are available to US crew members in this model.
20. Medical capabilities do not include the use of personal crew carry-on items contained in the Individual Medical Accessories Kit, (IMAK).
21. If a crew member is undergoing treatment for concurrent medical conditions requiring the same consumable resource, the crew member will only utilize resources at the level required by the condition that requires the most resources.
22. If the primary resource required for treating a medical condition is unavailable, one or more alternative resources are considered, if appropriate. One example might be using acetaminophen in place of ibuprofen.
23. Total quantities of a consumable medical resource requiring a daily dose will be adjusted if a dosage schedule runs past the end of the mission.
24. If a solar particle event causes acute radiation sickness in one or more crew members, IMM assumes the condition begins identically in all affected crew members at the beginning of the solar particle event.
25. The IMM does not decrement non-consumable items and allows all non-consumable items to be used simultaneously by multiple astronauts (e.g. blood pressure cuff).

Results

The IMM results for the simulated DRMs are presented in the tables below. The list of top 20 influential conditions for both DRMs are presented in tables 3-6. The Probability of Occurrence of 1 or more events for both DRMs is presented in tables 7 and 8.

Table 3: DRM 1 (ISS 6) Fully Treated Average QAMTL per Trial top 20 Influential Conditions

Scenario	Treated	Medical Condition	Category	Total Occurrences	Avg. QAMTL per Trial	Percent Contribution	Cumulative Percent
WORST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	12175	247.84	22.86	22.86
BEST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	161425	193.17	17.82	40.68
WORST CASE	TREATED	SKIN ABRASION	INJURY/TRAUMA	46698	59.45	5.48	46.16
WORST CASE	TREATED	SKIN LACERATION	INJURY/TRAUMA	6811	33.75	3.11	49.27
BEST CASE	TREATED	EYE IRRITATION/ABRASION	INJURY/TRAUMA	634053	33.24	3.07	52.34
WORST CASE	TREATED	EYE CHEMICAL BURN	ENVIRONMENTAL	4094	32.80	3.03	55.36
BEST CASE	TREATED	SKIN RASH	MEDICAL	851202	24.64	2.27	57.64
WORST CASE	TREATED	HEARING LOSS	MEDICAL	18168	19.85	1.83	59.47
BEST CASE	TREATED	SKIN ABRASION	INJURY/TRAUMA	809150	19.61	1.81	61.28
BEST CASE	TREATED	SLEEP DISORDER	MEDICAL	1205360	19.58	1.81	63.08
BEST CASE	TREATED	BAROTRAUMA (EAR/SINUS BLOCK)	ENVIRONMENTAL	277703	18.49	1.71	64.79
WORST CASE	TREATED	BACK SPRAIN/STRAIN	INJURY/TRAUMA	5929	17.98	1.66	66.45
BEST CASE	TREATED	RESPIRATORY INFECTION	MEDICAL	296537	17.45	1.61	68.06
WORST CASE	TREATED	SPACE MOTION SICKNESS (SPACE ADAPTATION)	MEDICAL	54918	15.44	1.42	69.48
WORST CASE	TREATED	BAROTRAUMA (EAR/SINUS BLOCK)	ENVIRONMENTAL	4357	14.43	1.33	70.81
WORST CASE	TREATED	EYE INFECTION	MEDICAL	3641	13.98	1.29	72.10
WORST CASE	TREATED	EYE IRRITATION/ABRASION	INJURY/TRAUMA	3184	11.36	1.05	73.15
WORST CASE	TREATED	INDIGESTION	MEDICAL	3794	9.37	0.86	74.01
WORST CASE	TREATED	NEPHROLITHIASIS	MEDICAL	417	9.32	0.86	74.87
BEST CASE	TREATED	SPACE MOTION SICKNESS (SPACE ADAPTATION)	MEDICAL	309703	8.56	0.79	75.66
WORST CASE	TREATED	MOUTH ULCER	MEDICAL	4175	8.31	0.77	76.43
BEST CASE	TREATED	BACK SPRAIN/STRAIN	INJURY/TRAUMA	285815	8.06	0.74	77.17
WORST CASE	TREATED	SMOKE INHALATION	ENVIRONMENTAL	626	7.50	0.69	77.87
WORST CASE	TREATED	URINARY TRACT INFECTION	MEDICAL	5029	7.45	0.69	78.55
WORST CASE	TREATED	DENTAL EXPOSED PULP	MEDICAL	1034	7.43	0.69	79.24
WORST CASE	TREATED	RESPIRATORY INFECTION	MEDICAL	4487	6.99	0.64	79.88
WORST CASE	TREATED	ACUTE SINUSITIS	MEDICAL	4388	6.91	0.64	80.52

Table 4: DRM 1 (ISS 6) Fully Treated EVAC top 20 Influential Conditions

Scenario	Treated	Medical Condition	Category	Total EVAC	Percent Contribution	Cumulative Percent
WORST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	1294	32.54	32.54
WORST CASE	TREATED	NEPHROLITHIASIS	MEDICAL	417	10.49	43.02
WORST CASE	TREATED	DENTAL ABSCESS	MEDICAL	199	5.00	48.03
WORST CASE	TREATED	SMOKE INHALATION	ENVIRONMENTAL	193	4.85	52.88
WORST CASE	TREATED	SEPSIS	MEDICAL	186	4.68	57.56
WORST CASE	TREATED	WRIST FRACTURE	INJURY/TRAUMA	126	3.17	60.72
WORST CASE	TREATED	HIP/PROXIMAL FEMUR FRACTURE	INJURY/TRAUMA	98	2.46	63.19
BEST CASE	TREATED	STROKE (CEREBROVASCULAR ACCIDENT)	MEDICAL	94	2.36	65.55
WORST CASE	TREATED	BACK SPRAIN/STRAIN	INJURY/TRAUMA	80	2.01	67.56
BEST CASE	TREATED	SEIZURES	MEDICAL	72	1.81	69.37
WORST CASE	TREATED	STROKE (CEREBROVASCULAR ACCIDENT)	MEDICAL	70	1.76	71.13
BEST CASE	TREATED	ANGINA/MYOCARDIAL INFARCTION	MEDICAL	63	1.58	72.72
WORST CASE	TREATED	TRAUMATIC HYPOVOLEMIC SHOCK	INJURY/TRAUMA	58	1.46	74.18
BEST CASE	TREATED	ATRIAL FIBRILLATION/ ATRIAL FLUTTER	MEDICAL	57	1.43	75.61
WORST CASE	TREATED	MEDICATION OVERDOSE/ADVERSE REACTION	MEDICAL	48	1.21	76.82
WORST CASE	TREATED	HEAD INJURY	INJURY/TRAUMA	46	1.16	77.97
BEST CASE	TREATED	TRAUMATIC HYPOVOLEMIC SHOCK	INJURY/TRAUMA	45	1.13	79.10
WORST CASE	TREATED	ACUTE DIVERTICULITIS	MEDICAL	41	1.03	80.14
WORST CASE	TREATED	APPENDICITIS	MEDICAL	40	1.01	81.14
WORST CASE	TREATED	NECK SPRAIN/STRAIN	INJURY/TRAUMA	35	0.88	82.02
WORST CASE	TREATED	TOXIC EXPOSURE (AMMONIA)	ENVIRONMENTAL	35	0.88	82.90
WORST CASE	TREATED	URINARY TRACT INFECTION	MEDICAL	32	0.80	83.71

Table 5: DRM 2 (ISS 12) Fully Treated Average QAMTL per Trial top 20 Influential Conditions

Scenario	Treated	Medical Condition	Category	Total Occurrences	Avg. QAMTL per Trial	Percent Contribution	Cumulative Percent
WORST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	12247	572.52	19.82	19.82
BEST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	161225	437.35	15.14	34.96
WORST CASE	TREATED	SKIN ABRASION	INJURY/TRAUMA	94244	208.33	7.21	42.17
WORST CASE	TREATED	EYE CHEMICAL BURN	ENVIRONMENTAL	8074	126.68	4.39	46.56
WORST CASE	TREATED	SKIN LACERATION	INJURY/TRAUMA	13611	126.00	4.36	50.92
WORST CASE	TREATED	HEARING LOSS	MEDICAL	36264	77.28	2.68	53.60
WORST CASE	TREATED	BACK SPRAIN/STRAIN	INJURY/TRAUMA	11607	67.10	2.32	55.92
BEST CASE	TREATED	EYE IRRITATION/ABRASION	INJURY/TRAUMA	1263465	65.42	2.26	58.18
BEST CASE	TREATED	SKIN RASH	MEDICAL	1693968	48.44	1.68	59.86
WORST CASE	TREATED	EYE INFECTION	MEDICAL	7235	48.27	1.67	61.53
WORST CASE	TREATED	BAROTRAUMA (EAR/SINUS BLOCK)	ENVIRONMENTAL	8593	43.04	1.49	63.02
WORST CASE	TREATED	EYE IRRITATION/ABRASION	INJURY/TRAUMA	6488	42.36	1.47	64.49
BEST CASE	TREATED	SKIN ABRASION	INJURY/TRAUMA	1612531	38.56	1.33	65.82
BEST CASE	TREATED	SLEEP DISORDER	MEDICAL	2401399	38.51	1.33	67.16
BEST CASE	TREATED	BAROTRAUMA (EAR/SINUS BLOCK)	ENVIRONMENTAL	552931	36.38	1.26	68.41
WORST CASE	TREATED	NEPHROLITHIASIS	MEDICAL	772	35.04	1.21	69.63
BEST CASE	TREATED	RESPIRATORY INFECTION	MEDICAL	587966	34.32	1.19	70.82
WORST CASE	TREATED	INDIGESTION	MEDICAL	7606	32.99	1.14	71.96
WORST CASE	TREATED	SMOKE INHALATION	ENVIRONMENTAL	1289	31.77	1.10	73.06
WORST CASE	TREATED	DENTAL EXPOSED PULP	MEDICAL	2079	28.98	1.00	74.06
WORST CASE	TREATED	MOUTH ULCER	MEDICAL	7977	27.97	0.97	75.03
WORST CASE	TREATED	URINARY TRACT INFECTION	MEDICAL	10084	25.24	0.87	75.90
WORST CASE	TREATED	DENTAL ABSCESS	MEDICAL	866	25.06	0.87	76.77
WORST CASE	TREATED	RESPIRATORY INFECTION	MEDICAL	9061	24.88	0.86	77.63
WORST CASE	TREATED	GASTROENTERITIS	MEDICAL	5682	22.68	0.79	78.42

Table 6: DRM 2 (ISS 12) Fully Treated EVAC top 20 Influential Conditions

Scenario	Treated	Medical Condition	Category	Total EVAC	Percent Contribution	Cumulative Percent
WORST CASE	TREATED	VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	MEDICAL	1255	19.46	19.46
WORST CASE	TREATED	NEPHROLITHIASIS	MEDICAL	772	11.97	31.43
WORST CASE	TREATED	DENTAL ABSCESS	MEDICAL	415	6.43	37.86
WORST CASE	TREATED	SEPSIS	MEDICAL	380	5.89	43.75
WORST CASE	TREATED	SMOKE INHALATION	ENVIRONMENTAL	377	5.84	49.60
WORST CASE	TREATED	WRIST FRACTURE	INJURY/TRAUMA	229	3.55	53.15
WORST CASE	TREATED	BACK SPRAIN/STRAIN	INJURY/TRAUMA	173	2.68	55.83
BEST CASE	TREATED	STROKE (CEREBROVASCULAR ACCIDENT)	MEDICAL	157	2.43	58.26
WORST CASE	TREATED	HIP/PROXIMAL FEMUR FRACTURE	INJURY/TRAUMA	155	2.40	60.67
WORST CASE	TREATED	STROKE (CEREBROVASCULAR ACCIDENT)	MEDICAL	154	2.39	63.05
WORST CASE	TREATED	TRAUMATIC HYPOVOLEMIC SHOCK	INJURY/TRAUMA	132	2.05	65.10
BEST CASE	TREATED	ANGINA/MYOCARDIAL INFARCTION	MEDICAL	130	2.02	67.12
BEST CASE	TREATED	ATRIAL FIBRILLATION/ ATRIAL FLUTTER	MEDICAL	129	2.00	69.12
BEST CASE	TREATED	SEIZURES	MEDICAL	114	1.77	70.88
BEST CASE	TREATED	TRAUMATIC HYPOVOLEMIC SHOCK	INJURY/TRAUMA	106	1.64	72.53
WORST CASE	TREATED	HEAD INJURY	INJURY/TRAUMA	105	1.63	74.16
WORST CASE	TREATED	MEDICATION OVERDOSE/ADVERSE REACTION	MEDICAL	96	1.49	75.64
WORST CASE	TREATED	APPENDICITIS	MEDICAL	88	1.36	77.01
WORST CASE	TREATED	ACUTE DIVERTICULITIS	MEDICAL	84	1.30	78.31
WORST CASE	TREATED	TOXIC EXPOSURE (AMMONIA)	ENVIRONMENTAL	76	1.18	79.49
BEST CASE	TREATED	APPENDICITIS	MEDICAL	61	0.95	80.43
WORST CASE	TREATED	HERPES ZOSTER REACTIVATION (SHINGLES)	MEDICAL	53	0.82	81.26
WORST CASE	TREATED	ATRIAL FIBRILLATION/ ATRIAL FLUTTER	MEDICAL	52	0.81	82.06
WORST CASE	TREATED	RESPIRATORY INFECTION	MEDICAL	51	0.79	82.85

Table7: DRM 1 (ISS 6) Probability of Occurrence of 1 or more events. Probability of 1 or more events is broken down into best and worst case

Medical Condition	Probability (> 0)	Probability (>0) Best Case	Probability (>0) Worst Case
SLEEP DISORDER	1.0000	0.9950	0.0050
SKIN ABRASION	0.9998	0.9448	0.0550
SKIN RASH	0.9998	0.9948	0.0050
SPACE MOTION SICKNESS (SPACE ADAPTATION)	0.9986	0.8488	0.1498
EYE IRRITATION/ABRASION	0.9983	0.9933	0.0050
HEADACHE (LATE)	0.9886	0.9788	0.0099
NASAL CONGESTION (SPACE ADAPTATION)	0.9878	0.9829	0.0049
BACK PAIN (SPACE ADAPTATION)	0.9757	0.9611	0.0146
DIARRHEA	0.9510	0.9367	0.0143
RESPIRATORY INFECTION	0.9510	0.9367	0.0143
INSOMNIA (SPACE ADAPTATION)	0.9498	0.9451	0.0047
BACK SPRAIN/STRAIN	0.9466	0.9277	0.0189
BAROTRAUMA (EAR/SINUS BLOCK)	0.9411	0.9270	0.0141
HEADACHE (SPACE ADAPTATION)	0.8848	0.8317	0.0531
VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	0.8756	0.8143	0.0613
SHOULDER SPRAIN/STRAIN	0.8750	0.8575	0.0175
HEADACHE (CO2 INDUCED)	0.8392	0.8182	0.0210
SKIN INFECTION	0.6951	0.6708	0.0243
ELBOW SPRAIN/STRAIN	0.6783	0.6648	0.0136
ANKLE SPRAIN/STRAIN	0.6464	0.6335	0.0129
URINARY TRACT INFECTION	0.6366	0.6047	0.0318
ALLERGIC REACTION (MILD TO MODERATE)	0.6340	0.6086	0.0254
PHARYNGITIS	0.6340	0.6055	0.0285
CONSTIPATION (SPACE ADAPTATION)	0.6065	0.6035	0.0030
NECK SPRAIN/STRAIN	0.5729	0.5614	0.0115
MOUTH ULCER	0.5606	0.5326	0.0280
PARESTHESIAS SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.4869	0.4723	0.0146
KNEE SPRAIN/STRAIN	0.4840	0.4743	0.0097
ACUTE SINUSITIS	0.4220	0.3883	0.0338
EYE CHEMICAL BURN	0.4220	0.3904	0.0317
INDIGESTION	0.4220	0.3925	0.0295
HEARING LOSS	0.3885	0.2428	0.1457
WRIST SPRAIN/STRAIN	0.3766	0.3710	0.0056
EYE INFECTION	0.3667	0.3374	0.0293
FINGERNAIL DELAMINATION SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.3309	0.3127	0.0182
HIP SPRAIN/STRAIN	0.3148	0.3085	0.0063
GASTROENTERITIS	0.3061	0.2817	0.0245
CHOKING/OBSTRUCTED AIRWAY	0.2398	0.2386	0.0012

Medical Condition	Probability (> 0)	Probability (>0) Best Case	Probability (>0) Worst Case
OTITIS EXTERNA	0.2398	0.2362	0.0036
OTITIS MEDIA	0.2398	0.2158	0.0240
VAGINAL YEAST INFECTION	0.1756	0.1493	0.0263
HEMORRHOIDS	0.1670	0.1662	0.0008
MEDICATION OVERDOSE/ADVERSE REACTION	0.1670	0.1662	0.0008
LOWER EXTREMITY (LE) STRESS FRACTURE	0.1109	0.0981	0.0127
FINGER DISLOCATION	0.0873	0.0869	0.0004
HERPES ZOSTER REACTIVATION (SHINGLES)	0.0873	0.0751	0.0122
INFLUENZA	0.0873	0.0655	0.0218
SKIN LACERATION	0.0873	0.0218	0.0655
URINARY RETENTION (SPACE ADAPTATION)	0.0816	0.0694	0.0122
URINARY INCONTINENCE (SPACE ADAPTATION)	0.0556	0.0508	0.0047
DENTAL EXPOSED PULP	0.0490	0.0387	0.0103
DECOMPRESSION SICKNESS SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.0462	0.0458	0.0005
NOSE BLEED (SPACE ADAPTATION)	0.0444	0.0428	0.0016
SMOKE INHALATION	0.0442	0.0380	0.0062
ABNORMAL UTERINE BLEEDING	0.0257	0.0252	0.0005
DENTAL CARIES	0.0233	0.0146	0.0086
DENTAL ABSCESS	0.0202	0.0160	0.0042
HYPERTENSION	0.0160	0.0142	0.0018
DENTAL FILLING LOSS	0.0127	0.0116	0.0011
BURNS SECONDARY TO FIRE	0.0125	0.0125	0.0001
NEPHROLITHIASIS	0.0099	0.0060	0.0039
ACUTE PROSTATITIS	0.0098	0.0091	0.0006
DEPRESSION	0.0076	0.0070	0.0006
ANXIETY	0.0073	0.0070	0.0003
DENTAL AVULSION (TOOTH LOSS)	0.0073	0.0056	0.0017
ACUTE RADIATION SYNDROME	0.0064	0.0064	0.0000
SEPSIS	0.0060	0.0040	0.0020
WRIST FRACTURE	0.0059	0.0047	0.0012
ACUTE ARTHRITIS	0.0049	0.0048	0.0001
ACUTE DIVERTICULITIS	0.0035	0.0026	0.0009
DENTAL CROWN LOSS	0.0026	0.0022	0.0004
APPENDICITIS	0.0023	0.0019	0.0004
STROKE (CEREBROVASCULAR ACCIDENT)	0.0023	0.0015	0.0008
ACUTE CHOLECYSTITIS/BILIARY COLIC	0.0022	0.0020	0.0002
TRAUMATIC HYPOVOLEMIC SHOCK	0.0016	0.0010	0.0006
ANGINA/MYOCARDIAL INFARCTION	0.0015	0.0013	0.0002
ATRIAL FIBRILLATION/ ATRIAL FLUTTER	0.0015	0.0012	0.0003
ANAPHYLAXIS	0.0012	0.0012	0.0000
ABDOMINAL WALL HERNIA	0.0011	0.0010	0.0001
HEAD INJURY	0.0011	0.0005	0.0006

Medical Condition	Probability (> 0)	Probability (>0) Best Case	Probability (>0) Worst Case
EYE CORNEAL ULCER	0.0009	0.0009	0.0000
HIP/PROXIMAL FEMUR FRACTURE	0.0009	0.0001	0.0008
ACUTE PANCREATITIS	0.0008	0.0006	0.0001
SEIZURES	0.0007	0.0006	0.0001
CHEST INJURY	0.0006	0.0002	0.0004
LUMBAR SPINE FRACTURE	0.0005	0.0004	0.0001
ABDOMINAL INJURY	0.0004	0.0003	0.0001
TOXIC EXPOSURE (AMMONIA)	0.0004	0.0000	0.0004
RETINAL DETACHMENT	0.0003	0.0001	0.0002
ACUTE ANGLE-CLOSURE GLAUCOMA	0.0001	0.0001	0.0000
ACUTE COMPARTMENT SYNDROME	0.0001	0.0001	0.0001
ALTITUDE SICKNESS	0.0001	0.0001	0.0000
ELBOW DISLOCATION	0.0001	0.0001	0.0000
SHOULDER DISLOCATION	0.0001	0.0000	0.0001
BEHAVIORAL EMERGENCY	0.0000	0.0000	0.0000
CARDIOGENIC SHOCK SECONDARY TO MYOCARDIAL INFARCTION	0.0000	0.0000	0.0000
EYE PENETRATION (FOREIGN BODY)	0.0000	0.0000	0.0000
NEUROGENIC SHOCK	0.0000	0.0000	0.0000
SUDDEN CARDIAC ARREST	0.0000	0.0000	0.0000

Table 8: DRM 2 (ISS 12) Probability of Occurrence of 1 or more events. Probability of 1 or more events is broken down into best and worst case

Medical Condition	Probability (> 0)	Probability (>0) Best Case	Probability (>0) Worst Case
EYE IRRITATION/ABRASION	1.0000	0.9950	0.0050
SKIN ABRASION	1.0000	0.9450	0.0550
SKIN RASH	1.0000	0.9950	0.0050
SLEEP DISORDER	1.0000	0.9950	0.0050
HEADACHE (LATE)	0.9999	0.9899	0.0100
SPACE MOTION SICKNESS (SPACE ADAPTATION)	0.9986	0.8488	0.1498
DIARRHEA	0.9976	0.9826	0.0150
RESPIRATORY INFECTION	0.9976	0.9826	0.0150
BACK SPRAIN/STRAIN	0.9971	0.9772	0.0199
BAROTRAUMA (EAR/SINUS BLOCK)	0.9965	0.9816	0.0149
NASAL CONGESTION (SPACE ADAPTATION)	0.9878	0.9829	0.0049
SHOULDER SPRAIN/STRAIN	0.9844	0.9647	0.0197
BACK PAIN (SPACE ADAPTATION)	0.9757	0.9611	0.0146
HEADACHE (CO2 INDUCED)	0.9741	0.9498	0.0244
INSOMNIA (SPACE ADAPTATION)	0.9498	0.9451	0.0047

IMM Service Request Report – Training
S-20180521-403

SKIN INFECTION	0.9071	0.8753	0.0317
ELBOW SPRAIN/STRAIN	0.8965	0.8786	0.0179
HEADACHE (SPACE ADAPTATION)	0.8848	0.8317	0.0531
VISUAL IMPAIRMENT AND/OR INCREASED INTRACRANIAL PRESSURE (VIIP)(SPACE ADAPTATION)	0.8756	0.8143	0.0613
ANKLE SPRAIN/STRAIN	0.8750	0.8575	0.0175
URINARY TRACT INFECTION	0.8679	0.8245	0.0434
ALLERGIC REACTION (MILD TO MODERATE)	0.8660	0.8314	0.0346
PHARYNGITIS	0.8660	0.8271	0.0390
NECK SPRAIN/STRAIN	0.8176	0.8012	0.0164
MOUTH ULCER	0.8069	0.7666	0.0403
PARESTHESIAS SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.7368	0.7147	0.0221
KNEE SPRAIN/STRAIN	0.7337	0.7191	0.0147
ACUTE SINUSITIS	0.6660	0.6127	0.0533
EYE CHEMICAL BURN	0.6660	0.6160	0.0499
INDIGESTION	0.6660	0.6193	0.0466
HEARING LOSS	0.6260	0.3913	0.2348
WRIST SPRAIN/STRAIN	0.6114	0.6022	0.0092
CONSTIPATION (SPACE ADAPTATION)	0.6065	0.6035	0.0030
EYE INFECTION	0.5990	0.5511	0.0479
FINGERNAIL DELAMINATION SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.5523	0.5219	0.0304
HIP SPRAIN/STRAIN	0.5305	0.5199	0.0106
GASTROENTERITIS	0.5186	0.4771	0.0415
CHOKING/OBSTRUCTED AIRWAY	0.4220	0.4199	0.0021
OTITIS EXTERNA	0.4220	0.4157	0.0063
OTITIS MEDIA	0.4220	0.3798	0.0422
VAGINAL YEAST INFECTION	0.3204	0.2723	0.0481
HEMORRHOIDS	0.3061	0.3046	0.0015
MEDICATION OVERDOSE/ADVERSE REACTION	0.3061	0.3046	0.0015
LOWER EXTREMITY (LE) STRESS FRACTURE	0.2094	0.1853	0.0241
FINGER DISLOCATION	0.1670	0.1662	0.0008
HERPES ZOSTER REACTIVATION (SHINGLES)	0.1670	0.1436	0.0234
INFLUENZA	0.1670	0.1253	0.0418
SKIN LACERATION	0.1670	0.0418	0.1253
DENTAL EXPOSED PULP	0.0956	0.0755	0.0201
DECOMPRESSION SICKNESS SECONDARY TO EXTRAVEHICULAR ACTIVITY	0.0903	0.0894	0.0009
SMOKE INHALATION	0.0864	0.0743	0.0121
URINARY RETENTION (SPACE ADAPTATION)	0.0816	0.0694	0.0122
URINARY INCONTINENCE (SPACE ADAPTATION)	0.0556	0.0508	0.0047
ABNORMAL UTERINE BLEEDING	0.0507	0.0497	0.0010
DENTAL CARIES	0.0460	0.0290	0.0170
NOSE BLEED (SPACE ADAPTATION)	0.0444	0.0428	0.0016
DENTAL ABSCESS	0.0400	0.0316	0.0084
HYPERTENSION	0.0318	0.0281	0.0037

IMM Service Request Report – Training
S-20180521-403

DENTAL FILLING LOSS	0.0252	0.0230	0.0023
BURNS SECONDARY TO FIRE	0.0249	0.0248	0.0001
NEPHROLITHIASIS	0.0196	0.0119	0.0077
ACUTE PROSTATITIS	0.0194	0.0181	0.0013
DEPRESSION	0.0151	0.0139	0.0012
ANXIETY	0.0146	0.0139	0.0007
DENTAL AVULSION (TOOTH LOSS)	0.0145	0.0112	0.0033
ACUTE RADIATION SYNDROME	0.0127	0.0127	0.0001
SEPSIS	0.0119	0.0079	0.0040
WRIST FRACTURE	0.0117	0.0093	0.0024
ACUTE ARTHRITIS	0.0098	0.0096	0.0002
ACUTE DIVERTICULITIS	0.0071	0.0053	0.0018
DENTAL CROWN LOSS	0.0052	0.0043	0.0008
APPENDICITIS	0.0047	0.0038	0.0008
STROKE (CEREBROVASCULAR ACCIDENT)	0.0046	0.0030	0.0016
ACUTE CHOLECYSTITIS/BILIARY COLIC	0.0043	0.0039	0.0004
TRAUMATIC HYPOVOLEMIC SHOCK	0.0032	0.0019	0.0013
ATRIAL FIBRILLATION/ ATRIAL FLUTTER	0.0031	0.0025	0.0006
ANGINA/MYOCARDIAL INFARCTION	0.0030	0.0025	0.0004
ANAPHYLAXIS	0.0025	0.0024	0.0000
ABDOMINAL WALL HERNIA	0.0023	0.0020	0.0003
HEAD INJURY	0.0021	0.0009	0.0012
EYE CORNEAL ULCER	0.0018	0.0018	0.0000
HIP/PROXIMAL FEMUR FRACTURE	0.0018	0.0001	0.0017
ACUTE PANCREATITIS	0.0015	0.0013	0.0003
CHEST INJURY	0.0013	0.0004	0.0008
SEIZURES	0.0013	0.0012	0.0002
LUMBAR SPINE FRACTURE	0.0010	0.0008	0.0002
ABDOMINAL INJURY	0.0008	0.0006	0.0002
TOXIC EXPOSURE (AMMONIA)	0.0008	0.0000	0.0008
RETINAL DETACHMENT	0.0005	0.0002	0.0003
ACUTE COMPARTMENT SYNDROME	0.0003	0.0001	0.0002
ALTITUDE SICKNESS	0.0003	0.0003	0.0000
ELBOW DISLOCATION	0.0003	0.0002	0.0000
ACUTE ANGLE-CLOSURE GLAUCOMA	0.0002	0.0001	0.0000
SHOULDER DISLOCATION	0.0002	0.0000	0.0002
BEHAVIORAL EMERGENCY	0.0001	0.0001	0.0000
SUDDEN CARDIAC ARREST	0.0001	0.0000	0.0001
CARDIOGENIC SHOCK SECONDARY TO MYOCARDIAL INFARCTION	0.0000	0.0000	0.0000
EYE PENETRATION (FOREIGN BODY)	0.0000	0.0000	0.0000
NEUROGENIC SHOCK	0.0000	0.0000	0.0000

Table9: DRM 1 (ISS 6) Resource Utilization - Resources in the list that may require additional crew training are highlighted in yellow for ease of reference.

Resource	Mean Quantity Required
TYLENOL (ACETAMINOPHEN) 325 MG	88.40628
MOTRIN (IBUPROFEN) 400MG	77.07638
BENADRYL 25 MG CAPSULE	35.32253
BZK WIPES	25.44966
BACTRIM DS (SULFAMETHOXAZOLE/TRIMETHOPRIM) 800 MG/160 MG TABLET	24.76568
NITRILE GLOVES (LARGE, MEDIUM, AND SMALL) (PAIR)	18.60009
GAUZE PADS (4X4)	18.37014
BANDAID STRIP	16.18444
AMBIEN 10MG TABLET	14.28958
COTTON SWABS	14.10355
CAMERA	10.39385
PANOPTIC OPHTHALMOSCOPE	10.39262
DIAMOX (ACETAZOLAMIDE) 250 MG TABLETS	10.227
FLUORESCEIN 1MG STRIPS	10.22135
THERMOMETER	9.50675
HOT AND COLD PAD	9.25105
REFRESH ARTIFICIAL TEARS (CARBOXYMETHYLCELLULOSE) 0.5%, 0.4ML BOTTLE	9.0588142
DISPOSABLE OTOSCOPE SPECULA	8.90193
VICODIN HP (HYDROCODONE/ ACETAMINOPHEN HP) 10 MG/660 MG	5.75763
SYRINGE (3CC)	5.46854
IMODIUM (LOPERAMIDE HCL) 2 MG TABLET	4.9237
AMOXICILLIN 500 MG CAPSULE	4.78396
STETHOSCOPE	4.77737
SUDAFED 12 HOUR (PSEUDOEPHEDRINE) 120 MG	4.60552
BENZOCAINE SWAB STICK ORAL 20%, 0.15 ML SWAB	4.28625
OTOSCOPE HANDLE	3.95963
OTOSCOPE HEAD	3.95963
OTOSCOPE USB CABLE	3.95963
SHARPS CONTAINER	3.89664
PROMETHAZINE INJECTABLE (PHENERGAN) 50MG/ML SINGLE DOSE VIAL	3.816545
URINE CHEMSTRIPS	3.80625
CLEOCIN (CLINDAMYCIN) 300MG	3.6922
PHENERGAN (PROMETHAZINE TABLET) 25 MG	3.6015
ACE BANDAGE 3 INCHES	3.47032
BLOOD OXIMETER	3.40097
PRILOSEC 20MG	2.9561
AFRIN (OXYMETAZOLINE) 0.05% 15ML BOTTLE	2.4225416

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
DULCOLAX (BISACODYL) TABLET 5MG	2.08401
ULTRASOUND MACHINE	1.99872
LEVAQUIN (LEVOFLOXACIN) 500MG	1.89072
VALACYCLOVIR 1 GM TABLET	1.88652
TONOMETER	1.73632
TONOMETER TIP COVER	1.73631
SPACE ANTICIPATION GLASSES	1.73596
TROPICAMIDE 1%	1.73593
TONGUE DEPRESSOR	1.32344
FOAM ELECTRODES	1.26977
WATER	1.12625
URINE COLOR CHART	1.01061
PEPTO-BISMOL 262MG CHEWABLE TABS	1.00508
PENLIGHT	0.99952
LOPRESSOR (METOPROLOL) 50 MG	0.89744
FLUOCINONIDE 0.05%, 30GM TUBE	0.8412732
PREDNISONE 20 MG	0.83948
EFFEXOR XR (VENLAFAXINE XR) 75 MG CAPSULES	0.64183
BLOOD PRESSURE /ECG MONITOR	0.58844
EYEWASH WASTE WATER BAG	0.58491
BLOOD PRESSURE CUFF - LARGE	0.56413
SCISSORS - TRAUMA	0.55924
EYE WASH GOGGLES & TUBING	0.54427
SPACE STATION EYE WASH	0.54427
TORADOL (KETOROLAC) 30MG/ML, 2ML SINGLE DOSE VIAL	0.49557
ULTRASOUND GEL	0.41747
ZOLOFT (SERTRALINE) 50 MG	0.39905
SMOOTH FORCEPS	0.27712
EAR WICK	0.27553
MOXIFLOXACIN (AVELOX) 0.5%, 3ML BOTTLE	0.2742573
HEIMLICH MANEUVER	0.27229
ZITHROMAX (AZITHROMYCIN) 250 MG	0.26654
IODINE SWAB STICK	0.26288
ERTAPENEM 1GM	0.2543
CYCLOPENTOLATE 2% 15ML BOTTLE.	0.250776643
DIFLUCAN (FLUCONAZOLE) 150 MG	0.2482
IV FLUID 1L (1000ML)	0.22972
NEEDLE (23G)	0.22181
ZOFRAN (ONDANSETRON) 8 MG TABLET	0.19578
ACE BANDAGE 4 INCHES	0.18974
ESTROGEN 1.25 MG TABLETS	0.18362
CMRS	0.18149

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
STERILE GLOVES (LARGE, MEDIUM, AND SMALL) (PAIR)	0.17037
COTTON BALLS	0.16154
ACE BANDAGE 2 INCHES	0.16025
MUIPIROCIN (BACTROBAN) 2%, 22 GM TUBE	0.15572194
LOTRIMIN AF CREAM (CLOTRIMAZOLE) 1%, 30GM TUBE	0.15439
SAM SPLINT - LEG/ARM SPLINT	0.14228
PROPARACAINE EYE DROPS 0.5%, 15ML BOTTLE	0.11932305
FLAGYL (METRONIDAZOLE) 500MG	0.11751
DENTAL MIRROR (H)	0.11683
SYRINGE (10CC)	0.11397
IV ADMINISTRATION SET	0.10203
URINE CATHETER SHORT	0.10179
URINE CATHETER STRAIGHT	0.10179
TOURNIQUET	0.10053
TAMSULOSIN 0.4 MG TABLET	0.09733
IV PRESSURE INFUSER	0.09688
BACITRACIN 500 UNITS/GM. 28 GM TUBE	0.09093255
FINGER SPLINT	0.09051
LIDOCAINE JELLY 2% 30ML TUBE	0.0876017
DILAUDID (HYDROMORPHONE) 2MG/ML, 1ML SYRINGE	0.08381
COTTON PELLET	0.08176
IV CAP	0.07931
IV CATHETER (18G)	0.0764
DENTAL EUGENOL ANESTHETIC 1ML ORAL SYRINGE	0.07575
CIPROFLOXACIN AND DEXAMETHASONE (CIPRODEX) 3%,7%, 7.5 ML BOTTLE	0.0702156
SKIN STAPLE REMOVER	0.06858
SKIN STAPLER	0.06857
NEEDLE DRIVER (AA)	0.06812
NYLON SUTURE 5.0	0.06812
SUTURE SCISSORS (BB)	0.06812
TOOTHED FORCEPS (EE)	0.06812
ABSORBABLE SUTURE 3.0	0.06811
NYLON SUTURE 2.0	0.06811
MEDICAL TAPE	0.0619227
ATIVAN (LORAZEPAM) 1 MG TABLET	0.05434
ASPIRIN 325MG TAB.	0.04915
DCS EXAMINATION SCORECARD	0.04578
DERMABOND APPLICATOR 0.5ML	0.04475
SILVER NITRATE STICK 75%/25%	0.04331
LIDOCAINE (XYLOCAINE) PLAIN 1%, 10ML MULTI DOSE VIAL	0.042875
NONSTICK BANDAGE (TEFAPADS)	0.03985
ZANTAC (RANITIDINE) 150 MG	0.03939

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
DEXAMETHASONE (DECADRON) 10MG INJECTABLE	0.03679
IV CATHETER (20G)	0.02725
BURN BANDAGE	0.02626
EPT	0.02626
DENTAL EXPLORER/PROBE (E)	0.02429
NITROGLYCERIN TABLET 0.4MG	0.02082
VALIUM (DIAZEPAM) 5 MG/ML, 2 ML SYRINGE	0.01973
URINARY COLLECTION BAG (LEG BAG)	0.01527
PSYCHOTHERAPY	0.01443
ALBUTEROL INHALER (PROVENTIL) 90 MCG, 6.7 GM	0.01406
VARIABLE OXYGEN SYSTEM	0.01403
SURGICAL LUBRICANT	0.0137
DENTAL CARVER FILE (G)	0.0133
AMBU BAG AND MASK	0.01299
TEMPORARY TOOTH FILLING	0.01287
ILMA ENDOTRACHEAL TUBE 7.0/7.5 & ENDOTRACHEAL TUBE 7.0/8.0	0.01255
ILMA SYRINGE	0.01205
SUCTION DEVICE	0.01205
SUCTION DEVICE COLLECTION BAG	0.01205
SUCTION DEVICE SYRINGE	0.01205
VOS INTUBATED PATIENT HARDWARE (VENTILATOR/RESPIRATOR)	0.01205
SUCTION TIP - MOUTH (CURETTE)	0.01154
NEEDLE [25G]	0.01087
INTRAOSSEOUS DEVICE STARTER KIT	0.00937
INTRAOSSEOUS INJECTION DEVICE	0.00937
ETHINYL ESTRADIOL / NORGESTREL 0.05 MG/ 0.5 MG	0.00786
ADRENALINE (EPINEPHRINE 1:10000) 10ML	0.00586
MAXIMUM ABSORBENCY GARMENT (MAG)	0.00554
DILANTIN (PHENYTOIN) 300MG CAPSULES	0.00498
SALINE NOSE SPRAY 22ML BOTTLE	0.004449
DENTAL ELEVATOR - 301 (I)	0.00422
DENTAL ELEVATOR - 34S (J)	0.00422
DENTAL FORCEPS-10S (A)	0.00422
DENTAL FORCEPS-151A (B)	0.00422
DENTAL FORCEPS-17 (C)	0.00422
KETAMINE 50 MG/ML, 10 ML MULTI DOSE VIAL	0.003615
ILMA STABILIZING ROD	0.00322
ROCEPHIN (CEFTRIAXONE) 1 GM	0.003146667
ILMA CUE CARD	0.00272
CLEAR BANDAGE	0.0016
NASAL PACKING (POSTERIOR NASAL PACKING)	0.00157

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
LIDOCAINE W/ EPINEPHRINE (XYLOCAINE) 2 %, 2-ML UNITS 1:100,000 EPI, 20 ML. MULTI DOSE VIALS.	0.001535
ATROPINE 1 MG, 10ML SYRINGE.	0.00121
EPIPEN 1:1000	0.00121
BENADRYL 50 MG/ML, 1ML INJECTABLE	0.0012
HEMOSTATS	0.00115
SCALPEL #11 (SCALPEL BLADE & HANDLE)	0.00115
IV CATHETER (14G)	0.001
ENDOTRACHEAL STYLET	0.00084
IV CATHETER (22G)	0.00083
ERYTHROMYCIN OINTMENT 0.5%, 3.5 GM TUBE	0.00082
BIOHAZARD TRASH BAG	0.0008
SUCTION TUBING - ENDOTRACHEAL TUBE	0.0005
SYRINGE (35CC)	0.0005
DENTAL ADHESIVE TIP	0.00043
URINE CATHETER FOLEY	0.00013
SUCTION TUBING - GASTRIC TUBE	0.00012
DENTAL ADHESIVE (76 GRAMS)	0.000043
AED	0.00003
LIDOCAINE (XYLOCAINE) CARDIAC 2% (20MG/ML) 5ML SYRINGE	0.00003
EYE SHIELD	0.00002
LARYNGOSCOPE (BLADE)	0.00001
LARYNGOSCOPE HANDLE	0.00001
ABILIFY (ARIPIRAZOLE) 5 MG	0
ABILIFY (ARIPIRAZOLE) 7.5 MG/ML, 1.3 ML	0
ANTIVERT (MECLIZINE) 25 MG	0
BANDAID (2X3)	0
BANDAID (KNUCKLE)	0
BANDAID DOT	0
BLOOD PRESSURE CUFF - SMALL	0
BOUGIE ET TUBE INTRODUCER	0
CLARITIN (LORATADINE)10MG TABLET	0
DEBROX FOR EARWAX (CARBAMIDE PEROXIDE) 6.5% 15ML BOTTLE	0
DENTAL AMALGAM FILE	0
DENTAL CROWN REMOVER	0
DENTAL SYRINGE (TUBEX)	0
EAR CURETTE	0
EYE SIMULATOR CORNEA	0
FLUTICASONE 220MCG, 12GM INHALER	0
G1 CAMCORDER	0
ILMA HARDWARE	0

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
MELATONIN 3 MG	0
MIRROR	0
NASAL AIRWAY 6MM	0
NASAL AIRWAY 7MM	0
NEEDLE PLASTIC	0
ORAL AIRWAY	0
OXYGEN MASK - RESUSCITATION MASK	0
OXYGEN TUBING	0
PROVIGIL (MODAFINIL) 200 MG TABLETS	0
REFRESH EYE OINTMENT (PETROLATUM WHITE AND MINERAL OIL) 42.5%; 57.3%, 3.5GM	0
ROBINUL (GLYCOPYRROLATE) 0.2MG/ML	0
ROLLED GAUZE	0
STETHOSCOPE EAR PIECES	0
SUCTION CARTRIDGE	0
SUDAFED (PSEUDOEPHEDRINE) 30MG	0
SURGICAL TOOLS KIT	0
SYRINGE (5CC)	0
SYRINGE (60ML)	0
TOBRAMYCIN AND DEXAMETHASONE 0.3%; 0.1%, 10ML BOTTLE	0
URINE CATHETER COUDE	0
WOUND PACKING	0
ZYRTEC (CETIRIZINE) 10 MG TABLET	0

Table10: DRM 2 (ISS 12) Resource Utilization - Resources in the list that may require additional crew training are highlighted in yellow for ease of reference.

Resource	Mean Quantity Required
TYLENOL (ACETAMINOPHEN) 325 MG	176.00371
MOTRIN (IBUPROFEN) 400MG	146.764595
BENADRYL 25 MG CAPSULE	70.88563
BZK WIPES	43.42111
NITRILE GLOVES (LARGE, MEDIUM, AND SMALL) (PAIR)	37.00987
BACTRIM DS (SULFAMETHOXAZOLE/TRIMETHOPRIM) 800 MG/160 MG TABLET	36.91026667
GAUZE PADS (4X4)	36.67717
BANDAID STRIP	32.21611
COTTON SWABS	27.98674
AMBIEN 10MG TABLET	26.26183
CAMERA	20.66542
PANOPTIC OPHTHALMOSCOPE	18.9789
THERMOMETER	18.79673
HOT AND COLD PAD	18.4285
DISPOSABLE OTOSCOPE SPECULA	17.55708
CLEOCIN (CLINDAMYCIN) 300MG	17.374295
FLUORESCEIN 1MG STRIPS	16.93635
REFRESH ARTIFICIAL TEARS (CARBOXYMETHYLCELLULOSE) 0.5%, 0.4ML BOTTLE	16.3545441
VICODIN HP (HYDROCODONE/ ACETAMINOPHEN HP) 10 MG/660 MG	11.11724
DIAMOX (ACETAZOLAMIDE) 250 MG TABLETS	10.28968
IMODIUM (LOPERAMIDE HCL) 2 MG TABLET	9.77684
AMOXICILLIN 500 MG CAPSULE	9.615115
STETHOSCOPE	9.49675
SUDAFED 12 HOUR (PSEUDOEPHEDRINE) 120 MG	8.9983005
BENZOCAINE SWAB STICK ORAL 20%, 0.15 ML SWAB	8.54085
OTOSCOPE HANDLE	7.82021
OTOSCOPE HEAD	7.82021
OTOSCOPE USB CABLE	7.82021
URINE CHEMSTRIPS	7.51834
LEVAQUIN (LEVOFLOXACIN) 500MG	6.954983333
ACE BANDAGE 3 INCHES	6.89365
BLOOD OXIMETER	6.74794
PRILOSEC 20MG	6.27175
SYRINGE (3CC)	5.64441
SHARPS CONTAINER	4.14556
PHENERGAN (PROMETHAZINE TABLET) 25 MG	4.10617
AFRIN (OXYMETAZOLINE) 0.05% 15ML BOTTLE	4.0920172

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
PROMETHAZINE INJECTABLE (PHENERGAN) 50MG/ML SINGLE DOSE VIAL	3.875215
VALACYCLOVIR 1 GM TABLET	3.78774
TONGUE DEPRESSOR	2.64333
FOAM ELECTRODES	2.5428
DULCOLAX (BISACODYL) TABLET 5MG	2.45253
ULTRASOUND MACHINE	2.25821
WATER	2.24756
URINE COLOR CHART	2.02571
PEPTO-BISMOL 262MG CHEWABLE TABS	2.01558
PENLIGHT	1.99158
LOPRESSOR (METOPROLOL) 50 MG	1.81954
TONOMETER	1.73542
TONOMETER TIP COVER	1.73542
SPACE ANTICIPATION GLASSES	1.73471
TROPICAMIDE 1%	1.73469
FLUOCINONIDE 0.05%, 30GM TUBE	1.68876905
PREDNISONE 20 MG	1.68466
EFFEXOR XR (VENLAFAXINE XR) 75 MG CAPSULES	1.38989
BLOOD PRESSURE /ECG MONITOR	1.18202
EYEWASH WASTE WATER BAG	1.16843
SCISSORS - TRAUMA	1.12471
EYE WASH GOGGLES & TUBING	1.08844
SPACE STATION EYE WASH	1.08844
TORADOL (KETOROLAC) 30MG/ML, 2ML SINGLE DOSE VIAL	1.058
BLOOD PRESSURE CUFF - LARGE	1.01417
ZOLOFT (SERTRALINE) 50 MG	0.86569
ULTRASOUND GEL	0.83194
ASPIRIN 325MG TAB.	0.76239
MOXIFLOXACIN (AVELOX) 0.5%, 3ML BOTTLE	0.5471538
HEIMLICH MANEUVER	0.54695
SMOOTH FORCEPS	0.54691
EAR WICK	0.54496
ZITHROMAX (AZITHROMYCIN) 250 MG	0.5413
ERTAPENEM 1GM	0.52228
IODINE SWAB STICK	0.51596
CYCLOPENTOLATE 2% 15ML BOTTLE.	0.501109752
DIFLUCAN (FLUCONAZOLE) 150 MG	0.49174
IV FLUID 1L (1000ML)	0.45777
NEEDLE (23G)	0.45148
ZOFRAN (ONDANSETRON) 8 MG TABLET	0.38266
ACE BANDAGE 4 INCHES	0.37855
CMRS	0.36355

Resource (cont.)	Mean Quantity Required
ESTROGEN 1.25 MG TABLETS	0.36222
ACE BANDAGE 2 INCHES	0.31958
MUPIROCI (BACTROBAN) 2%, 22 GM TUBE	0.31294402
LOTRIMIN AF CREAM (CLOTRIMAZOLE) 1%, 30GM TUBE	0.3092182
SAM SPLINT - LEG/ARM SPLINT	0.28171
STERILE GLOVES (LARGE, MEDIUM, AND SMALL) (PAIR)	0.23755
FLAGYL (METRONIDAZOLE) 500MG	0.23439
DENTAL MIRROR (H)	0.2322
PROPARACAINE EYE DROPS 0.5%, 15ML BOTTLE	0.21541556
IV ADMINISTRATION SET	0.20246
TOURNIQUET	0.19844
TAMSULOSIN 0.4 MG TABLET	0.19689
IV PRESSURE INFUSER	0.19207
BACITRACIN 500 UNITS/GM. 28 GM TUBE	0.18050712
FINGER SPLINT	0.17959
COTTON BALLS	0.16726
ZANTAC (RANITIDINE) 150 MG	0.16541
COTTON PELLET	0.16316
DILAUDID (HYDROMORPHONE) 2MG/ML, 1ML SYRINGE	0.16203
IV CAP	0.15509
DENTAL EUGENOL ANESTHETIC 1ML ORAL SYRINGE	0.15126
IV CATHETER (18G)	0.1494
LIDOCAINE JELLY 2% 30ML TUBE	0.1407478
CIPROFLOXACIN AND DEXAMETHASONE (CIPRODEX) 3%,7%, 7.5 ML BOTTLE	0.1404162
SKIN STAPLE REMOVER	0.13699
SKIN STAPLER	0.13697
NEEDLE DRIVER (AA)	0.13594
NYLON SUTURE 5.0	0.13594
SUTURE SCISSORS (BB)	0.13594
TOOTHED FORCEPS (EE)	0.13594
ABSORBABLE SUTURE 3.0	0.13592
NYLON SUTURE 2.0	0.13592
SYRINGE (10CC)	0.12589
MEDICAL TAPE	0.1089511
ATIVAN (LORAZEPAM) 1 MG TABLET	0.10838
URINE CATHETER SHORT	0.10056
URINE CATHETER STRAIGHT	0.10056
DCS EXAMINATION SCORECARD	0.09244
DERMABOND APPLICATOR 0.5ML	0.0908
LIDOCAINE (XYLOCAINE) PLAIN 1%, 10ML MULTI DOSE VIAL	0.08671
SILVER NITRATE STICK 75%/25%	0.08138
NONSTICK BANDAGE (TEFLA PADS)	0.07541

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
DEXAMETHASONE (DECADRON) 10MG INJECTABLE	0.07516
IV CATHETER (20G)	0.05534
EPT	0.05108
BURN BANDAGE	0.05024
DENTAL EXPLORER/PROBE (E)	0.04819
NITROGLYCERIN TABLET 0.4MG	0.03895
VALIUM (DIAZEPAM) 5 MG/ML, 2 ML SYRINGE	0.03742
VARIABLE OXYGEN SYSTEM	0.02928
PSYCHOTHERAPY	0.02915
ALBUTEROL INHALER (PROVENTIL) 90 MCG, 6.7 GM	0.02899
SURGICAL LUBRICANT	0.02832
AMBU BAG AND MASK	0.02702
DENTAL CARVER FILE (G)	0.02598
ILMA ENDOTRACHEAL TUBE 7.0/7.5 & ENDOTRACHEAL TUBE 7.0/8.0	0.02585
TEMPORARY TOOTH FILLING	0.02506
ILMA SYRINGE	0.02498
SUCTION DEVICE	0.02498
SUCTION DEVICE COLLECTION BAG	0.02498
SUCTION DEVICE SYRINGE	0.02498
VOS INTUBATED PATIENT HARDWARE (VENTILATOR/RESPIRATOR)	0.02498
SUCTION TIP - MOUTH (CURETTE)	0.02411
NEEDLE [25G]	0.02298
INTRAOSSEOUS DEVICE STARTER KIT	0.02049
INTRAOSSEOUS INJECTION DEVICE	0.02049
ROCEPHIN (CEFTRIAXONE) 1 GM	0.016084167
ETHINYL ESTRADIOL / NORGESTREL 0.05 MG/ 0.5 MG	0.01588
URINARY COLLECTION BAG (LEG BAG)	0.01486
ADRENALINE (EPINEPHRINE 1:10000) 10ML	0.01251
DENTAL ELEVATOR - 301 (I)	0.00864
DENTAL ELEVATOR - 34S (J)	0.00864
DENTAL FORCEPS-10S (A)	0.00864
DENTAL FORCEPS-151A (B)	0.00864
DENTAL FORCEPS-17 (C)	0.00864
DILANTIN (PHENYTOIN) 300MG CAPSULES	0.0082
KETAMINE 50 MG/ML, 10 ML MULTI DOSE VIAL	0.007494
ILMA STABILIZING ROD	0.00642
ILMA CUE CARD	0.00555
MAXIMUM ABSORBENCY GARMENT (MAG)	0.00527
SALINE NOSE SPRAY 22ML BOTTLE	0.004443
CLEAR BANDAGE	0.0032

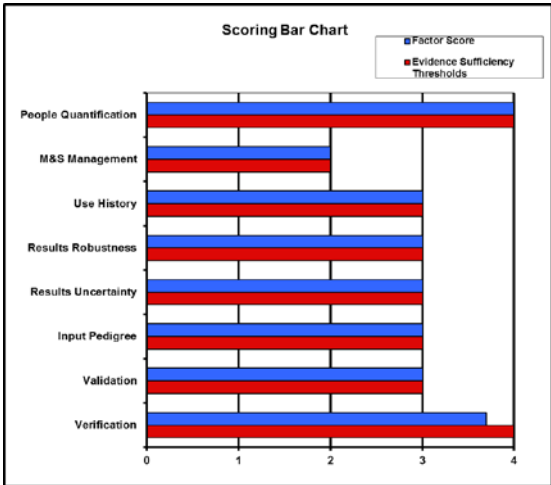
<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
LIDOCAINE W/ EPINEPHRINE (XYLOCAINE) 2 %, 2-ML UNITS 1:100,000 EPI, 20 ML. MULTI DOSE VIALS.	0.002948
BENADRYL 50 MG/ML, 1ML INJECTABLE	0.00249
EPIPEN 1:1000	0.00249
HEMOSTATS	0.00247
SCALPEL #11 (SCALPEL BLADE & HANDLE)	0.00247
ATROPINE 1 MG, 10ML SYRINGE.	0.00238
ERYTHROMYCIN OINTMENT 0.5%, 3.5 GM TUBE	0.00194
BIOHAZARD TRASH BAG	0.00187
NASAL PACKING (POSTERIOR NASAL PACKING)	0.00177
ENDOTRACHEAL STYLET	0.00174
IV CATHETER (14G)	0.00174
IV CATHETER (22G)	0.00174
DENTAL ADHESIVE TIP	0.00092
SUCTION TUBING - ENDOTRACHEAL TUBE	0.00087
SYRINGE (35CC)	0.00087
URINE CATHETER FOLEY	0.00032
SUCTION TUBING - GASTRIC TUBE	0.00031
DENTAL ADHESIVE (76 GRAMS)	0.000092
AED	0.00008
LIDOCAINE (XYLOCAINE) CARDIAC 2% (20MG/ML) 5ML SYRINGE	0.00008
ABILIFY (ARIPIRAZOLE) 7.5 MG/ML, 1.3 ML	0.00003
EYE SHIELD	0.00001
SUDAFED (PSEUDOEPHEDRINE) 30MG	2E-06
ABILIFY (ARIPIRAZOLE) 5 MG	0
ANTIVERT (MECLIZINE) 25 MG	0
BANDAID (2X3)	0
BANDAID (KNUCKLE)	0
BANDAID DOT	0
BLOOD PRESSURE CUFF - SMALL	0
BOUGIE ET TUBE INTRODUCER	0
CLARITIN (LORATADINE)10MG TABLET	0
DEBROX FOR EARWAX (CARBAMIDE PEROXIDE) 6.5% 15ML BOTTLE	0
DENTAL AMALGAM FILE	0
DENTAL CROWN REMOVER	0
DENTAL SYRINGE (TUBEX)	0
EAR CURETTE	0
EYE SIMULATOR CORNEA	0
FLUTICASONE 220MCG, 12GM INHALER	0
G1 CAMCORDER	0
ILMA HARDWARE	0

<u>Resource (cont.)</u>	<u>Mean Quantity Required</u>
LARYNGOSCOPE (BLADE)	0
LARYNGOSCOPE HANDLE	0
MELATONIN 3 MG	0
MIRROR	0
NASAL AIRWAY 6MM	0
NASAL AIRWAY 7MM	0
NEEDLE PLASTIC	0
ORAL AIRWAY	0
OXYGEN MASK - RESUSCITATION MASK	0
OXYGEN TUBING	0
PROVIGIL (MODAFINIL) 200 MG TABLETS	0
REFRESH EYE OINTMENT (PETROLATUM WHITE AND MINERAL OIL) 42.5%; 57.3%, 3.5GM	0
ROBINUL (GLYCOPYRROLATE) 0.2MG/ML	0
ROLLED GAUZE	0
STETHOSCOPE EAR PIECES	0
SUCTION CARTRIDGE	0
SURGICAL TOOLS KIT	0
SYRINGE (5CC)	0
SYRINGE (60ML)	0
TOBRAMYCIN AND DEXAMETHASONE 0.3%; 0.1%, 10ML BOTTLE	0
URINE CATHETER COUDE	0
WOUND PACKING	0
ZYRTEC (CETIRIZINE) 10 MG TABLET	0

References

1. Integrated Medical Model Project. Integrated Medical Model Operations Plan. JSC-66114. 2011. Houston, TX, NASA, Johnson Space Center. *Ref Type: Report*
2. Integrated Medical Model Project. Integrated Medical Model Software Requirements Specification. IMM-SFTWR-008. 2017. Houston, Texas, KBRwyle IntegratedScience, Technology and Engineering.*Ref Type: Report*
3. Integrated Medical Model Project. Integrated Medical Model version 4 Assumptions and Limitations. IMM-GEN-300. 2017. Houston, Texas, KBRwyle Integrated Science and Engineering Space Medicine Information Technology. *Ref Type: Report*
4. NASA-STD-7009: Standard for Models and Simulations (2008). NASA: Washington, DC.
5. ISS Medical Checklist (Med CL), 04 June 2014, NASA Johnson Space Center, Medical Operations Group.

Appendix A: IMM Status at Time of Service Request Report

Validation status for IMM	IMM V&V Matrix: The following bar chart shows the IMM v4.1 MATLAB status of IMM validation for each IMM element listed. Scoring Bar Chart <table><thead><tr><th>IMM Element</th><th>Factor Score (Blue)</th><th>Evidence Sufficiency Thresholds (Red)</th></tr></thead><tbody><tr><td>People Quantification</td><td>4.0</td><td>4.0</td></tr><tr><td>M&S Management</td><td>2.0</td><td>2.0</td></tr><tr><td>Use History</td><td>3.0</td><td>3.0</td></tr><tr><td>Results Robustness</td><td>3.0</td><td>3.0</td></tr><tr><td>Results Uncertainty</td><td>3.0</td><td>3.0</td></tr><tr><td>Input Pedigree</td><td>3.0</td><td>3.0</td></tr><tr><td>Validation</td><td>3.0</td><td>3.0</td></tr><tr><td>Verification</td><td>3.7</td><td>4.0</td></tr></tbody></table>	IMM Element	Factor Score (Blue)	Evidence Sufficiency Thresholds (Red)	People Quantification	4.0	4.0	M&S Management	2.0	2.0	Use History	3.0	3.0	Results Robustness	3.0	3.0	Results Uncertainty	3.0	3.0	Input Pedigree	3.0	3.0	Validation	3.0	3.0	Verification	3.7	4.0																															
IMM Element	Factor Score (Blue)	Evidence Sufficiency Thresholds (Red)																																																									
People Quantification	4.0	4.0																																																									
M&S Management	2.0	2.0																																																									
Use History	3.0	3.0																																																									
Results Robustness	3.0	3.0																																																									
Results Uncertainty	3.0	3.0																																																									
Input Pedigree	3.0	3.0																																																									
Validation	3.0	3.0																																																									
Verification	3.7	4.0																																																									
Compliance with NASA-Standard-7009 requirements	IMM Compliance Matrix: The IMM has no waivers to any of the requirements in the NASA-Standard-7009 for Models and Simulations (6); however there are certain requirements that are not applicable to the IMM and other requirements where IMM compliance has not yet been fully attained. <table><thead><tr><th>Compliant</th><th>Compliance Incomplete</th><th>Not applicable</th></tr></thead><tbody><tr><td>36</td><td>5</td><td>5</td></tr></tbody></table>	Compliant	Compliance Incomplete	Not applicable	36	5	5																																																				
Compliant	Compliance Incomplete	Not applicable																																																									
36	5	5																																																									
Current NASA-Standard-7009 credibility assessment score	IMM Credibility Matrix: The following table shows the overall IMM v4.1 MATLAB credibility assessment score (CAS), individual factor CAS, customer-specified sufficiency thresholds, and weighted scores. Legend depicts CAS score designated range and color assignments from NASA-Standard-7009. <table><thead><tr><th>Factor</th><th>Sufficiency Thresholds</th><th>Factor Score</th><th>Weighted Scores</th><th>Overall Score</th></tr></thead><tbody><tr><td>Verification</td><td>4</td><td>3.7</td><td>0.28</td><td></td></tr><tr><td>Validation</td><td>3</td><td>3</td><td>0.45</td><td></td></tr><tr><td>Input Pedigree</td><td>3</td><td>3</td><td>0.53</td><td></td></tr><tr><td>Results Uncertainty</td><td>3</td><td>3</td><td>0.60</td><td>3.06</td></tr><tr><td>Results Robustness</td><td>3</td><td>3</td><td>0.45</td><td></td></tr><tr><td>Use History</td><td>3</td><td>3</td><td>0.45</td><td></td></tr><tr><td>M&S Management</td><td>2</td><td>2</td><td>0.10</td><td></td></tr><tr><td>People Qualification</td><td>4</td><td>4</td><td>0.20</td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></tbody></table> Legend from NASA-STD-7009 <table><tbody><tr><td>CAS Score > Threshold</td><td>Exceeds credibility requirements</td></tr><tr><td>Threshold ≥ CAS Score ≥ (Threshold-0.5)</td><td>Ready for use</td></tr><tr><td>Threshold-0.5 > CAS Score ≥ Threshold-1.0</td><td>Use with caution</td></tr><tr><td>CAS Score < Threshold - 1.0</td><td>Use not recommended or to be used with EXTREME CAUTION by subject matter experts only</td></tr></tbody></table>	Factor	Sufficiency Thresholds	Factor Score	Weighted Scores	Overall Score	Verification	4	3.7	0.28		Validation	3	3	0.45		Input Pedigree	3	3	0.53		Results Uncertainty	3	3	0.60	3.06	Results Robustness	3	3	0.45		Use History	3	3	0.45		M&S Management	2	2	0.10		People Qualification	4	4	0.20							CAS Score > Threshold	Exceeds credibility requirements	Threshold ≥ CAS Score ≥ (Threshold-0.5)	Ready for use	Threshold-0.5 > CAS Score ≥ Threshold-1.0	Use with caution	CAS Score < Threshold - 1.0	Use not recommended or to be used with EXTREME CAUTION by subject matter experts only
Factor	Sufficiency Thresholds	Factor Score	Weighted Scores	Overall Score																																																							
Verification	4	3.7	0.28																																																								
Validation	3	3	0.45																																																								
Input Pedigree	3	3	0.53																																																								
Results Uncertainty	3	3	0.60	3.06																																																							
Results Robustness	3	3	0.45																																																								
Use History	3	3	0.45																																																								
M&S Management	2	2	0.10																																																								
People Qualification	4	4	0.20																																																								
CAS Score > Threshold	Exceeds credibility requirements																																																										
Threshold ≥ CAS Score ≥ (Threshold-0.5)	Ready for use																																																										
Threshold-0.5 > CAS Score ≥ Threshold-1.0	Use with caution																																																										
CAS Score < Threshold - 1.0	Use not recommended or to be used with EXTREME CAUTION by subject matter experts only																																																										
Additional verification and validation information applicable to this analysis	none																																																										
Integrated Medical Evidence Database (iMED) code version and date accessed	iMED Lockdown ID: (26), created on (2/21/2017)																																																										
IMM version and code version	Data analysis for this report was generated using IMM v4.1 with release 2016a of MATLAB software. MATLAB and all other MathWorks product or service names are registered trademarks or trademarks of MathWorks, Natick, MA, USA.																																																										
Modifications made to the code for analysis	None																																																										

Appendix B: Medical Conditions in iMED by Category (iMED_20170221)**ENVIRONMENTAL**

Acute Radiation Syndrome
 Altitude Sickness
 Barotrauma (ear/sinus block)
 Burns secondary to Fire
 Decompression Sickness Secondary to EVA
 Eye Chemical Burn

Headache (CO₂ induced)
 Smoke Inhalation
 Toxic Exposure: Ammonia

INJURY/TRAUMA

Abdominal Injury
 Acute Compartment Syndrome
 Ankle Sprain/Strain
 Back Sprain/Strain
 Chest Injury
 Dental: Avulsion (tooth loss)
 Elbow Dislocation
 Elbow Sprain/Strain
 Eye Irritation/Abrasion
 Eye Penetration (foreign body)
 Finger Dislocation
 Fingernail Delamination Secondary to EVA
 Head Injury
 Hip Sprain/Strain
 Hip/Proximal Femur Fracture
 Knee Sprain/Strain
 Lower Extremity Stress Fracture
 Lumbar Spine Fracture
 Neck Sprain/Strain
 Neurogenic Shock
 Paresthesias Secondary to EVA
 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 Angle-Closure Glaucoma
 Acute Arthritis
 Acute Cholecystitis/Biliary Colic
 Acute Diverticulitis
 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/Obstructed Airway
 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)
 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
 Sleep Disorder
 Small Bowel Obstruction
 Space Motion Sickness (space adaptation)
 Stroke (Cerebrovascular Accident)
 Sudden Cardiac Arrest
 Urinary Incontinence (space adaptation)
 Urinary Retention (space adaptation)
 Urinary Tract Infection
 Vaginal Yeast Infection
 Visual Impairment and Increased Intracranial Pressure (VIIP) (space adaptation)