# Clinical Finding Form (CliFF)

Branch: Baseline

### ICL107_Tendinopathy/Enthesopathy/Bursitis/Over-Use Injuries - Lower Extremity

This CliFF includes tendinopathy, tendinitis, tenosynovitis, and bursitis of the lower extremity. Tendinopathy is a degeneration of the collagen protein that forms the tendon. Tendinopathy is often caused by overuse of a tendon. Bursitis is an inflammation of a bursa. Symptoms of tendinopathy and bursitis include pain, swelling, and reduced function. Treatment may include rest, activity modification, physical therapy, medications, injections, and surgery. There are no documented episodes of tendinopathy or bursitis in spaceflight. Therefore, terrestrial studies are used to estimate the incidence and outcomes of this condition in spaceflight. This may result in overestimation of the incidence and impact of this condition since the microgravity environment of spaceflight typically results in decreased forces on joints, muscles, and tendons of the lower extremities. However, exercise countermeasures during the transit phase of spaceflight missions and terrestrial EVAs could contribute to the development of lower extremity tendinopathies. The incidence and outcomes of overuse injuries was not included. These conditions may need to be considered in separate CliFFs. There is no IMM CliFF for this condition.

## INCIDENCE DATA INCLUDED IN THE MODEL

The model imports the following incidence information from the MEDPRAT Evidence Library Database: incidence data category, space adaption status, EVA status, incidence data type, incidence and occurrence distribution data and incidence data characteristics. Data category defines the type of data available for incidence calculations (i.e. raw data vs. adjusted data). Space adaptation identifies medical events that where onset occurs in the first 5-7 days of flight and does not reoccur. EVA-related incidence values identify medical events that occur only during an EVA. Incidence values types vary by data category and define the number of medical events per person-year (rates) or medical events per person at-risk (proportion) for each medical condition. Incidence values can be modified by crew characteristics such as gender sex and certain crew medical history characteristics. Modifying characteristics are noted below and incidence values are listed individually for each characteristic. Distributions are assigned to medical events incidence values and occurrences in the model. For each crewmember in a given trial, the incidence and number of occurrences of each medical condition are randomly selected from these probability distributions. Detailed descriptions of the distributions are included in the MEDPRAT Technical Description Document.

## INCIDENCE DATA

#### SPACEFLIGHT LITERATURE

There are no documented episodes of tendinopathy, tendinitis, tenosynovitis, or bursitis in spaceflight. Therefore, terrestrial studies are used to estimate the incidence and outcomes of this condition in spaceflight.

#### ANALOG LITERATURE

A military population were used as analog for astronauts in spaceflight. This may result in an overestimation of incidence since the rigorous physical training and activities of typical military personnel compared to astronauts in the spaceflight environment would result in a significant overestimation of the incidence and severity of this condition.

#### TERRESTRIAL LITERATURE

General terrestrial population studies were used to estimate the outcomes for astronauts in spaceflight. This may result in a slight overestimation of the impact of this condition since the microgravity environment of spaceflight typically results in decreased forces on joints, muscles, and tendons of the lower extremities. However, exercise countermeasures during the transit phase of spaceflight missions and terrestrial EVAs could contribute to the development of lower extremity tendinopathies and bursitis.

## OVERALL INCIDENCE SUMMARY

#### INCIDENCE

mean 0.01469 and SD 0.005576

#### INCIDENCE SUMMARY

The Bayesian posterior distribution for the incidence rate given data from an analog Naval Special Warfare study, estimated assuming independence of MSK injury location and type, is Gamma(shape=6.941, rate=472.472) with mean 0.01469 and SD 0.005576. The rate of MSK injuries was modeled using the data from a Naval Special Warfare analog (63 injuries over 210 person-years). The probability of the injury being located within the lower extremity was also modeled from the same source data (22 out of the 63 injuries). The probability of the injury type being

relevant to this condition was modeled from the same source as well (8 out of the 63 injuries). Assuming independence of type and location, the adjusted incidence rate was estimated from the overall model incorporating all the data elements. All priors were uninformative. Evidence: Analog Naval Special Warfare – Lovalekar 2016. Descriptive Epidemiology of Musculoskeletal Injuries in Naval Special Warfare Sea, Air, and Land Operators. 210 person-years of chart review. 63 total injuries reported over 210 person-years. 22 out of the 63 were located in the lower extremity. 8 of the 63 were relevant to the condition (6 Tendonitis/Tenosynovitis/Tendinopathy and 2 Bursitis). The overall rate and proportions will be used to estimate the site-specific relevant condition incidence rate. Since we don't have access to data about the joint site and condition distribution, we will assume independence in the probabilities of MSK conditions occurring, i.e. where the injury occurs is independent of which type of injury. This is a noted limitation of the incidence approach for the upper and lower extremity Tendinopathy CliFFs.

**TABLE 1. INCIDENCE MODEL**

**Incidence Details**

Incidence Type
**General**

Segment
**All**

Env. Exposure
**NA**

Sex
**Any**

Crowns
**Any**

Contacts
**Any**

Pregnancy
**Any**

**Incidence Distribution**

Occurrence Dist
**Poisson**

Incidence Dist.
**Gamma**

Mean
**0.0146908**

SD
**0.00557616**

Gamma
**(Shape): 6.941**
**(Rate): 472.472**

**TABLE 2. INCIDENCE LEVEL OF CONFIDENCE (LOC)**

| Citation | Source | LOC Value |
|---|---|---|
| Lovalekar et al, 2016 | Analog | 2 |

LOC = 2 (neutral) based on a military analog population study. This study probably results in an overestimation of incidence. There were no good terrestrial general population studies available to estimate the incidence of this condition. No spaceflight data are available.

## CREWMEMBER SELECTION/PREVENTION

#### DISQUALIFYING CONDITIONS

Refer to Medical Evaluation Documents (MED) Volume A, Medical Standards for ISS Crewmembers, International Space Station Program, Rev 3.4 (2016).

#### PREFLIGHT PREVENTATIVE MEASURES

There are no specific preflight preventive measures. Inflight preventive measures may included vehicle and equipment design, including exercise countermeasure devices, and training of crewmembers to avoid overuse injuries and tendinopathies.

#### BEST CASE SCENARIO DEFINITION

A tendinopathy/enthesopathy, bursitis, or overuse injury which can be managed symptomatically (e.g. rest, non-opioid analgesics, physical therapy) and does not impact mission objectives.

#### WORSE CASE SCENARIO DEFINITION

A tendinopathy/enthesopathy, bursitis, or overuse injury which requires treatment (e.g. corticosteroid injection, dry needling, physical therapy, nitroglycerin patches), or impacts mission objectives. Elective surgery may be necessary post-mission.

#### CONDITIONS INCLUDED, BUT NOT EXPLICITLY STATED (CNES)

None

## BEST CASE/WORST CASE PROBABILITY COMMENTS

Best case/worst case percentages are based on the percentage of patellar tendinopathy and achilles tendinopathy cases that are unable to participate in sports or eventually require surgery. Based on Dynamed references for Patellar Tendinopathy and Achilles Tendinopathy, 30% - 38% of cases are unable to participate in sports or eventually require surgery. References: Br J Sports Med. 1997 Dec;31(4):332-6. doi: 10.1136/bjsm.31.4.332. Am J Sports Med. Sep-Oct 2000;28(5):634-42. doi: 10.1177/03635465000280050301.

#### TABLE 3.BEST/WORST CASE PROBABILITY LEVEL OF CONFIDENCE (LOC)

| Citation | Source | LOC Value |
|---|---|---|
| Paavola et al, 2000 | Terrestrial | 3 |

Best case/worst case are based on the percentage of patellar tendinopathy and achilles tendinopathy cases that are unable to participate in sports or eventually require surgery. Based on Paavola et al, 2000, 30% - 38% of cases are unable to participate in sports or eventually require surgery. LOC = 3 (somewhat confident).

**TABLE 4. CLIFF TREATMENT & OUTCOME TABLE BY CLINICAL PHASE**

| Case Scenario | Composite Incidence | Condition Probability % | CP1: Diagnosis | | CP2: Treatment | | | CP3: Condition End State | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TI% | Duration | TI% | Duration | | TI% | RTDC | | LOCL | |
| | | | Preset | Preset | Preset | Min | Max | Preset | Min% | Max% | Min% | Max% |
| Treated Best Case (TBC) | mean 0.01469 and SD 0.005576 | 62 - 70 | 100 | 1.36 | 2.80361 | 672 | 1008 | 0 | 0 | 0 | 0 | 0 |
| Treated Worst Case (TWC) | | 30 - 38 | 100 | 1.36 | 7.62689 | 1008 | 1344 | 0 | 0 | 0 | 0 | 0 |
| Untreated Best Case (UTBC) | N/A | N/A | N/A | 1.36 | 18.2036 | 672 | 1008 | 0 | 0 | 0 | 0 | 0 |
| Untreated Worst Case (UTWC) | N/A | N/A | N/A | 1.36 | 35.663 | 1008 | 1344 | 32.5538 | 0 | 0 | 0 | 0 |

**TABLE 4 KEY**

**Composite Incidence:** The same composite incidence will be used for both TBC and TWC. For EVA conditions: events per EVA (events/EVA). For space adaptation conditions: events per person (events/person). For non-spaceflight conditions: events per person year (events/py).

**Condition Probability:** The probability that CLiFF condition progresses to a worst case scenario. Best case scenario: 100%-Worst Case.

**Clinical Phase General Comments:**

- TI% = Task Impairment %. Task Impairment is the % of tasks that the crewmember is incapable of performing without impairment secondary to the medical condition.
- Durations are defined in hours.
- Removal to Definitive Care (RTDC): The probability the entire crew aborts the mission and returns to earth. This is considered as a condition end state result if any of the following criteria are met: 1) the potential for LOCL, 2) potential for significant permanent task impairment, or 3) potential for intractable pain.
- Loss of Crew Life (LOCL): The probability of death of affected crewmember due to medical condition.

**Clinical Phase 1: Initial Assessment and Diagnosis:**

- Covers only the initial assessment and diagnosis of the affected crewmember to define his or her medical condition. While the affected crewmember is being assessed, he or she is not able to perform any assigned tasks, thus Task Impairment (TI) during this phase is considered 100%. In the untreated case, there is no diagnosis performed, therefore Task Impairment and Duration will always be " not applicable."

**Clinical Phase 2: Stabilization, Treatment, and Convalescence:**

- The affected crewmember is receiving any appropriate initial or follow-on treatment for his or her medical condition to allow the crewmember to recover as much as he or she is able to recover in the spaceflight environment. Clinical phase 2 also encompasses relapses or recurrences of the same original medical condition in Clinical Phase 1. The duration of Clinical Phase 2 is expressed as minimum and maximum hours.

**Clinical Phase 3: Condition End State:**

- Reached once the affected crewmember has recovered from the medical condition as much as he or she is able to recover in the spaceflight environment amongst treated and untreated best and worst case scenarios. This may or may not be recovery from the given medical condition to the full extent possible. If this “recovered” state results in Removal to Definitive Care (RTDC) or Loss of Crew Life (LOCL) this will be noted in the condition end state results.

**SCENARIO OVERVIEW COMMENTS**

Best case scenario is a mild case of tendinopathy that only requires symptomatic treatment and results in temporary limited task impairment. Worst case scenario is a more severe case of tendinopathy that requires more extensive treatment. Untreated worst case scenario results in ongoing task impairment throughout the mission.

**TREATED BEST CASE (TBC) SCENARIO COMMENTS**

Treated best case scenario results in temporary minor task impairment. Clinical Phase 2 durations are based on terrestrial recovery times for mild cases of tendinopathy (Paavola et al, 2000). RTDC and LOCL is not expected based on the best case definition.

**TREATED WORST CASE SCENARIO (TWC) COMMENTS**

Treated worst case scenario results in temporary moderate task impairment. Clinical Phase 2 durations are based on terrestrial recovery times for moderate to severe cases of tendinopathy (Paavola et al, 2000). RTDC is not expected since significant permanent impairment is not expected. LOCL is not expected.

**UNTREATED BEST CASE (UTBC) SCENARIO COMMENTS**

Untreated best case scenario results in temporary moderate task impairment. Clinical Phase 2 durations are based on terrestrial recovery times for mild cases of tendinopathy (Paavola et al, 2000). RTDC and LOCL is not expected based on the best case definition.

**UNTREATED WORST CASE (UTWC) SCENARIO COMMENTS**

Untreated worst case scenario results in ongoing moderate task impairment throughout the mission. Clinical Phase 2 durations are based on terrestrial recovery times for moderate to severe cases of tendinopathy (Paavola et al, 2000). RTDC is not expected since significant permanent impairment is not expected. LOCL is not expected.

**TABLE 5. CLINICAL PHASE II DURATION LEVEL OF CONFIDENCE (LOC)**

| Citation | Source | LOC Value |
|---|---|---|
| Hong et al, 2014 | Terrestrial | 2 |
| Strauss et al, 2011 | Terrestrial | |

CP2 durations based on terrestrial general population studies. LOC = 3 (somewhat confident) for treated scenarios and LOC = 1 (somewhat unconfident) for the untreated scenarios since estimates are based on terrestrial studies that include treatment.

**TABLE 6. RTDC LEVEL OF CONFIDENCE (LOC)**

| Citation | Source | LOC Value |
|---|---|---|
| N/A | Case definitions | 4 |

RTDC is no expected in any scenarios since significant permanent impairment and/or LOCL is not expected. LOC = 4 (confident) based on best case and worst case definitions.

**TABLE 7. LOCL LEVEL OF CONFIDENCE (LOC)**

| Citation | Source | LOC Value |
|---|---|---|
| N/A | Case definitions | 4 |

LOCL is not expected based on best case and worst case definitions. LOC = 4 (confident).

**CAPABILITY RESOURCE TABLE (CRT) OVERVIEW**

Capabilities and Resourcing Scope

Overview

Tendinopathy/enthesopathy/bursitis/over-use injuries encompasses multiple diagnoses that may occur in the lower extremity as stated in the title. (Examples may include but are not limited to: Achilles or patellar tendinopathy, peroneus brevis enthesopathy, trochanteric bursitis). The best-case scenario can be managed symptomatically and does not impair mission objectives, whereas the worst-case scenario requires treatment and/or impacts mission objectives and may require surgical intervention post-mission.

CNES: N/A

Diagnostic Scope and Resourcing

In both the best- and worst-case scenario, diagnosis is based on history and physical examination (musculoskeletal and neurologic). Musculoskeletal ultrasound was considered a useful adjunct in diagnosis, but not a necessity for the diagnosis. It was included as a non-necessary capability. X-ray and MRI capabilities will not be possible in-flight.

Clinical Phase 1 Duration and Rationale
This version of IMPACT presumes physician level knowledge, skill, and ability will be present on the mission. The CRT working group SME consensus duration is as follows:

CP1 BC (Treated or Untreated): 1.36 hours
CP1 WC (Treated or Untreated: 1.36 hours

This CRT includes a scope of practice code of 5 (which correlates to an “Experienced procedure trained generalist attending (ED attending)” and was included for musculoskeletal ultrasound and interpretation.

Treatment Scope and Resourcing

Terrestrially, tendinopathy, enthesopathy, bursitis, and over-use injuries can have a prolonged recovery with progress and relapses based on the activity level of the patient.

The best-case scenario management includes pain management, NSAIDs, acetaminophen and iontophoresis with dexamethasone (which terrestrially has shown improvements in both pain and function in tendinopathy). Iontophoresis is a topical application of medication utilizing the charge of the particles to disperse the medication into the skin directly over an affected tendon. Physical therapy is the mainstay of treatment. Exercise modification is also recommended, but not built into the CRT as this does not represent a clinical resource.

The worst-case scenario management has the following additional resources: Corticosteroid injection for bursitis, needle tenotomy for tendinopathy, and topical nitroglycerin patches for tendinopathy. It should be noted that corticosteroid injections should only be used for bursitis in this condition and not for tendinopathy as injection of corticosteroids into the tendon will weaken the tendon and put it at risk for rupture. Topical nitroglycerin for chronic tendinopathy is an off-label treatment that has been used successfully in Sports Medicine for approximately 20 years with meta-analysis level data supporting its efficacy for pain reduction and improved function. While nitroglycerin patches are not currently included on the spaceflight formulary, nitroglycerin tablets and spray are, providing precedence for flying nitroglycerin. Again, physical therapy is the mainstay of treatment. Orthopedic surgery capabilities are outside the scope of medical resources for this CRT.

Communications and Support Needs

While real-time video and audio loop communications are desired for diagnosis and treatment, they were not considered a necessity for the best-case scenario. For the worst-case scenario, consultation with ground specialists to facilitate treatment and healing was considered necessary given the limited diagnostic and treatment capabilities in-flight.

REFERENCES
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**IMM CLIFF RECONCILATION COMMENTS**

There is no IMM CliFF for this condition.

**LIMITATIONS SUMMARY**

No spaceflight data are available for this medical condition. Therefore, military analog and general terrestrial population studies were used to estimate the incidence and outcomes for astronauts in spaceflight. This may result in an overestimation of the incidence and impact of this condition since the microgravity environment of spaceflight typically results in decreased forces on joints, muscles, and tendons of the lower extremities. Since we don't have access to incidence data about the joint site and condition distribution, we assumed independence in the probabilities of MSK conditions occurring, i.e. where the injury occurs is independent of which type of injury. This is a noted limitation of the incidence approach for the upper and lower extremity Tendinopathy CliFFs. The incidence and outcomes for overuse injuries was not included because relevant incidence data was not available for these conditions.

**TABLE 8. TASK IMPAIRMENT CALCULATION BASED ON AFFECTED HUMAN SYSTEMS TASK CATEGORIES (HSTC)**

| Clinical Phase 2: Treatment | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Affected HSTCs | | | | | | | | | | | |
| | Cognitive - Simple | Cognitive - Complex | Communications | Inter-personal Skills | Vision | Hearing | Cardio-pulmonary | Dentition | GI | GU | | |
| Treated Best Case (TBC) | | | | | | | | | | | | |
| Untreated Best Case (UTBC) | | 664 | | | | | 145 | | | | | |
| Treated Worst Case (TWC) | | | | | | | 145 | | | | | |
| Untreated Worst Case (UTWC) | | 664 | | 89 | | | 145 | | | | | |
| | Affected HSTCs (Continued) | | | | | | | | TI Calculation | | | TI Score |
| | Hand (Dom) | Hand (Any) | Upper Extremity | Lower Extremity | Ambul & Standing (g) | Translation & Stabilization (microgravity) | Don/Doff Equipment | Pressure Ops | Total Tasks Impaired By Condition | Total Human System Category Tasks Full Mission | TI Decimal | TI % |
| Treated Best Case (TBC) | | | | | | | | 211 | 211 | 3763 | 0.0560723 | 5.60723 |
| Untreated Best Case (UTBC) | 132 | | | 22 | 196 | | | 211 | 1370 | 3763 | 0.364071 | 36.4071 |
| Treated Worst Case (TWC) | | | | 22 | 196 | | | 211 | 574 | 3763 | 0.152538 | 15.2538 |
| Untreated Worst Case (UTWC) | 132 | | | 22 | 196 | | | 211 | 1459 | 3763 | 0.387723 | 38.7723 |

| Clinical Phase 3: Condition End State | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Affected HSTCs | | | | | | | | | | | |
| | Cognitive - Simple | Cognitive - Complex | Communications | Inter-personal Skills | Vision | Hearing | Cardio-pulmonary | Dentition | GI | GU | | |
| Treated Best Case (TBC) | | | | | | | | | | | | |
| Untreated Best Case (UTBC) | | | | | | | | | | | | |
| Treated Worst Case (TWC) | | | | | | | | | | | | |
| Untreated Worst Case (UTWC) | | 664 | | | | | | | | | | |
| | Affected HSTCs (Continued) | | | | | | | | TI Calculation | | | TI Score |

| | Hand (Dom) | Hand (Any) | Upper Extremity | Lower Extremity | Ambul & Standing (g) | Translation & Stabilization (microgravity) | Don/Doff Equipment | Pressure Ops | Total Tasks Impaired By Condition | Total Human System Category Tasks Full Mission | TI Decimal | TI % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Treated Best Case (TBC)** | | | | | | | | | 0 | 3763 | 0 | 0 |
| **Untreated Best Case (UTBC)** | | | | | | | | | 0 | 3763 | 0 | 0 |
| **Treated Worst Case (TWC)** | | | | | | | | | 0 | 3763 | 0 | 0 |
| **Untreated Worst Case (UTWC)** | 132 | | | 22 | 196 | | | 211 | 1225 | 3763 | 0.325538 | 32.5538 |

**TABLE 8 KEY**
Human System Task Category (HSTC) Definitions: Cognitive-Simple: Tasks requiring simple cognitive involvement (low levels of attention, following simple checklists, and not requiring extensive decision making) in conjunction with inputs from other systems. Cognitive-Complex: Tasks requiring complex cognitive involvement (requiring constant attention, frequent interpretation of outside stimuli to inform real-time situations) in conjunction with inputs from other systems. Communication: Tasks requiring primarily communication, via hearing and speaking. Interpersonal Skills: Tasks requiring interpersonal, social interaction between crew including complex technical tasks that require extended crew interaction. Vision: Tasks in which visual information is required. Hearing: Tasks in which primarily auditory information is required, excluding communication, e.g. hearing alarms, medical auscultation, OOHAs. Cardiopulmonary: Tasks requiring greater-than-baseline cardiopulmonary effort, e.g. physically strenuous activities. Dentition: Tasks requiring use of teeth for mastication. GI (Gastrointestinal): Tasks requring use of the alimentary sytem, e.g. solids/liquids consumption and solids excretion. GU (Genitourinary): Tasks requiring use of the male/female genitourinary systems. Hand (Dominant): Tasks performed using primarily the hand, requiring use of the dominant hand (piloting, medical procedures, dental procedures). Hand (Any): Tasks performed using primarily the hand(s), with no preference for dominance, with equivalent bilateral effectiveness. Upper Extremity: Tasks requiring specific use of the upper extremities, excluding hands. Lower Extremity: Tasks requiring specific use of the lower extremities (excluding ambulation and standing in the presence of gravity), e.g. using exercise equipment. Ambulation and Standing (g): Tasks requiring use of both lower extremities to accomplish ambulation or standing in the presence of gravity. Translation and Stabilization (microgravity): Tasks requiring use of either the upper or lower extremities to accomplish translational movement and stabilization (securing oneself to remain stationary) in the setting of microgravity. Don/Doff Equipment: Tasks requiring the donning of personal equipment (including pressure suit, exercise harness, EVA equipment, etc). Pressure Ops: EVA/contingency tasks performed while pressurized in a suit.

**Criteria for Assignment of Conditions to HSTCs (any of the following):**
1) Is affected crew member physically incapable of performing the human system task category, without impairment, with the condition?
2) Would the treatment (e.g. medications) impair the crewmember's ability to perform the human system task category? (Does not apply to UTx)
3) Does the condition have a high likelihood of causing a significant aeromedical contraindication with an associated human system task category
4) Would performing tasks in an associated task category worsen the condition? (If so, it is affected).
5) Does pain associated with the condition impair any further human system categories?

## TASK IMPAIRMENT COMMENTS

CP2: No comment CP3: No comment

## EVIDENCE COLLECTION PROCESS

Mesh terms that most closely resembled the best-case and worst-case scenarios, and associated Conditions Included but Not Explicitly Stated (CNES), were utilized to build incidence, duration, RTDC, and LOCL searches by best- and worst-case.

**Incidence:**
Databases searched for spaceflight and analog incidence data included: PubMed, Google Scholar, NASA Technical Reports Server (NTRS) public search, Defense Technical Information Center (DTIC), and Barratt MR, Baker E, Pool SL. Principles of Clinical Medicine for Space Flight. New York, NY: Springer; 2019. 2nd Edition. Databases searched for terrestrial incidence included: DynaMed, PubMed, and Google Scholar.

**Duration, RTDC, LOCL:**
Databases searched for duration, RTDC, and LOCL included: Dynamed, Cochrane, PubMed, and Google Scholar. Note, that if duration, RTDC, or LOCL data was found in a DynaMed search, the other search engines were not included. Relevant articles were selected and reviewed. If applicable, the article was included in the CLiFF.

## LEVEL OF CONFIDENCE (LOC) SCORING

Articles obtained to update the evidence behind this CLiFF were scored by ExMC editors, based on their applicability to the Exploration Spaceflight environment using the following grading scale:

4 – Confident
3 – Somewhat confident
2 – Neutral
1 – Somewhat unconfident
0 – Not confident

The following considerations factor into the grading scale above:

• How closely does the paper describe the medical condition as defined by the IMPACT 1.0 Condiltion List (relevance)?
• How closely does the population included resemble the astronaut population?
• Quality of the paper (number of subjects, methods, etc.)
• How much does the editor trust the source of the evidence?
• How closely does the editor think that the data represents the exploration spaceflight environment?
• Other considerations, at the discretion of the editor, supported in the comments for LOE scoring.

## REFERENCES


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## ACRONYMS

| ACRONYM | PHRASE |
| --- | --- |
| **AAOMS** | American Association of Oral and Maxillofacial Surgeons |
| **AMA** | American Medical Association |
| **ARCL** | All Remaining Conditions List |
| **ARS** | Acute Radiation Sickness |
| **BHP** | Behavioral Health and Performance |
| **CAC** | Coronary Artery Calcium |
| **CHS** | Crew Health and Safety |
| **CL** | Condition List |
| **CliFF** | Clinical Finding Form |
| **CMO** | Crew Medical Officer |
| **COMFORT** | Clinical Outcome Metrics for Optimization of Robust Training |
| **CP1** | Clinical Phase 1 |
| **CP2** | Clinical Phase 2 |
| **CP3** | Clinical Phase 3 |
| **CRL** | Clinical Resource Level |
| **CRT** | Capability Resource Table |
| **CST** | Clinical Science Team |
| **DCS** | Decompression Syndrome |
| **DRM** | Design Reference Mission |
| **ED** | Emergency Medicine Doctor |
| **EL** | Evidence Library |
| **EMCL** | Exploration Medical Condition List |
| **EMT** | Emergency Medical Technician |
| **EVA** | Extravehicular Activity |
| **EXMC** | Exploration Medical Capability |
| **HRP** | Human Research Program |
| **ICD** | International Classification of Disease |
| **ICL 1.0** | IMPACT 1.0 Medical Conditions List |

| | |
|---|---|
| **ICU** | Intensive Care Unit |
| **IMCL** | iMED Condition List |
| **iMED** | Integrated Medical Evidence Database |
| **IMM** | Integrated Medical Model |
| **IMPACT-MD** | Impact Medical Database |
| **IP** | Incidence Proportion |
| **IR** | Incidence Rate |
| **ISS** | International Space Station |
| **IV** | Intravenous |
| **JSC** | Johnson Space Center |
| **LEO** | Low-Earth orbit |
| **LEVA** | Lunar Extravehicular Activity |
| **LOCL** | Loss of Crew Life |
| **LOM** | Loss of Mission |
| **LSAH** | Lifetime Surveillance of Astronaut Health |
| **LSO** | Lunar Surface Operations |
| **MCL** | Master Condition List |
| **MEVA** | Medical Extravehicular Activity |
| **NASA** | National Aeronautics and Space Administration |
| **N/A** | Not Applicable |
| **NP** | Nurse Practitioner |
| **OBGYN** | Obstetrics and Gynecology |
| **OR** | Occurrence Rate |
| **PA** | Physician Assistant |
| **PDQ** | Pain Disability Questionnaire |
| **PFCL** | Proposed Future Conditions List |
| **PPE** | Personal Protective Equipment |
| **PTRS** | Project Technical Requirements Specification |
| **PRL** | Pharmaceutical Resource Level |
| **QTL** | Quality Time Lost |
| **RCL** | Removed Conditions List |
| **REP** | Rochester Epidemiology Study |
| **RTDC** | Removal to Definitive Care |
| **SANS** | Spaceflight-Associated Neuro-ocular Syndrome |
| **SAS** | Space Adaptation Syndrome |
| **SEVA** | Spaceflight Extravehicular Activity |
| **SME** | Subject Matter Expert |
| **SoP** | Standard Operating Procedure |
| **SPE** | Solar Particle Event |
| **TBD** | To Be Determined |
| **TI** | Task Impairment |