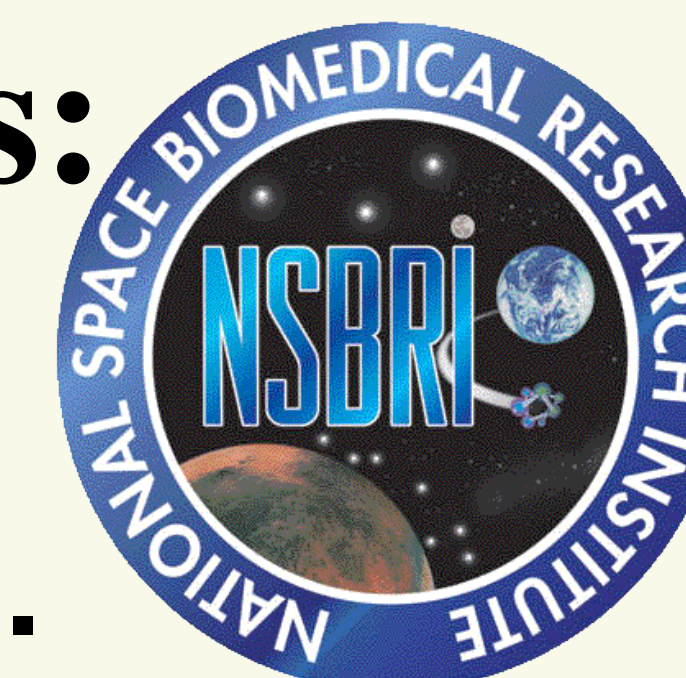


Different Perspectives on Asthenia in Astronauts and Cosmonauts: International Research Literature

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Introduction

The Behavioral Health and Performance (BHP) Element is one of the six elements within the NASA Human Research Program (HRP) and is responsible for managing four risks: a) The Risk of Performance Decrements due to inadequate Cooperation, Coordination, Communication and Psychological Adaptation within a Team (Team), b) the Risk of Performance Errors due to Sleep Loss, Circadian Desynchronization, Fatigue and Work Overload (Sleep), c) Risk of Behavioral Conditions (BMed), and d) the Risk of Psychiatric Disorders (BMed).

The aim of this report is to address some of the recommendations made by the recent NASA HRP Standing Review Panel for the Behavioral Medicine Risk of Psychiatric Disorders. Such recommendations included: a) the inclusion of important national and international literature in English and non-English language materials; including journals, books, magazines, conference reports and b) an extensive literature review of certain types of psychological states to predict, detect, and assess adverse mental states that may negatively affect the psychological well being of the astronauts, specifically asthenia.

This report was a collaborative international work effort focused on the evaluation and determination of the importance of continuing research on asthenia as a possible psychological problem that might affect the optimal psychological functioning among crewmembers during long-duration space flight missions.

Russian medical personnel (flight surgeons and psychologist) have observed symptoms of asthenia (weakness, increased fatigue, irritability, and attention and memory disorders) in cosmonauts after four months in space (Myasnikov & Zamaledinov 1996; Grigoriev, 1996) and believe that asthenia is one of the greater risks that will affect crews' optimal psychological functioning.

"If our diagnostic systems do not readily match the symptoms profiles presented, practitioners will continue to underdiagnose psychological disorders (Kessler et al. 1994; Üstun et al. 1995; Mason & Wilkison, 1996 as cited in Hickie, 1997)"

Methods

This comprehensive international systematic literature review includes six phases: Phase 1: Inclusion and Exclusion criteria, Phase 2: Data collection, Phase 3: Initial evaluation of data, Phase 4: Interviews with experts, Phase 5: Analysis and interpretation, and Phase 6: Results. We examined physical, psychological and psychiatric literature that comprised studies involving astronauts and cosmonauts during short- and long-duration space flight missions. Countries included in the literature review were Canada, Germany, Spain, Japan, Czech Republic, Russia, U.S.A., U.K., Australia, and Switzerland, and, in the interview process, Canada, Germany, Spain, Japan, Czech Republic, Russia, and U.S.A.

Inclusion criteria included 1) journal articles, conferences, books, magazines, newspapers, empirical/quantitative studies with astronauts and cosmonauts; 2) time period: > to 2010; and 3) databases: Psych Info, Psych article, ISI Web of Knowledge, PubMed, DynaMed, Access Medicine, MD Consult, STATREF, Diagnosticsaurus, East View information Services, World Cat, Elsevier, ScienceDirect.

Exclusion criteria were: 1) technical reports, books, conference, newspapers, magazines, dissertations, commentaries, case-sample studies, literature reviews that were not representative of the astronaut or cosmonaut population and that were not related to the area of psychology, psychiatry, asthenia, mental health during long- and short-duration space flight missions.

Data collection and analysis: Thirteen major databases were examined: PsychInfo, Psycharticle, ISI Web of Knowledge, PubMed, DynaMed, Access Medicine, MD Consult, STATREF, Diagnosticsaurus, East View information Services, World Cat, Elsevier, ScienceDirect. The keywords used in the systematic analysis were: astronaut(s), cosmonaut(s), asthenia, neurasthenia, neurocirculatory asthenia, psychoasthenia, space, space flight, psychology, psychiatry, long-duration missions, short-duration missions and mental health. The key word selection identified a total of 350 articles. After applying our inclusion and exclusion criteria, the final articles for review were 104. Six experts, from around the world in the field of psychiatry, psychology (clinical, sport and neuropsychology) and space medicine, who are either working directly with space agencies to help support astronauts or cosmonauts or are involved in analog projects related to space flight missions like Mars 500, were interviewed in a semi-structured interview model.

Table of international Definitions of Asthenia

Author	Terminology	Definition	Field	country
Drachman D.B. 2008	Neurasthenia	Is the historic term for a myasthenia-like fatigue syndrome without an organic basis. These patients may present with subjective symptoms of weakness and fatigue, but muscle testing usually reveals the "jerky release" or "give-away weakness" characteristic of nonorganic disorders (Harrison med book)	Physiology	USA
Brown, 1804	Asthenia	Asthenic diseases were caused by insufficient exciting power and had to be treated by strong stimulants, notably opium and alcohol; 'asthenic' diseases were caused by an excess of the exciting power.		
Beard 1880	Neurasthenia	Is a set of 30 symptoms to diagnose neurasthenia, including [dilation, abnormal activity, sick headache, pain pressure, and heaviness in the back of the head, changes in the expression of the eye, disturbance of the nerves of special sense, deficient mental control, mental irritability, hopelessness, morbid fear (the result of various functional diseases of the nervous system, and imply a debility, a weakness, an incompetency and inadequacy as compared with the normal state of the individual), flushing and flidgetiness, insomnia, drowsiness, nervous exhaustion, feeling of profound exhaustion, unaccompanied by positive pain, vague pains and flying neuralgias (...)]	Physiology	USA
Petrovsky and Yaroshevsky 1987p. 28). As cited in Kanas 2003	Asthenia or Asthenization	Nervous or mental weakness manifesting itself in tiredness... and quick loss of strength, low sensation threshold, extremely unstable moods, and sleep disturbance. (Asthenia) may be CAUSED by somatic disease as well as excessive mental or physical strain, prolonged negative emotional experience or conflict.	Psychology- psychiatry	Russia
WHO 2010 (ICD-10)	Neurasthenia	Considerable cultural variations occur in the presentation of this disorder, and two main types occur with substantial overlap, 1) the main feature is a complaint of increased fatigue after mental effort, often associated with some decrease in occupational performance or coping efficiency in daily tasks. The mental fatigue is typically described as an unpleasant intrusion of distracting associations or recollections, difficulty in concentrating, and generally inefficient thinking, 2) the emphasis is on feelings of bodily or physical weakness and exhaustion after only minimal effort, accompanied by a feeling of muscular aches and pains and inability to relax. In both types a variety of other unpleasant physical feelings is common, such as dizziness, tension headaches, and feelings of general instability. Worry about decreasing mental and bodily well being, irritability, anhedonia, and varying minor degrees of both depression and anxiety are all common. Sleep is often disturbed in its initial and middle phases but hypersomnia may also be prominent.	Psychology- psychiatry	International
Gordeev (2003)	Asthenia	Is characterized by abnormal spontaneous fatigue and easy physical and mental fatigability that develops after minimal physical and mental work, persists for a long time, and does not disappear after rest. It also includes emotional lability, increased anxiety, reduced motivation, sleep and memory disorders, and impaired concentration. Asthenia violates physical and mental capacities and affects patient's life and social activity. Asthenia is often associated with psychoautonomic syndrome (autonomic dystonia) and underlies the development of somatic and neurological disorders (Vein 1991). As differentiated from physiological fatigue, asthenic syndrome requires medical treatment.	Physiology	Russia
Myasnikov & Zamaledinov (1996)	Asthenia	Is defined as an abnormal state marked by weakness, increased tendency towards fatigue, irritability, and disorders of attention and memory. Asthenia is distinct from normal fatigue.	Psychological- psychiatric	Russia
Aleksandrovskiy and Novikov (1996). In Kanas 2003	Asthenia	Partial Asthenia Mild form of asthenia (hyposthenia) develops in many cosmonauts after 1 or 2 months of flight. The hyposthenic state is one in which inhibitory processes predominate and is characterized by fatigue, decrease work capacity, sleep problem, anxiety, autonomic??? disturbance, attention and concentration difficulties, and heightened sensitivity to bright lights and loud noises.	Space Psychology	Russia
Aleksandrovskiy (1976) In Kanas 1991	Asthenia	Describe three stages of Asthenia. • Stage one (hyperesthesia), there is a general increase in sensitivity to external stimuli, resulting in hyperarousal and increased (sometimes pointless) activity, emotional instability and irritability, impatience, decreased memory, poor attention and concentration, fatigue, headaches, perspiration, instability of pulse and blood pressure, and sleep disturbances • Stage two: (irritable weakness), irritability and emotional instability progress into more severe fatigue, negative emotional reactions, and somnolence. • Stage three: there is indifference and inertness, apathy, constant fatigue, passiveness, and lack of work capability.	Psychological- psychiatric	Russia
Voloshina, V.M 1989	Asthenia	Is defined based on etiological criteria: psychogenic, physiogenic, somatogenic and cerebrogogenic asthenias resulting from the impact of the extreme factors causing maladaptation, especially when their role was unequal. • Psychogenic: occurred when psycho-traumatic factor was dominant. With apparent emotional instability manifested in either irritability and excitability with aggressive tendencies or extreme resentfulness and tearfulness. • Physiogenic: occurred as a result of gradual fatigue accumulation caused by overwhelming physical and mental strain. Decrease in performance and increase in asthenic phenomena presented and worsened after periods of hard work and subsided after rest • Somatogenic: A correlation between asthenia and the phase, as well as intensity of a physical illness was observed, while asthenic symptoms had a tendency towards becoming more complex. • Cerebrogogenic: who in the past had experienced cranial trauma, arachnoiditis and other central nervous system impairments that did not expressly manifest as organic symptoms, as well as subjects with cerebrovascular disorders of various intensity deemed of insufficient significance during pre-employment selection. Asthenia in these subjects was characterized by acute irritability, sleep disturbances and dysfunction of autonomic nervous system.	Physiology	Russia

Three variants of asthenia

a) Non-pathological adaptational asthenic restrictions: manifested as a decreased capability of psychological adaptation mechanisms to counter the impact of extreme conditions. The rate of function recovery in these cases largely depended on the degree of psychogenesis, fatigue level, physical predisposition and severity of physical illness.

b) Preexisting asthenic state: encompassed pre-morbid form of adjustment disorders caused by adaptation mechanism breakdown and functional exhaustion of individual's psychological adaptation defense mechanisms. Increased polymorphism of symptoms

c) Asthenic disorder: clinical forms of borderline neuropsychiatric disorders.

Asthenia Def. cont.

Tiganov, A.S. 1975	Asthenia	Is a state characterized by the heightened susceptibility to fatigue, fast onset of exhaustion, partial or total loss of capacity for prolonged physical activity or mental exertion	Space psychology	Russia
Encyclopedic Dictionary of Medicine Terms 1982	Asthenia	A state characterized by increased susceptibility to fatigue, frequent change of mood, irritable weakness, hyperesthesia, tearfulness, ANS and sleep disorders	Physiology	Russia
Encyclopedic Dictionary of Medicine Terms 1982	Neuropsychiatric asthenia	Decrease of functional capabilities of the central nervous system manifested in reduced performance, mental fatigue, worsening of attention and memory, and hyperactivity with irritable weakness, that occurs after serious illness, trauma, or as a result of psychoemotional overexertion	Physiology	Russia
Encyclopedic Dictionary of Medicine Terms 1982	Psychasthenia	Asthenia manifesting in increased susceptibility to exhaustion of psychological processes and delay in recovery that occurs in combination with hyperesthesia and emotional lability.	Physiology	Russia
Alexandrovskiy & Navikov 1997	Psychasthenia	Often refers to problems in adapting to the new external and internal factors as psychological maladaptation meaning, essentially, asthenia that does not produce any psychotic disorders or major psychopathological disorders.	Space psychology	Russia
Psychoasthenia syndrome in space flight (Myasnikov V.I et al 2000)	Asthenia	One distinguishing characteristic of asthenia syndrome is irritable weakness, which is expressed as elevated excitability, quick changing (unstable) moods, and irascibility. All these expressions intensify in the afternoon or closer to the evening. The mood is usually low with some traces of peevishness and dissatisfaction. Asthenia syndrome is frequently accompanied by headaches and sleep disturbances that present as increased sleepiness or persistent insomnia, as well as low tolerance for bright light, loud noises, and sharp aromas. Asthenia syndrome in space can be indentified in three different stages: a) First stage: expressed primarily in a heightened emotional excitability b) Second stage: characterized by a set of symptoms, at the heart of which are mood swings, frequent fatigue, decrease of performance quality, and signs of sleep disturbance. c) Third stage: consistently low mood, expressed irritability, conflict tension, hypochondriac phenomena, frequent and significant errors in performing work-related tasks, and expressly manifested sleep disturbances (requiring systematic use of sleep aid medication)	Space psychology	Russia
DSMIV-TR (APA 2000)	shenjing shuairao	A condition characterized by physical and mental fatigue, dizziness, headaches, other pains, concentration difficulties, sleep disturbance and memory loss.	Psychological- psychiatric	Japan
Tsung 1989	shinkeisaijuku	Psychological reaction developed in a certain type of personality characterized by hypersensitivity, introversion, Self-consciousness, perfectionism and hypochondriacal disposition.	Psychological- psychiatric	China
Titov, A.S. 1975	Asthenia	It is a syndrome that should be viewed as adaptive reaction due to exhaustion of nervous system as a result of overexertion, lack of proper nutrition, disruptions in intercellular metabolism and intoxication.	Space physiology	Russia
Morant, 2008	Neurasthenia	Asthenia is a pathological fatigue, also associated with various non-neoplastic diseases, particularly acute or chronic infections. Symptoms include: weakness, need to rest, lack of concentration, lack of appetite, problems with sleep, anxiety and depression	Physiology	Switzerland



Preliminary Conclusions

While Russia, China, Japan, and many European countries recognize asthenia, neurasthenia, or psychoasthenia as a psychological illness, North America does not. However, in the U.S., the symptoms of asthenia overlap with different psychological diagnoses such as depression, chronic fatigue, anxiety, and adjustment disorders. The U.S. and Russia are the most experienced countries in supporting astronauts and cosmonauts in space. However, only the Russian program recognizes asthenia, neurasthenia, or psychoasthenia as a possible threat during long-duration missions.

The Behavioral Health and Performance research element is aware of the existence of asthenia in space and is currently developing an exhaustive international literature review and conducting interviews with experts in the area of space psychology and psychiatry. International collaborative research in this area is sorely needed to determine and evaluate whether asthenia is a potential psychological problem that adversely affects the optimal psychological functioning of crewmembers for future long-duration space flight missions of extended duration and/or beyond low-Earth orbit.

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