Dental Exposed Pulp Cliff

Branch Baseline

Pulpitis is an inflammation of the dental pulp resulting from untreated caries, trauma, or multiple restorations. Its principal symptom is pain. Pressure necrosis frequently results from this form of exposed pulp and can be complicated by persistant pain and periapical abscess. (Merck Manual, 2008) Due to required dental examinations and care before flight, untreated caries is an unlikely etiology. A more likely mechanism on orbit would be due to damage to pre-existing restorations or dental trauma. Treatment is available on orbit with topical and systemic analgesics, instruments in a toothache kit (Red Cross, and antibiotics. (International Space Station Integrated Medical Group, 2006)

Incidence Data Included in the Model

The model imports the following incidence information from the IMM database: incidence data category, space adaption status, incidence data, 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. fixed data). Space adaptation identifies medical events that onset occurs in the first 5 days of flight and does not reoccur. Incidence values vary by data category and define the number of medical events per person-year or medical events per person-at-risk for each medical condition. Incidence values can be modified by crew characteristics such as gender. 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 crew member 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 IMM Technical Description Document.

Incidence	
Data Category:	Fixed
Space Adaptation:	No
Incidence Type:	Rate

Distribution Data	
Incidence:	Fixed
Occurrence:	Poisson

Data Characteristics	
Fixed Rate:	0.0201

Incidence Comments

Chaffin studied dental emergencies experienced by US soldiers in Bosnia, in 2000. The rate for Stabilization Force (SFOR) VII and SFOR VIII was 156 and 170 per 1000 person-year, 0.156 and 0.17 respectively. Of these 12.9% were diseases of the pulp and periapical tissue, which resulted in an incidence of 0.0201 and 0.022 per person year. ICD codes were not included; an "emergency" is defined as any condition that prompts a soldier to leave their duty station. The true emergencies like extreme pain due to infection, irreversible pulpitis or trauma represented 25% of patients seen. These conditions would have required evacuation without on site dental care. (Chaffin, 2008)

Information Regarding Prevention

Disqualifying dental conditions include:

Any dental defects that interfere with clear speech or cause changes in the contours of the face which interfere with the performance of duties; complete edentulism or insufficient number of natural healthy teeth to masticate a normal diet or enunciate clearly; dental prostheses (any removable dental prosthesis, which if lost or broken, would not leave enough natural healthy teeth to masticate a normal diet or enunciate clearly; any unilateral removable dental prosthesis that could be swallowed); diseases and abnormalities of the jaws or associated structures, including periodontal disease, that are not easily remedied or may interfere with the performance of duties; severe malocclusion that interferes with the mastication of a normal diet or clear enunciation; any dental defects such as dental caries, dental dysplasia, enamel dysplasia, symptomatic cracked teeth, defective restorations, defective prosthesis, and defective implants until resolved; partially erupted or impacted third molar teeth with the potential to cause erosion of adjacent teeth, pericoronitis, or periodontal defect until resolved; infections of endodontic or periodontic origin until resolved. Active orthodontic treatment requires dental consultation. Active orthodontic treatment is disqualifying for space flight duties (International Space Station Program, 2009).

Prevention:

At 6 months before launch crewmembers undergo complete dental examinations. If treatment is deemed necessary, all such treatment is completed 3 months before launch. All astronauts are expected to maintain optimal physical and oral health and to follow oral hygiene practices (Hodapp, 2008).

Treatment(s):

Cracked teeth treatment is based on the presenting signs. If the pulp is exposed the recommended treatment is a cotton pellet moistened with Red Cross medication and covered with a thin sheet of foil to keep debris out of the exposed area. Reversible pulpitis is treated by removing the offending stimulus. This eliminates the pain, then a sedative dressing can be applied. Irreversible pulpitis causes intermittent or continuous paroxysms of pain ranging from moderate to severe. Treatment is local anesthesia, which may be repeated. It may progress to necrosis, where the condition is guarded. Antibiotics do not eliminate bacteria in the infected tooth. Tooth extraction in space flight should be considered only as a last resort. (Hodapp, 2008)

Other:

Root canal treatment for spontaneously occurring tooth pain requires considerable skill and the transportation of bulky equipment. The treatment includes drilling to access the canal deep in the tooth, locating canal orifices in the presence of internal tooth bleeding, using fine instruments to remove all of the cell contents, shaping and filling the canal. Considerable skill is essential to achieve this. Local anesthetic is also needed, which entails another set of complex skills.

BioMat Sciences developed a lightweight, miniaturized microwave system to enable emergency dental treatments by a non-dental expert (e.g., an astronaut). The system is customized for tooth repair and reconstruction, including treatment of diseased pulpal tissue (root canal) without drilling (Byerly, 2010). At this point, we are not aware of plans for this equipment to be made available on board and is not included in the ISS checklist procedures.

Incidence Level of Evidence (LOE)

The IMM level of evidence appropriate assessment of the quality of the IMM input data. Since IMM incorporates input data from a wide variety of sources including astronaut population, terrestrial or analog populations, and external models, an innovative approach to assess the quality of input data was required. Information obtained from the astronaut population and/or space flight is the more relevant so it is assigned the highest level of evidence and less relevant data sources are assigned a lower level of evidence.

Citation	LOE Value	LOE Category
Chaffin, 2008	2	Incidence

Incidence data not included in the model

The model pulls the incidence information from the IMM database ... the information shown below does not go into the model.

Incidence	
Data Category:	Fixed
Space Adaptation:	No
Incidence Type:	Rate

Distribution Data	
Incidence:	Fixed
Occurrence:	Poisson

Data Characteristics	
Fixed Rate:	0.002

Incidence Comments

Our 2009 data lockdown included 0.075 incidence rate, from preliminary results of a study on cracked teeth and pulpal exposure in the US (Bader, 1995),. A most recent study reported that although complete cusp fracture is acknowledged to occur frequently, incidence rates have been reported rarely. This study determined incidence rates for complete coronal cusp fracture per person and per tooth type. The incidence rates for complete coronal cusp fracture per enrollees for 105 days; incidence 89 per 1000 person-years = 0.089. The incident rate for pulpal exposure in fractures not associated with caries occurred infrequently at 3%, = 0.002 (Bader, 2001).

Alternative Incidence Data

For Skylab missions, the possibility for an unanticipated dental problem occurring in-flight which could significantly impair a crewman's ability to work effectively was computed at 0.92 percent for a 3-man 28-day mission. This figure was based on studies of dental experiences in other isolated environments, i.e., polar expeditions, United States Navy FBM submarine patrols, and from a 3-year study of the astronaut population. The most likely problems which could impair a crewman's effectiveness in-flight were judged to be either a painful tooth due to pulpitis or severe, localized gingival inflammation with or without a periodontal abscess. The pulpitis would be most likely to occur in a tooth which had previously been restored with a deep restoration which suddenly had become symptomatic. This is a common ground-based dental problem and the resulting potentially debilitating pain could occur for a number of reasons, including decreased resistance of the host and/or increased virulence of the organisms involved. No dental problems occurred during the Skylab series of missions which required use of the In-flight Medical Support System-Dental. Some changes in oral health were noted but most significant was the relative non-existence of health hazardous intra-oral changes (Brown, 1977).

In the Apollo missions, one pre-flight and one post flight occurrence of pulpitis could have caused significant crewmember impairment if the pulpitis had occurred during a flight requiring root-canal therapy or extraction. Prediction of such occurrences is virtually impossible, although the preventive treatment of known causative factors can lower the risk of occurrence. In flight, no problems were reported.

The experience with Apollo astronauts in an intensive preventive program leads to the conclusion that the probability of a dental emergency in the Apollo population is one occurrence in 9,000 man-days (3,285,000 person-years). The probability of dental problems of lesser severity, but associated with significant discomfort, is one in 1,500 man-days (547,500 person-years). These figures are comparable to those recorded for Navy personnel on long submarine patrols. From these estimations, it is obvious that a provision for emergency in-flight dental care must be made only for very long-duration missions (Hawkins, 1975).

Odontocrexis (cracked teeth) has been reported in decompression simulation and during an uncompressed 18,000-ft flight (Zadik, 2006). In the Russian space program vibration and acceleration during launch have dislodged crewmembers' dental crowns (Marshburn, 2008).

A study in US submarines population reported 78 events among enlisted crew men; incidence rate 1.5 per 100 person-years; 54 event in the <30 years cohort; rate 1.6 per 100 person-years; 24 events in the 30+ years cohort; rate 1.2 per 100 person-years. Among officers, total events were 5; rate 0.8 per 100 person-years; <30 years had 1 event, rate 0.3 per 100 person-years; 30+ years had 4 events, rate 1.4 per 100 person-years. Submarine and spacecraft environments share certain characteristics, including conditions of isolation, and a closed environment with an artificial atmosphere. Thus, some medical conditions may be relevant to both submariners and the astronaut population. The number of subjects in the study was large (n =13,441), as was the number of person-days at risk accumulated during the study period (over 2 million). The present study is the first to evaluate morbidity rates among deployed U.S. Navy submarine officers. In summary, potentially mission-impacting medical events reported among officers aboard submarine patrols were rare (36.3 per 100 person-years underway; i.e., among a crew of seven individuals, one medical event would be expected to occur during a 6 month mission). The officers are most analogous to current space program participants (Thomas, 2003). The study included all dental ICD-9 codes (520 to 528) thus we cannot segregate for pulp related codes (522).

A prospective study by Krell, from a private endodontic practice during a 6 year period, fount that of 127 patients specifically diagnosed with reversible pulpitis, 27 converted to irreversible pulpitis (N_21) in 58 days or to necrotic pulp (N_6) in 149 days (21% of total). None of the original remaining 100 cases of reversible pulpitis have required root canal treatment. The distribution of teeth requiring root canal therapy was as follows: maxillary first molars (9/27, 33%), mandibular second molars (8/27, 29%), mandibular first molars (7/27, 26%), and maxillary second molars (3/27, 11%) (Krell, 2007).

We found anecdotal report of a Russian cosmonaut experiencing severe dental pain for over 14 days in-flight. (Savage, 2002)(Montgomery, 1989)

Treatment and Outcomes

Based on the best evidence available best and worst case percentage ranges are assigned. The medical condition is divided into three clinical phases in all three clinical phases a functional impairment is assigned. The clinical phase I and II's functional impairments remain for the duration for that respective clinical phase. The function impairment in clinical phase III represents final impairment for this medical condition and remains for the rest of the mission. Other mission end states include evacuation and loss of crew life.

The IMM checks medical resource availability once the number of medical events and scenarios has been established. If there is not sufficient essential resources called out in the CliFF, then the medical condition will go down an untreated best or worst case scenario pathway.

The table below summarizes the treated and untreated best and worst case scenarios.

	Clinical Phase I Diagnosis & Initial Treatment[1]		**Clinical Phase II On-going Treatment / Convalescence[2]**		**Clinical Phase III Recovered / Mission End State[3]**		
	FI* (%)	**Duration (hrs)**	**FI* (%)**	**Duration (hrs) (Min - ML - Max)**	**FI* (%)**	**EVAC** (%)**	**LOCL** (%)**
ISS-based Treatment (best case scenario %: 79)	100	0.5	6 - 41	0.5 - 1 - 1.5	0	0	0
ISS-based Treatment (worst case scenario %: 21)	100	0.5 - 1	26 - 65	1.5 - 84.75 - 168	0 - 65	0	0
Untreated Best Case	0	0	26 - 65	0.5 - 1 - 1.5	26 - 65	0	0
Untreated Worst Case	0	0	58 - 80	1.5 - 84.75 - 168	58 - 80	100	0

[1]Clinical Phase I: Clinical phase I covers only the initial assessment of the affected crew member to define his or her medical condition, and completion of appropriate initial treatment to stabilize the crew member. While the affected crew member is being assessed, he or she is not able to perform any assigned tasks, thus Functional Impairment during this phase is considered 100%. In the untreated case, there is no diagnosis performed or treatment given, therefore Functional Impairment and Duration will always be "not applicable".

[2]Clinical Phase II: On-going Treatment and Convalescence- During clinical phase II, the affected crew member is receiving any appropriate follow-on treatment for his or her medical condition to allow the crew member to recover as much as he or she is able to recover in the ISS environment. Clinical phase II also encompasses relapses or reoccurrences of the same original medical condition in clinical phase I necessitating additional treatment or recovery time due to unsuccessful primary treatment response. The duration in Clinical Phase II is expressed in minimum, most likely (ML) and maximum hours. This was updated for future capabilities in IMM but is currently not being used by the model.

[3]Clinical Phase III: Recovered/Mission End State- Clinical phase III is reached once the affected crew member has recovered from the medical condition as much as he or she is able to recover in the ISS environment. This may or may not be recovery from the given medical condition to the full extent possible. If this "recovered" state results in an evacuation or loss of the crew member, this will be noted in the mission end state results.

*Functional Impairment (FI) is a measure of the affected crew member's health and performance ability.

**Two mission end state results are addressed in the CliFF: 1) Evacuation (EVAC) - crew and patient are evacuated from the spacecraft due to the medical condition, and 2) Loss of crew (LOCL) - death of affected crew member due to medical condition. EVAC is considered as an end state result if any of the following criteria are met: 1) potential LOCL, 2) potential significant permanent impairment, or 3) potential intractable pain. Probability distributions are assigned for each range of values within the Table of Treatments and Outcomes.

Refer to the Integrated Medical Model Technical Document for more information on how risk is reported by the IMM, Crew Health Index (CHI) and Quality Adjusted Mission Time calculations.

Definition and Probability of Best and Worst Case Scenario: (includes definitions of best and worst case scenarios and identifies the probability of those scenarios.)

Scenario Comments

The **best case scenario definition** is reversible pulpitis, when pain is controlled by removing the painful stimuli, oral pain reliever, or by topical anesthetic.

The **worst case scenario is defined** as irreversible pulpitis when pain is not relieved by oral pain reliever or topical anesthetic, and requires injected analgesic.

Percentages of how often best versus worst case scenarios occur: based in Krell's study, 27 of 127 teeth progressed from reversible pulpitis to irreversible or necrotic; our estimate is 21% would be worst case (Krell, 2007).

Apical and periodontal abscesses are addressed in the Dental Abscess Cliff. Sepsis secondary to necrosis is addressed in the sepsis CliFF.

Best Case Comments

Pulpitis is a temporary condition and it is not listed in the AMA Guides for Permanent Impairment. Our functional impairments calculation follows the IMM severe non-space adaptation template and Guidelines to the Evaluation of Impairment of the Oral and Maxillofacial Region (American Association of Oral and Maxillofacial Surgeons, 2008). On the untreated best case scenario, pain relief may not be achieved (HealthPartners Dental Group, 2009); therefore the functional impairments (FI) calculation deviates from the IMM standard template for this scenario. Mastication disorders ratings are based on Table 11-7, p.269 (American Medical Association, 2008). Complex Regional Pain (UEI) is based on Table 15-26, p.454. The CRPS (UEI) ratings are then converted to percentage of Whole Person Impairment (WPI), which are based on Table 15-1, p 385 (American Medical Association, 2008). Combined FI ratings are calculated combining the Mastication FI and Whole Body Impairment using the Combined Values Chart as indicated in Appendix A, pp 604-606 (American Medical Association, 2008).

By definition, functional impairment (FI) is 100% during **Clinical Phase I**. Duration is estimated to be 30 minutes, to follow the procedure indicated in the ISS Medical checklist for exposed pulp (Hatcher, 2007). During **Clinical Phase II**, FI is estimated in 6 to 41%. Duration is estimated in 30 to 90 minutes based in time to take oral medication or to apply local anesthetic. During **Clinical Phase III**, the pain resolves and FI is 0%. By definition, EVAC and LOCL are not expected in the best case scenario.

Worst Case Comments

Pulpitis is a temporary condition and it is not listed in the AMA Guides for Permanent Impairment. Our functional impairments calculation follows the IMM severe non-space adaptation template and Guidelines to the Evaluation of Impairment of the Oral and Maxillofacial Region (American Association of Oral and Maxillofacial Surgeons, 2008). On the untreated best case scenario, pain relief may not be achieved (HealthPartners Dental Group, 2009); therefore the functional impairments (FI) calculation deviates from the IMM standard template for this scenario. Mastication disorders ratings are based on Table 11-7, p.269 (American Medical Association, 2008). Complex Regional Pain (UEI) is based on Table 15-26, p.454. The CRPS (UEI) ratings are then converted to percentage of Whole Person Impairment (WPI), which are based on Table 15-1, p 385 (American Medical Association, 2008). Combined FI ratings are calculated combining the Mastication FI and Whole Body Impairment using the Combined Values Chart as indicated in Appendix A, pp 604-606 (American Medical Association, 2008).

By definition, functional impairment (FI) is 100% during **Clinical Phase I**. Duration is estimated to be 30 to 60 minutes, to follow the procedures indicated in the ISS Medical checklist for exposed pulp (Hatcher, 2007). During **Clinical Phase II**, FI is estimated in 26 to 65%, Class 2 to 3. Duration is estimated in 90 minutes to seven days. During **Clinical Phase III**, the pain may not resolve or reoccurs thus FI is 0-65%. EVAC has occurred in an analog submarine population for endodontical diagnoses (Deutsch, 2008). Chaffin (Chaffin, 2008) estimated that 25% of soldiers seen due to pain would have required evacuation without on-site care. Due to uncertainty our EVAC estimate is 0 to 100%. LOCL is not expected.

Untreated Best Case Comments

Pulpitis is a temporary condition and it is not listed in the AMA Guides for Permanent Impairment. Our functional impairments calculation follows the IMM severe non-space adaptation template and Guidelines to the Evaluation of Impairment of the Oral and Maxillofacial Region (American Association of Oral and Maxillofacial Surgeons, 2008). On the untreated best case scenario, pain relief may not be achieved (HealthPartners Dental Group, 2009); therefore the functional impairments (FI) calculation deviates from the IMM standard template for this scenario. Mastication disorders ratings are based on Table 11-7, p.269 (American Medical Association, 2008). Complex Regional Pain (UEI) is based on Table 15-26, p.454. The CRPS (UEI) ratings are then converted to percentage of Whole Person Impairment (WPI), which are based on Table 15-1, p 385 (American Medical Association, 2008). Combined FI ratings are calculated combining the Mastication FI and Whole Body Impairment using the Combined Values Chart as indicated in Appendix A, pp 604-606 (American Medical Association, 2008).

During Clinical Phase II, FI is estimated in 26 to 65%, Class 2 to 3, considering moderate to severe pain and eating liquid or no foods (American Medical Association, 2008). Duration is estimated in 90 minutes to seven days. During **Clinical Phase III**, the pain may not resolve or reoccurs and FI remains 26-65%. EVAC has occurred in an analog submarine population for endodontical diagnoses (Deutsch, 2008). Chaffin (Chaffin, 2008) estimated that 25% of soldiers seen due to pain would have required evacuation without on-site care. Our EVAC estimate is 0 to 100%. LOCL is not expected.

Untreated Worst Case Comments

Pulpitis is a temporary condition and it is not listed in the AMA Guides for Permanent Impairment. Our functional impairments calculation follows the IMM severe non-space adaptation template and Guidelines to the Evaluation of Impairment of the Oral and Maxillofacial Region (American Association of Oral and Maxillofacial Surgeons, 2008). On the untreated best case scenario, pain relief may not be achieved (HealthPartners Dental Group, 2009); therefore the functional impairments (FI) calculation deviates from the IMM standard template for this scenario. Mastication disorders ratings are based on Table 11-7, p.269 (American Medical Association, 2008). Complex Regional Pain (UEI) is based on Table 15-26, p.454. The CRPS (UEI) ratings are then converted to percentage of Whole Person Impairment (WPI), which are based on Table 15-1, p 385 (American Medical Association, 2008). Combined FI ratings are calculated combining the Mastication FI and Whole Body Impairment using the Combined Values Chart as indicated in Appendix A, pp 604-606 (American Medical Association, 2008).

During **Clinical Phase II**, FI is estimated at 58 to 80%, Class 3-4. Duration is estimated from one and a half to 7 days, similar to the treated scenario. During **Clinical Phase III**, the pain may not resolve and FI remains 58 to 80% (American Medical Association, 2008). Subsiding pain may be a sign of progression to necrosis. Based on the need for definitive care on the ground (Hodapp, 2008) EVAC is estimated at 100% for this scenario. LOCL is not expected.

Treatment and Options Level of Evidence (LOE)

The IMM level of evidence appropriate assessment of the quality of the IMM input data. Since IMM incorporates input data from a wide variety of sources including astronaut population, terrestrial or analog populations, and external models, an innovative approach to assess the quality of input data was required. Information obtained from the astronaut population and/or space flight is the more relevant so it is assigned the highest level of evidence and less relevant data sources are assigned a lower level of evidence.

Citation	LOE Value	LOE Category
Krell, 2007	4	BCWC
American Medical Association, 2008	3	FI
Deutsch, 2008	2	EVAC
Chaffin, 2008	2	EVAC
Hodapp, 2008	5	EVAC

Additional Comments

We conducted a PubMed search using the terms pulpal exposure, exposed dental pulp, pulpitis acute pulpitis and epidemiology with less than 300 results. We refined our search by relevance and date. There is a dearth of studies in dental epidemiology which was also noted by other authors (Bader, 2001) (Eriksen, 1991).

In 2009, NASA concern for dental emergencies in space was presented (Risin, 2009). Risin reported dental emergencies that have occurred in space (n=2) (Newkirk, 1990; Brown et al., 1977) which we were not able to locate.

Extractions and fillings have also been required in Antarctica (Beynon, 1969) (Lisney, 1976). These articles do not let us calculate annual incidence.

The Resource Table (RT)

Resource	Units Required Best Case	Units Required Worst Case	Units Available At Start Of Mission	Consumable	Essential	Rationale
CMRS	0	1	1	No	No	Restrain crew member to ensure safety
Cotton pellet	1	1	6	Yes	No	To apply topical anesthetic (pain reliever)
Dental eugenol anesthetic 1mL oral syringe	1	1	2	Yes	Yes	Pain relief - dental
Dental mirror (H)	1	1	1	No	Yes	Assist in examination of teeth
Gauze pads (4x4)	2	2	50	Yes	No	To absorb blood or fluids from skin
Lidocaine w/ Epinephrine (Xylocaine) 2 %, 2-mL units 1:100,000 epi, 20 mL. Multi dose vials.	0	0.1	2	Yes	Yes	Local anesthesia
Motrin (Ibuprofen) 400mg	2	36	500	Yes	Yes	For pain management
Needle (23G)	0	1	20	Yes	No	Administer lido
Sharps container	0	1	40	No	No	To dispose of medical waste such as used medical needles, scalpels, IV catheters, razors, vials
Syringe (3cc)	0	1	20	Yes	Yes	administration lido.
Vicodin HP (Hydrocodone/ Acetaminophen HP) 10 mg/660 mg	2	12	30	Yes	Yes	Pain relief

Resource Comments

Table was exported from database on 6/23/2010 and revised.

Notes: We changed acetaminophen from 0 to 6 for best case and from 6 to 0 for worst case. We added cotton pellet and gauze pads to best case. The toothache kit (Red Cross) comprises 3 cartridges of Eugenol, 1 pair of tweezers, and 6 cotton pellets, thus after adding the individual components, we deleted the dental kit.

0.5 carpule of Xylocaine is used for upper teeth and 1 for lower teeth.

Dental treatment outlined in Principles of Clinical Medicine for Space-flight (Hodapp, 2008)is very similar to the described ISS procedures.

Comparison of the Med Checklist and current treatment process:

The Med Checklist (Mission Operations Directorate (MOD), 2011) goal in the management of exposed pulp is to anesthetize the area while terrestrial guidelines focus on pulpal treatment (pulp capping, pulpotomy, and root canal treatment (HealthPartners Dental Group, 2009)

Required Resources Level of Evidence (LOE)

The IMM level of evidence appropriate assessment of the quality of the IMM input data. Since IMM incorporates input data from a wide variety of sources including astronaut population, terrestrial or analog populations, and external models, an innovative approach to assess the quality of input data was required. Information obtained from the astronaut population and/or space flight is the more relevant so it is assigned the highest level of evidence and less relevant data sources are assigned a lower level of evidence.

Citation	LOE Value	LOE Category
NASA Mission Operations Directorate (MOD), 2011	2	Resources

Level Of Evidence

Input Data	LOE Average
Incidence	2
Functional Impairment	3
Best Case / Worst Case	4
EVAC / LOCL	3
Resources	2
QUALITY OF EVIDENCE	**2.8**

Description	Range
Excellent	1-2
Good	2.1-3
Fair	3.1-4
Poor	4.1-5

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