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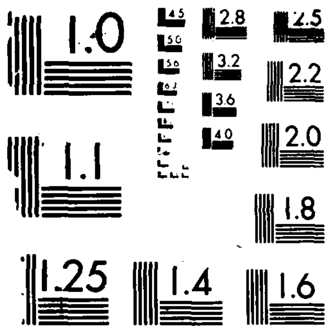

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Group Adaptation and Individual Adjustment in Antarctica:
A Summary of Recent Research

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SUMMARY

Problem

Despite extensive research on the health and performance of Antarctic winter-over personnel while they are "on the ice," little is known about the long-term effects of the winter-over experience. The prolonged isolation during this period is associated with numerous social and psychological stressors, in addition to physiological changes.

Objective

A series of studies conducted at the Naval Health Research Center examined the health and service records of enlisted Navy personnel who applied to the Operation Deep Freeze Program between 1963 and 1974. The objective of these studies was to determine if follow-up incidence rates and performance criteria were significantly different between a group of winter-over personnel and a control group of enlisted personnel who were screened and qualified for winter-over duty but assigned elsewhere.

Approach

Subjects for these studies were 2,724 enlisted Navy men who volunteered for winter-over duty in Antarctica between 1963 and 1974. All of these men were screened and found to be acceptable for winter-over duty. However, only 328 of these men actually wintered over at one of six small stations during this period. The remainder were assigned elsewhere. These two groups were followed using medical and service history records available at the Naval Health Research Center. A fifteen-year period from 1965 to 1979 was established for follow-up, although the mean length of follow-up time for all subjects was 5.4 years. Four types of data were examined: demographic characteristics obtained from the Operation Deep Freeze and Navy Enlisted History Files; inpatient medical data, including all first hospitalizations for all diagnoses which occurred after entry into the study; service history information, including number of promotions, demotions, unauthorized absences, desertions, medical and physical evaluation board hearings, and type of discharge; and personality inventories which assessed selected traits.

Results

The rate of all-cause first hospitalizations among the winter-over group was significantly less than the rate among the control group. The winter-over group also had significantly fewer first hospitalizations for neoplasms; endocrine, nutritional, and metabolic diseases; and diseases of the musculoskeletal system. No significant differences were observed on any of the performance indicators. An increase in total disease incidence was observed among the winter-over group within a year of their return from the Antarctic, but this increase failed to attain statistical significance relative to the rate of the control group. In addition, individuals with high needs for achievement and control over others were found to be at reduced risk for long-term disease incidence.

Conclusion

The winter-over experience does not appear to place enlisted personnel at significant long-term risk for first hospitalizations subsequent to their return from the Antarctic. The stressors associated with prolonged isolation in a harsh environment appear to be mediated by personality, socioenvironmental, and sociocultural factors.

Recommendations

A comprehensive research program is needed to address the limitations of these studies and determine why winter-over personnel have significantly fewer first hospitalizations. Additional behavioral and social research in the Antarctic could contribute to human factors research and development for long-term missions in space.

Group Adaptation and Individual Adjustment in Antarctica: A Summary of Recent Research

A. Introduction

It seems paradoxical that a continent that historically has been without indigenous human inhabitants should serve as an ideal laboratory for the social and behavioral sciences. Nevertheless, there has been a growing recognition that the human experience in Antarctica permits detailed study of certain behavioral principles pertinent to all human social groups, regardless of size and complexity (Gunderson, 1974; Pierce, 1985; Shurley, 1974). In fact, certain features of this experience are paradigmatic of the human factors associated with long-term missions in space. Particularly relevant to the task of planning for these missions are the relationship between group adaptation and individual adjustment and the effect of this relationship on human health and performance under conditions of prolonged isolation in an extreme environment.

The objective of this paper is to report on some recent studies conducted on archival data at the Naval Health Research Center (NHRC) which address these issues. In doing so, I wish to highlight three salient themes of this research: 1) its relevance for the space program; 2) its interdisciplinary nature; and 3) the need for developing a comprehensive program of additional behavioral and social research in the Antarctic.

1. Background

Throughout the 1960s and early 1970s, NHRC was a major center of psychological research in the Antarctic. Several studies conducted by Dr. Eric Gunderson and his colleagues examined the emotional effects of prolonged isolation; criteria measures of adaptation such as physical and mental health, task performance, and social compatability; and individual and group predictors of successful adaptation. This research provided valuable input into the methods used to screen Operation Deep Freeze candidates and has contributed to the overall record of health and performance characteristic of Antarctic operations since the early 1960s.

In 1983, the Center received approval from the Naval Medical Research and Development Command to pursue these studies further. Some of these data were reexamined in order to advise NASA regarding the application of the

Antarctic winter-over experience to their proposed Space Station Program. Of particular interest was the extension of these earlier studies to include follow-up assessments of personnel who had wintered-over in the Antarctic. The objective of these assessments was to determine the effects of prolonged isolation in an extreme environment on health and performance in both the short term (i.e., during the mission itself) and the long term (i.e., post-mission follow-up). It was hoped that such research could contribute to NASA's Space Station Program in four respects. First, it would lead to the development and modification of methods used to screen the best qualified candidates with an emphasis on traits necessary for coping with prolonged isolation. Second, it would contribute to the development of a training program designed to enhance stress-coping skills and resources. Third, it would suggest changes in organizational frameworks to enhance performance during long-term missions while minimizing any adverse effects of prolonged isolation. Finally, it would identify the means for minimizing the long-term consequences of prolonged isolation through periodic assessment of post-mission health and performance.

2. Prolonged Isolation and Stress in the Antarctic

One of the characteristics that Antarctic research stations share in common with the proposed space station is their location in an extreme, hostile environment. Known for being the highest, driest, coldest, and windiest of the earth's continents, it is little wonder that Antarctica has had no permanent human inhabitants. Nevertheless, since the turn of the century, people have resided there for varying periods of time. The first experience in wintering over was the Belgica expedition of 1898-99. Since that time, although winter-over personnel face dangers of fire, frostbite, falling into crevasses, and getting lost in the dark, the most potent source of stress has been the social environment rather than the physical environment. In Antarctica, this social environment is characterized by prolonged isolation. Severe weather conditions during the austral winter prohibit travel to and from the continent, and radio and satellite communication is frequently interrupted for extended periods. This isolation generates both external and internal stressors for station personnel. External stressors include difficulties in communicating with family or friends, real or imagined unpleasant events at home (Strange & Klein, 1974), shortages in supplies, and administrative actions that interfere with established routines or disappoint seemingly trivial expectations (Natani & Shurley, 1974). Internal stressors include the lack of privacy in cramped quarters; boredom due to the lack of environmental stimulation and interaction with the same limited number of individuals; sexual deprivation; reductions in the gratification of the "basic" human needs of affection, security, and feelings of personal significance; and the absence of statuses and roles which define one's social position in the outside world (Natani & Shurley, 1974; Rohrer, 1961).

Exposure to these social and environmental stressors results in a number of physiological and psychological changes among winter-over personnel. Gunderson (1968), for example, found that the incidence rates of psychiatric hospitalizations among Navy personnel assigned to Antarctic duty was approximately three times higher than among Navy personnel in general. Cases of psychoses or severe neuroses have been extremely rare; however, many individuals experience mild to moderate psychophysiological disturbances after several months of winter confinement. These symptoms appear to increase over time, peaking at mid-winter. Strange and Klein (1974) have grouped these symptoms into a general phenomenon known as the "winter-over syndrome." This syndrome has four major components: (1) depression, (2) problems of hostility, (3) sleep disturbance, and (4) impaired cognition. In a 1969 debriefing, 85% of the American winter-over contingent reported periods of a significant depressive syndrome occurring during the winter; 65% had periods of anger or hostility; 60% complained of significant problems with either going asleep or staying asleep; and 53% reported impaired cognition, including difficulty in concentration and memory, absentmindedness, and general slowing of intellectual activities (Strange & Youngman, 1971).

Alcohol-related problems have also been commonly but not universally reported in Antarctic stations. A number of the debriefing reports by U.S. Navy psychiatrists in recent years have noted "a widespread perception and outspoken assertion among winter-over personnel that alcohol was used excessively by certain individuals, and that this excessive use was deleterious to the community because of noise, rowdy behavior, and fighting and to the mission of the command because of alcohol-related injuries and motor vehicle accidents" (Blair, 1983). Strange and Klein (1974:413) note that the misuse of alcohol has caused two types of problems to occur in the Antarctic: (1) chronic excessive over-indulgence by older, more senior personnel interfering with their leadership ability; and (2) acute intoxication causing release of aggressive behavior, particularly in the younger men, and stimulating violent behavior in the group. A study by Popkin, Stillner, Osborn, Pierce, and Shurley (1974) also suggested the possibility of a relationship between cognitive drifting and increased use of alcohol as reported by subjects.

In addition to the psychological changes, physiological changes are experienced by Antarctic winter-over personnel as well. Dyspnea, anorexia, insomnia, and headaches are frequent symptoms at all Antarctic research stations. Arterial hypoxia, hyperventilation, and erythrocytosis are common in the high altitude environment of South Pole Station (Guenter, Joern, Shurley, & Pierce, 1970). The physiological changes incident to hypobaric hypoxia has resulted in several cases of acute mountain sickness with insomnia as a major symptom (Shurley, 1970). In one study, Muchmore, Blackburn, Shurley, Pierce, and McKown (1970) reported a significant drop in the number of circulating leukocytes among five subjects at South Pole Station throughout the winter. Immunoglobulin concentrations have also been found to undergo a significant decline during the Antarctic winter (Muchmore, Tatem, Worley, Shurley, & Scott, 1974), while increases in urinary catecholamine levels have been noted (Bodey, 1974). Injuries, however, are regarded as the most serious medical problem on the ice. During Deep Freeze 84, for instance, 294 accidents were reported; 22 or 7.5% or these were alcohol-related.

3. Post-Antarctic Followup

While we have learned much about the human experience in the Antarctic, the long-term effects of this experience remain largely a mystery. According to King (1986:354):

> No information exists on delayed physical and psychological consequences of temporary residence in polar regions. As the number of subjects exposed to this experience grows, the notion that it may result in adverse influences on physical and mental health, which are not immediately apparent, can no longer be ignored. A longitudinal study of morbidity and mortality of former polar expedi--tioners is required.

Most of the research to date on the effects of prolonged exposure to the

Antarctic environment has focused on the physiological changes which have occurred at the end of the winter-over period. A number of studies, for instance, (Dick, Mandel, Warshauer, Conklin, & Jerde, 1977; Meschievitz, Raynor, & Dick, 1983; Muchmore et al., 1974; Muchmore, Parkinson, & Scott, 1983; Parkinson, Muchmore, & Scott, 1979) have noted the outbreaks of upper respiratory infections and colds among winter-over personnel at the opening of a station each year. These are attributed to the immunosuppressed state of winter-over personnel due to the climate, psychological stress, and absence of viral agents, (Muchmore et al., 1970; Williams, Climie, Miller, & Lugg, 1986). Sleep studies have also demonstrated that South Polar Plateau subjects lose all stage IV sleep as well as significant amounts of stage III and REM. The restoration of a standard sleep-EEG pattern has required as long as 24 months after return from a year in the Antarctic (Natani & Shurley, 1974).

Winter-over personnel are also believed to experience emotional problems upon their return to the outside world. Oliver's (1979) study of personnel who wintered over at McMurdo Station in 1977 reported feelings of isolation and problems with readjusting to the larger society for periods as long as 12 months after returning to the U.S. In addition, there have been some anecdotal reports among Australian winter-over personnel of attempted suicides, severe depression, and alcohol abuse upon their return from the Antarctic (Lugg, pers. comm., 1986).

The impact of living and working under such conditions may be felt more dramatically after the experience itself. One working hypothesis for behavioral scientists, therefore, is that the risk for illness and disease subsequent to the winter-over experience may be similar to the risk for illness after a stressful life event or series of life events such as post-traumatic stress disorders among Vietnam combat veterans (Figley, 1978), risk of myocardial infarction after death of spouse (Helsing & Szklo, 1981), or the risk of a stroke after loss of job (Brenner & Mooney, 1982). To examine this possibility, we conducted a series of follow-up studies to determine if winter-over personnel were indeed at risk for physical and mental disorders in both the short term and long term, and what, if any, factors (social, psychological, environmental), moderated the relationship between the winter-over experience and subsequent health and performance.

B. Follow-up Studies of Operation Deep Freeze Volunteers

1. Methodology

The subjects for our studies were 2,724 enlisted Navy men who volunteered to winter-over in Antarctica between 1963 and 1974. All of these individuals were evaluated by screening teams, each consisting of a clinical psychologist and psychiatrist, and found to be acceptable for winter-over duty. The study population was divided into two groups on the basis of whether or not they actually wintered over at one of six small stations between 1963 and 1974. Because of the specific needs of personnel with certain qualifications at each station, only 328 of these individuals actually wintered over during this period. The remainder were assigned to other duty stations throughout the world during the austral winter.

Records of screening evaluations of the study subjects were compiled into a computerized file at the Naval Health Research Center. The Operation Deep Freeze File contains biographical and service history information and screening results on 4,557 military and civilian applicants from this period. However, only Navy enlisted personnel were selected for follow-up because of the availability of medical and service history data on these individuals. The Naval Health Research Center maintains an Inpatient Medical Data File containing records on all hospitalizations for all active duty Navy personnel for the period 1965-1984, and an Enlisted Service History File containing service history information on all enlisted personnel during this period as well (Garland, Helmkamp, Gunderson, Gorham, Miller, McNally, & Thompson, 1987). These two files were searched for all medical and service history information on the Navy enlisted personnel identified from the Operation Deep Freeze File.

A 15 year period from 1965 to 1979 was established for follow-up, based on the period of time for which medical and service history information was available for both groups at the time the study was conducted. The start date for participation in the study was established as 1 January 1965 or the year an individual was evaluated for the Operation Deep Freeze Program if after this date. Withdrawal was defined as the date of last discharge from the Navy or 31 December 1979, whichever came first. The mean length of follow-up for study subjects was 6.1 years for the winter-over group, 5.3 years for the control group, and 5.4 years for the entire population.

A description of our study subjects is provided in Table 1. The subjects were young ($\bar{X}$ = 26.1) enlisted men with a mean paygrade ($\bar{X}$ = 4.9) reflecting that of 2nd class petty officers and an average of seven ($\bar{X}$ = 7.0) years of service in the Navy at the time they were screened for the Operation Deep Freeze Program. Most (71.0%) of the subjects were high school graduates and 15% had one or more years of college. Slightly over half (50.5%) of the subjects were blue collar personnel; the remainder were classified in administrative-clerical (23.4%), electronic-technical (15.2%), medical (6.7%), and apprentice (3.8%) occupational categories. The winter-over group was slightly older ($\bar{X}$ = 27.1) than the control group ($\bar{X}$ = 26.0) with a higher mean paygrade and higher mean length of service prior to volunteering for Operation Deep Freeze. Twenty-nine percent of the control group had less than a high school education in comparison with 34.6 percent of the winter-over personnel. Blue collar occupations and hospital corpsmen were represented in greater numbers in the winter-over group, while the control group had significantly more apprentices and unrated personnel. However, no significant occupational difference between the two groups was observed when blue collar occupations were compared with all others. Similarly, no significant racial group difference (white vs nonwhite) was observed.

Table 1. Characteristics of Winter-Over and Control Groups, Operation Deep Freeze Participants: 1965-1979

	Winter-Over		Controls		Significance
Mean Age	27.11		25.98		$p<0.001$
Mean Pay Grade (E1-E9)	5.14		4.86		$p<0.001$
Mean Length of Service (Years)	8.18		6.83		$p<0.001$
Education	N	%	N	%	
8th Grade or Less	19	5.8	105	9.9	
Grades 9 to 11	93	28.8	564	19.1	
High School Graduate	180	55.7	1,340	56.0	
College	31	9.6	371	16.0	$p<0.004$
Race					
White	317	96.9	2,293	95.7	
Non-White	10	3.1	103	4.3	N.S.
Occupational Group					
Blue Collar	170	52.0	1,208	50.5	
All Other	157	48.0	1,188	49.5	N.S.

The health status of our subjects at entry into the study was assessed by responses to the Cornell Medical Index (CMI) scales. A comparison of CMI scores obtained from winter-over personnel and the control group found no significant differences between winter-over and control personnel on any of the questions except that winter-over personnel were heavier drinkers (CMI No. 144, $x^2 = 5.47$, $p < .02$); complained more of constant coughing (CMI No. 22, $x^2 = 4.59$, $p < .03$); and were more likely to have had hepatitis (CMI No. 62, $x^2 = 4.78$, $p < .03$). The control group, on the other hand, complained more of frequent urination (CMI No. 104, $x^2 = 5.07$, $p < .03$).

Disease incidence was defined on the basis of the first inpatient admission for all diagnoses for each subject. Inpatient medical data included all first hospitalizations for all diagnoses which occurred after entry into the study (i.e., subsequent to screening for Operation Deep Freeze). Diagnoses were in accordance with the Eighth Revision, International Classification of Disease Adapted for Use in the United States (ICDA-8). First hospitalization rates for sixteen ICDA-8 diagnostic categories were calculated using person-years at risk as the denominator. Rates were age-adjusted using the direct method of adjustment (Lilienfeld & Lilienfeld, 1980), with the standard population being comprised of all study subjects. The rates for the winter-over and control groups were compared to obtain estimates of relative risk by dividing the rates of the winter-over group by the respective rates of the control group. Levels of significance of these associations were obtained using 95% confidence intervals (Daniel, 1983).

In addition to first hospitalizations, other criteria were used to assess the long-term effects of the winter-over experience. Records of medical and physical evaluation board hearings and death records were obtained from the Inpatient Medical Record. Service history information obtained from the Navy Enlisted History File included the number of promotions, demotions, unauthorized absences, desertions, and the last change in active-duty status.

2. Health and Performance of Antarctic Winter-Over Personnel: A Follow-up Study

The first study conducted with these data compared personnel who wintered-over in the Antarctic with the control group to determine if they were at risk for illness and injury upon their return. Given the stressful nature of the winter-over experience, we expected that the winter-over group would have a significantly higher rate of first hospitalizations than the control group. Both groups were compared on a series of performance indices as well as rates of all-cause first hospitalizations and rates for each of the sixteen selected ICDA-8 categories.

The incidence of first hospitalizations for all diagnostic categories is presented in Table 2. The rate of total or all-cause first hospitalizations for the winter-over group was significantly less than the rate for the control group. The winter-over group had significantly fewer first hospitalizations for neoplasms; endocrine, nutritional, and metabolic diseases; and diseases of the musculoskeletal system, than the control group. Differences observed in the remaining diagnostic categories failed to attain statistical significance at the 0.05 level, although observed lower rates among the winter-over group for mental disorders and accidental and violent injuries are at the 0.10 level.

To further evaluate the significantly reduced risk in the observed diagnostic categories, we examined the number of cases of first hospitalization for neoplasms; endocrine, nutritional and metabolic diseases; and diseases of the musculoskeletal system by individual diagnoses. The results are presented in Tables 3, 4, and 5. The control group had a number of cases of lipomas, diabetes, obesity, osteoarthritis, internal derangement of joint, displacement of intervertebral disc, vertebrogenic pain syndrome, and other diseases of joint. However, a meaningful comparison of these cases between the winter-over and control groups, using estimates of relative risk, was limited by the relatively few cases of each diagnosis.

Table 6 provides a summary of selected service history and performance indicators of the two groups. No significant differences were observed on any of these indicators.

Table 2. Age-Adjusted First Hospitalization Rates (per 10,000 person years), Relative Risk Estimates and 95% Confidence Intervals by Winter-Over Status and Diagnostic Category, Operation Deep Freeze Volunteers, 1965-1979

Diagnostic Category	Winter-Over		Controls		Relative	95% C.I.
	N	Rate	N	Rate	Risk	
Infective and Parasitic Diseases	9	45.01	48	37.39	1.20	0.35 - 2.05
Neoplasms	2	9.53	45	35.38	0.27	0.00 - 0.65*
Endocrine, Nutritional and Metabolic Diseases	3	14.07	44	34.55	0.41	0.00 - 0.89*
Diseases of Blood and Blood-Forming Organs	3	14.13	8	6.29	2.25	0.00 - 5.24
Mental Disorders	10	47.02	94	73.84	0.64	0.22 - 1.06
Diseases of the Nervous System and Sense Organs	7	32.89	59	46.17	0.71	0.15 - 1.27
Diseases of the Circulatory System	17	81.97	114	89.54	0.92	0.45 - 1.39
Diseases of the Respiratory System	14	65.26	75	58.80	1.11	0.48 - 1.74
Diseases of the Digestive System	24	114.91	155	121.71	0.94	0.54 - 1.34
Diseases of the Genitourinary System	7	33.23	60	46.96	0.71	0.15 - 1.27
Diseases of the Skin and Subcutaneous Tissue	7	33.06	46	36.04	0.92	0.19 - 1.65
Diseases of the Musculo-skeletal System	10	46.63	106	83.22	0.56	0.20 - 0.92*
Congenital Anomalies	4	18.83	15	11.79	1.60	0.00 - 3.36
Symptoms and Ill-Defined Conditions	7	33.02	66	51.73	0.66	0.15 - 1.17
Accidents, Poisonings, and Violence	25	117.99	207	161.19	0.73	0.43 - 1.03
Supplementary Classifications	7	32.74	50	39.17	0.84	0.18 - 1.50
Total First Hospitalizations	156	740.32	1190	932.25	0.79	0.66 - 0.92*
Person Years at Risk	2001		12828			

* $p<0.05$

Table 3. First Hospitalizations for Neoplasms by Winter-Over Status, Operation Deep Freeze Volunteers, 1965-1979

ICDA-8 CODE	Diagnosis	Number of Cases: Winter Over	Number of Cases: Controls
153	Malignant Neoplasm of Large Intestine	0	1
154	Malignant Neoplasm of Rectum and Rectosigmoid Junction	0	1
156	Malignant Neoplasm of Gallbladder and Bile Ducts	0	1
162	Malignant Neoplasm of Trachia, Bronchus and Lung	0	2
173	Other Malignant Neoplasm of Skin	0	1
185	Malignant Neoplasm of Testis	0	1
188	Malignant Neoplasm of Bladder	0	1
196	Secondary and Unspecified Malignant Neoplasm of Lymph Nodes	0	1
197	Secondary Malignant Neoplasm of Respiratory and Digestive Systems	0	1
205	Myeloid Leukemia	0	2
207	Other and Unspecified Leukemia	0	1
209	Myelofibrosis	0	1
210	Benign Neoplasm of Buccal Cavity and Pharynx	0	1
211	Benign Neoplasm of Other Parts of Digestive System	0	5
212	Benign Neoplasm of Respiratory System	0	1
213	Benign Neoplasm of Bone and Cartilage	0	2
214	Lipoma	1	9
216	Benign Neoplasm of Skin	0	1
227	Hemangioma and Lymphangioma	0	2
228	Benign Neoplasm of Other and Unspecified Organs and Tissues	1	4
230	Neoplasm of Unspecified Nature of Respiratory Organs	0	1
237	Neoplasm of Unspecified Nature of Other Genitourinary Organs	0	1
239	Neoplasm of Unspecified Nature of Other and Unspecified Organs	0	4
Total Cases		2	45

Table 4. First Hospitalizations for Endocrine, Nutritional and Metabolic Diseases by Winter-Over Status, Operation Deep Freeze Volunteers, 1965-1979

ICDA-8 Code	Diagnosis	Number of Cases Winter Over	Number of Cases Controls
*	Allergic Disorders	0	1
240	Nontoxic Nodular Goiter	0	2
241	Thyrotoxicosis with or without Goiter	0	2
245	Hypothyroidism	0	1
250	Diabetes Mellitus	2	11
251	Disorders of Pancreatic Internal Secretion other than Diabetes Mellitus	0	1
266	Avitaminoses Deficiency	0	1
269	Other Nutritional Deficiency	0	1
272	Congenital Disorders of Lipid Metabolism	0	3
273	Other and Unspecified Congenital Disorders of Metabolism	0	1
274	Gout	0	1
277	Obesity not Specified as of Endocrine Origin	0	12
279	Other and Unspecified Metabolic Diseases	1	5
Total Cases		3	44

* DDDIC Code 245

Table 5. First Hospitalizations for Diseases of the Musculoskeletal System by Winter-Over Status, Operation Deep Freeze Volunteers, 1965-1979

ICDA-8 Code	Diagnosis	Number of Cases Winter Over	Number of Cases Control
710	Acute Arthritis Due to Pyogenic Organisms	1	0
712	Rheumatoid Arthritis and Allied Conditions	0	1
713	Osteoarthritis and Allied Conditions	0	11
714	Other Specified Forms of Arthritis	1	2
715	Arthritis, Unspecified	1	2
718	Rheumatism, Unspecified	0	1
720	Osteomyelitis and Periostitis	0	2
722	Osteochondrosis	0	1
723	Other Diseases of Bone	0	3
724	Internal Derangement of Joint	1	10
725	Displacement of Intervertebral Disc	3	22
726	Affection of Sacroiliac Joint	0	1
727	Ankylosis of Joint	0	2
728	Vertebrogenic Pain Syndrome	1	12
729	Other Diseases of Joint	0	13
730	Bunion	0	1
731	Synovitis, Bursitis, and Tenosynovitis	2	9
733	Other Diseases of Muscle, Tendon, and Fascia	0	6
734	Diffuse Diseases of Connective Tissue	0	1
735	Curvature of Spine	0	2
737	Hallux Valgus and Varus	0	1
738	Other Deformaties	0	3
Total Cases		10	106

Table 6. Service History of Winter-Over and Control Groups, Operation Deep Freeze Participants: 1965-1979

	Winter-Over		Control		Significance
	N	%	N	%	
Promotions	203	62.1	1,394	58.2	N.S.
Demotions	5	1.5	44	1.8	N.S.
Unexcused Absences	8	2.4	28	1.2	N.S.
Desertions	2	0.6	11	0.5	N.S.
Last Change Grouped					N.S.
Reinlisted	5	1.5	55	2.3	
Promoted	3	0.9	19	0.8	
Demoted	0	0.0	1	0.0	
Extension	4	1.2	81	3.4	
Released to Inactive Duty	225	68.8	1,540	64.3	
Honorable Discharge	41	12.5	371	15.5	
General Discharge	2	0.6	14	0.6	
Bad Conduct Discharge	2	0.6	5	0.2	
Other Discharge	9	2.8	76	3.2	
Died	3	0.9	25	1.0	
Duty Station Change	29	8.9	186	7.8	
Hospitalization	1	0.3	5	0.2	
Physical Evaluation Board	3	0.9	16	0.7	
Medical Disposition					
Medical Boards	12	3.7	83	3.5	N.S.
Physical Evaluation Boards	6	1.8	72	3.0	N.S.
Died in Service	3	0.9	25	1.0	N.S.

The results indicated that the winter-over experience did not seriously impair the long-term health and performance of enlisted Navy personnel. In fact, the experience appeared to be related to a reduced risk of subsequent disease incidence for certain diagnostic categories. To explain this observed relationship, several different possibilities were entertained. For instance, although not statistically significant, the lower rates of mental disorders and accidental injuries among the winter-over group might indicate that the Operation Deep Freeze screening program effectively eliminated candidates with high-risk psychological profiles. Similarly, the lower rates of other disease categories may indicate that the winter-over group was healthier than the control group at the time of screening. However, psychiatric suitability did not discriminate between winter-over and control groups because both were comprised of individuals who were evaluated by a screening team as suitable for winter-over duty. Other factors, such as the need for a certain occupational skill at a particular research station and the previous experience of the applicant are used in the final determination as to who does winter-over. Our examination of CMI responses indicated that the health status of both groups at the time of screening were similar except in those instances where the winter-over group appeared to have a less favorable health profile (i.e., greater alcohol consumption, complaints of constant coughing, history of hepatitis) than the control group.

Differences in age and education may also account for the observed differences in rates of first hospitalization. However, the incidence rates were age-adjusted to control for the possibility of a spurious relationship. Education may have been a factor in accounting for the observed differences; however, while other studies have indicated an inverse relationship between education and disease risk, our results suggested a direct relationship with the better-educated control group exhibiting the higher rates of first hospitalization.

Finally, we considered the possibility that the results may have simply been a representation of the "healthy worker effect," a phenomenon commonly observed in studies of occupational health where the observed differences in rates between workers in certain occupations and the general population are due to the fact that not only are persons selected for employment on the average healthier than the general population, but once they become employed, they tend to have better economic circumstances and better access to medical care; they also may make changes in their lifestyle that are conducive to better health (Kelsey, Thompson, & Evans, 1986). However, both groups were employed as enlisted Navy personnel; both were in similar occupations; and follow-up occurred only during the period of active-duty service. Moreover, when rates of first hospitalizations were adjusted for occupational differences (using the categories of blue collar versus all other occupational groups), the observed differences between the winter-over and control groups remained. Similarly, because both groups are comprised of volunteers, self-selection of highly motivated winter-over personnel does not explain the observed differences.

3. A Longitudinal Study of Disease Incidence

One of the issues not specifically addressed by this long-term follow-up study was the previously reported instances of stress and illness observed during the first year after wintering over in the Antarctic. The observation that winter-over personnel did not exhibit significantly higher rates of disease incidence than the control group over a long-period of time did not necessarily invalidate the possibility that the former were at increased risk during the period of time when struggling to return to their former jobs and renew relationships with family, friends, and co-workers. It was hypothesized that perhaps a more sensitive indicator of the relationship between prolonged isolation and disease risk would be to examine the rates of first hospitalization by selected time intervals small enough to observe the health status of winter-over personnel within the first year or two upon their return from the Antarctic. We therefore conducted a study to determine if winter-over personnel were at risk for first hospitalizations during the first year subsequent to returning from Antarctica.

A survival analysis method was adopted to calculate rates of first hospitalization by six month intervals subsequent to being screened for the Operation Deep Freeze Program. Because the number of cases among the winter-over group within these six month intervals were too small to permit the calculation of statistically valid rates for each diagnostic category, only all-cause first hospitalization rates were used in this study.

The incidence of total first hospitalizations for all diagnoses among the winter-over and and control groups by six month intervals for the first four years of study participation is presented in Table 7. The rate for the winter-over group during the first two six month periods of study participation was significantly lower than the rate for the control group. The rate for the winter-over group displayed a steady increase, however, reaching a peak during the fifth interval, which was about 27 months after entry into the study and nine months after the end of winter-over duty. With the increase in the rate of total first hospitalizations, the relative risk also increased, reaching a peak at the same time (i.e., nine months after the winter-over period). This was clearly evident from Figure 1. However, this relative risk of 1.43 was not statistically significant. Moreover, the rate of total first hospitalizations among the winter-over group for the remainder of the study period (months 30 to 180) was significantly less than the rate for the control group.

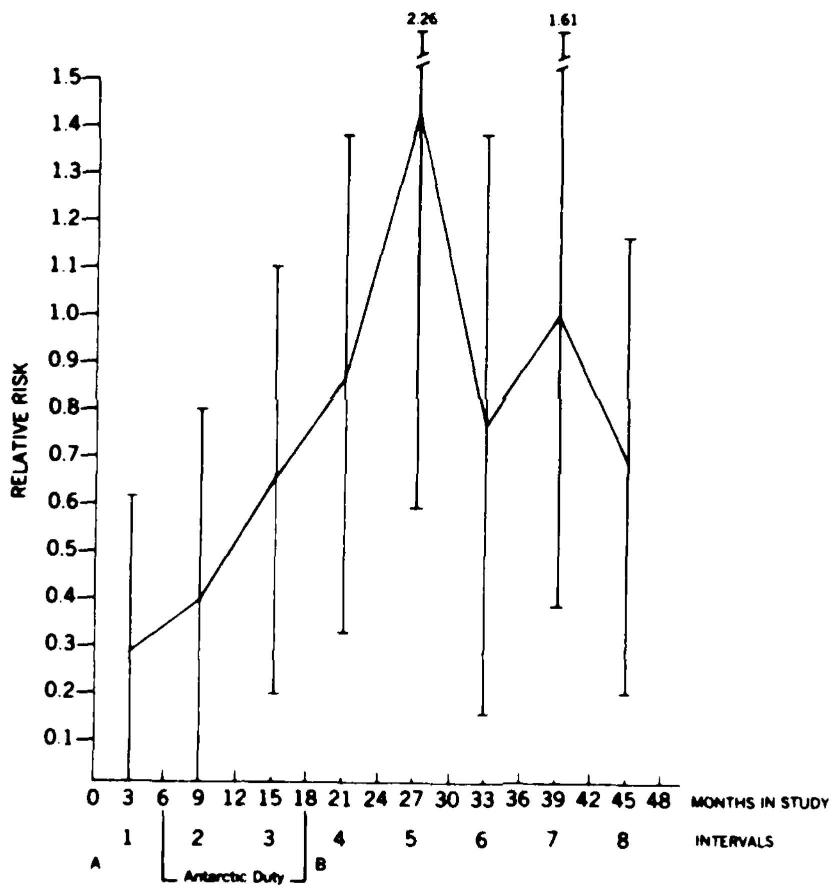
Table 7. Age-Adjusted First Hospitalization Rates (per 10,000 person years), Relative Risk Estimates and 95% Confidence Intervals at Six Month Intervals by Winter-Over Status, Operation Deep Freeze Volunteers, 1965-1979

Interval Number	Period (Months)	Mid-Point (Months)	Winter-Over N	Winter-Over Rate	Controls N	Controls Rate	Relative Risk	95% Confidence Limits
1	0-6	3	3	104.7	79	359.0	0.29	0.00 - 0.62*
2	6-12	9	4	137.3	65	345.2	0.40	0.00 - 0.80*
3	12-18	15	9	309.4	81	478.2	0.65	0.20 - 1.10
4	24-30	21	12	444.5	82	518.5	0.86	0.34 - 1.38
5	24-30	27	14	577.3	59	403.0	1.43	0.60 - 2.26
6	30-36	33	7	306.1	55	395.9	0.77	0.16 - 1.38
7	36-42	39	12	546.3	72	548.0	1.00	0.39 - 1.61
8	42-48	45	9	420.0	59	610.5	0.69	0.21 - 1.17
6-30	30-180	90	114	577.3	824	703.7	0.82	0.67 - 0.97*

* $p<0.05$

Despite the observed increase in rates during the first year upon returning from Antarctica, the incidence of first hospitalizations among those who wintered over was still no greater than that of the control group. This suggests that the experience is not associated with either short-term or long-term disease/injury risk.

One possible explanation for these results is that the harshness of the environment, combined with the processes of psychosocial adjustment to prolonged isolation, minimize the risk of disease both in the short-term and, in the context of adaptation to stressful life events, in the long-term as well. Previous research has attributed the low incidence of infectious disease and diseases of the respiratory system among Antarctic personnel during the austral winter as the result of prolonged isolation in a relatively sterile and disease free environment (Allen, 1973; Meschievitz et al., 1983; Muchmore et al., 1983; Parkinson et al., 1979). This would help to account for the smaller rates of first hospitalizations during the



A Date of screening for Operation Deep Freeze
B End of winter-over period

Figure 1 Relative risk of total first hospitalizations for winter-over group, 1965 1979 First four years of study participation by six-month intervals

intervals of Antarctic duty. In addition, despite the presence of the psychological symptoms of the "winter-over syndrome," the microcultures of Antarctic research stations support and promote values, rules for behavior, and personality traits in individual members enabling them to adapt to isolation and perhaps also promoting health on a long-term basis as well (Palinkas, 1985; Taylor, 1974). The significantly lower rate of total first hospitalizations among the winter-over group after the fifth interval (27 months after entry into the study and 9 months after returning from the Antarctic) would appear to suggest such a long-term benefit from this process of adaptation. This process may also begin immediately upon selection for winter-over duty, which would account for the significantly lower rates during the six month period prior to Antarctic duty. Hence, the process of psychosocial adjustment may have long-term as well as short-term benefits for one's health and well-being.

4. Personality and Disease Incidence

The third study to be reviewed examined differences in personality traits of winter-over and control groups in an effort to explain the observed difference in rates of first hospitalizations. Because the two groups were similar with respect to their clinical evaluations, the difference cannot be attributed to the screening process. However, it is possible that the differences in rates of disease incidence were due to differences in personality characteristics moderating the relationship between a prolonged stressful life event (the winter-over experience) and a subsequent long-term risk for disease incidence. Thus, two questions emerged from this earlier research: (1) do the winter-over and control groups exhibit different personality traits; and (2) do these traits predict for long-term disease incidence as defined by a first hospitalization for a specific disease?

The personality characteristics and interpersonal needs of study subjects were measured by two scales originally employed to screen prospective candidates for winter-over duty during this period and to predict for performance on the ice. The first inventory was the FIRO-B (Schutz, 1958). This questionnaire was designed to assess how an individual acts in three areas of social interaction (Inclusion, Affection, and Control) in terms of the behavior the individual expresses towards others (expressing) and how he wants others to behave towards him (wanting). The second set of scales and rating measures utilized in the study were developed especially for the Antarctic screening program on the basis of qualities believed to be desirable in winter-over personnel (Ford & Gunderson, 1962). Factor analysis was employed to identify highly intercorrelated clusters of inventory items which appeared to represent meaningful psychological concepts (Gunderson & Mahan, 1966). Four of the test scales measured common psychological needs: Achievement, Autonomy, Nurturance, and Order. The content of these four scales are generally similar to those of the corresponding Edwards Personal Preference Schedule (EPPS) scales (Edwards, 1959), although the format of the items was entirely different.

In this study, each of the ten scales were examined independently. In order to determine the effect of these personality characteristics on risk for first hospitalization, the subjects were divided into two groups for each personality measure on the basis of whether their scores fell above or below the median. The Cox proportional hazards model (Lee, 1980) was used to determine the independent effect of each personality dimension after adjusting for differences in age, education, and winter-over status.

The intercorrelations of the Antarctic and FIRO-B measures and demographic characteristics of age and education are presented in Table 8. Because of the large number of subjects, almost all of the correlations displayed statistical significance ($p < .001$). However, only fifteen of these correlations were greater than .20. The highest correlations were observed between Expressed and Wanted Inclusion ($r = .54$) and Expressed and Wanted Affection ($r = .57$). Inclusion (both Expressed and Wanted) also showed modest correlations with both measures of Affection. A modest correlation ($r = .36$) also was observed between Achievement and Order. With the exception of a .22 correlation between age and Autonomy, the correlations between the personality scales, age and education were either of a small order or statisticallly insignificant. Age and education were inversely related (-.27).

The next step was to examine the differences in the personality profiles of the winter-over and control groups. T-tests were used to compare the mean scores of each scale for the two groups. The results are presented in Table 9. None of the differences in mean personality scores between the two groups were statistically significant; hence, the differences in rates of first hospitalization observed in the previous studies could not be explained by

Table 8. Intercorrelations of EPPS and FIRO-B Measures of Personality Needs of Enlisted Navy Personnel, Operation Deep Freeze Volunteers, 1963-1974.

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1. Achievement	15.36	4.32	1.00	-.10	.18	.36	.15	.12	.17	-.08	.15	.11	.07	.01
2. Autonomy	31.54	5.61		1.00	.04	-.16	-.13	-.06	.17	.05	-.11	-.11	-.22	.14
3. Nurturance	20.17	4.22			1.00	.17	.27	.27	.15	.12	.26	.27	-.01	.01
4. Order	14.69	4.16				1.00	.15	.05	.03	-.09	.09	.07	.10	-.02
5. Inclusion (E)	4.67	2.13					1.00	.54	.17	.21	.42	.31	-.09	.11
6. Inclusion (W)	3.41	3.42						1.00	.15	.12	.41	.46	-.11	.05
7. Control (E)	2.64	2.14							1.00	.21	.12	.04	.10	.10
8. Control (W)	4.77	1.94								1.00	.11	.03	-.07	.07
9. Affection (E)	3.18	2.01									1.00	.57	.02	.07
10. Affection (W)	3.65	2.41										1.00	.06	.02
11. Age	26.12	5.95											1.00	-.27
12. Education*	5.51	1.33												1.00

*Education was scored from 1 (7 years or less) to 9 (17 years or more). High school graduates were scored as 6.

differences in personality traits.

Because the number of first hospitalizations in each diagnostic category were too small to yield meaningful results, the Cox proportional hazards model was used to assess the joint effects of demographic and personality characteristics on risk of all-cause first hospitalizations. As shown in Table 10, when all demographic and personality factors are combined in one model, age and education were significant predictors with personnel 26 years and older exhibiting the highest relative risk. After controlling for the demographic characteristics and winter-over experience, only Control-Expressed (p. < .01) and Achievement (p. < .05) were significant independent predictors of first hospitalization. Our results also indicated that those who wintered over in Antarctica had a significantly decreased risk for subsequent all-cause first hospitalizations than the control group. This

Table 9. Personality Scores of Winter-Over and Control Groups, Operation Deep Freeze Volunteers, 1963-1974

	Winter-Over		Control		F value
	Mean	SD	Mean	SD	
Achievement	15.01	4.38	15.43	4.30	1.04
Autonomy	32.46	5.30	31.45	5.59	1.11
Nurturance	19.94	3.99	20.21	4.23	1.12
Order	14.35	3.97	14.68	4.17	1.10
Inclusion-Expressed	4.75	2.13	4.63	2.12	1.01
Inclusion-Wanted	3.34	3.46	3.37	3.40	1.04
Control-Expressed	2.62	2.17	2.65	2.12	1.04
Control-Wanted	4.79	1.90	4.78	1.93	1.03
Affection-Expressed	3.26	1.86	3.16	2.02	1.18
Affection-Wanted	3.76	2.31	3.63	2.42	1.10

difference cannot be attributed to differences in personality, age or education. How, then, do we explain this positive effect of a prolonged stressful experience?

Other studies (Palinkas, 1985; Taylor, 1974) have suggested that winter-over personnel learn from their experience in Antarctica, becoming more independent and self-reliant. The fact that the winter-over personnel have significantly fewer first hospitalizations throughout their enlisted careers when contrasted with the control group suggests that the lessons learned in coping with the stressful Antarctic environment may be utilized in coping with other stressful experiences as well. If, in fact, this is the case, then stressful life events may not always result in illness because individuals with certain personality characteristics in certain social and environmental contexts may learn from their experience and develop coping styles and social resources enabling them to cope with subsequent events, thereby reducing the risk for illness in the long term. This may help to explain the low order correlations found in most studies of stressful life events and illness (Rabkin & Struening, 1976; Schroeder & Costa, 1984).

Table 10. Coefficients, Relative Risk Estimates, and 95% Confidence Intervals for All-Cause First Hospitalizations among Operation Deep Freeze Volunteers, 1965-1979 (based on Cox's proportional hazards model).

Variable	Coefficient	Standard Error	Relative Risk	95% C.I.
Age (26+/17-25)	0.3826	0.061	1.47	1.30-1.65***
Education (<12/HS Grad)	-0.1481	0.059	0.86	0.77-0.97**
Winter Over (W.O./Control)	-0.2256	0.090	0.80	0.62-0.97**
Achievement (Hi/Low)	-0.1249	0.060	0.88	0.77-0.99*
Autonomy (Hi/Low)	-0.0335	0.059	0.97	0.85-1.08
Nurturance (Hi/Low)	-0.0027	0.060	1.00	0.88-1.11
Order (Hi/Low)	-0.0116	0.059	0.99	0.87-1.10
Inclusion-Expressed (Hi/Low)	0.0611	0.071	1.06	0.92-1.22
Inclusion-Wanted (Hi/Low)	-0.0668	0.069	0.93	0.82-1.07
Control-Expressed (Hi/Low)	-0.1738	0.062	0.84	0.74-0.95**
Control-Wanted (Hi/Low)	0.0324	0.067	1.03	0.91-1.18
Affection-Expressed (Hi/Low)	0.0327	0.073	1.03	0.90-1.19
Affection-Wanted (Hi/Low)	0.0282	0.063	1.03	0.91-1.16

* $p<0.05$
** $p<0.01$
*** $p<0.001$

It is not suprising that both the winter-over experience and a high need for expressed control were significant predictors of improved health status. The winter-over experience addresses the issue of the limits of one's control over his or her physical and social environment. All winter-over personnel must learn to cope with limited control over their environment. They are dependent upon their physical shelters to withstand the harsh climate and must interact with the same group of people for eight months at a time. Removal from this environment during this period is not possible. Natani and Shurley (1974:110) hypothsize that under these conditions, "the independent individuals who volunteered for antarctic duty also have developed a strong need for behaviors that give them positive feedback about their own self-control, control over their fate, and control over their environment."

These behaviors may also be utilized in coping with other stressful environments and life events. A sense of control over the environment has been implicated as a moderator of stress in several different studies. A study of men who had experienced ischemic strokes (Adler, MacRitchie & Engel, 1971), for instance, found that the stroke typically occurred in a general situation in which the individual felt he was no longer in control of his environment. Studies which have applied Rotter's (1966) notion of locus of control have generally found that individuals with an external locus of control are at greater risk for physical and psychological disorders than individuals with an internal locus of control (Johnson & Sarason, 1978; Seligman, 1975). Evidence produced by Seeman and Seeman (1983), for example, showed that the sense of control is associated with: (1) practicing preventive health measures, e.g. diet, exercise, alcohol moderation; (2) making an effort to avoid the harm in smoking (by quitting, trying to quit, or simply not smoking); (3) being more sanguine about early medical treatment for cancer; (4) achieving higher self-ratings on general health status; and (5) reporting fewer episodes of both chronic and acute illness. The concept of mastery used by Pearlin and Schooler (1978) also includes notions of control, as does the concept of potency used by Ben-Shira (1984) and Kobasa's (1979) concept of hardiness.

Thus, while a need for control itself does not explain the difference in rates of first hospitalization between the winter-over and control groups, a synergistic relationship involving the individual need for control, the station microculture which reinforces this need and identifies strategies for meeting it, and the process of adaptation and adjustment to the stress associated with the winter-over experience, may be responsible for the significantly reduced risk for subsequent disease and injury.

C. Future Directions

A number of limitations to the findings of these studies are apparent. Because of the lack of follow-up data, civilian scientists and technicians and Navy officers were not included. Previous research has noted that these individuals come from different sociocultural backgrounds and display different patterns of performance and psychological adjustment while wintering over in the Antarctic (Doll & Gunderson, 1971; Gunderson & Nelson, 1966). Thus, only a partial representation of the winter-over experience and its effect on health and performance is provided in these studies.

There are also a number of shortcomings in using hospitalizations as a criterion measure of health status. In most instances, the small number of study subjects, especially winter-over personnel, precluded the calculation of meaningful rates of disease incidence. This limitation is particularly evident in studies of social, psychological, and environmental factors responsible for intragroup differences among the winter-over personnel. The number of first hospitalizations for any single diagnosis also were too few to permit the calculation of meaningful rates of disease incidence. The use of total first hospitalizations or first admissions by diagnostic categories, containing diagnoses of various etiologies and degrees of severity, is too general and too complex to provide a complete understanding of specific associations between the winter-over experience and post winter-over health and performance. Rather, the data provided here provide only a broad overview of the relationship and the moderating effects of a limited number of psychosocial characteristics. Moreover, because the majority of illness episodes never come to the attention of the modern health care system (Kleinman, Eisenberg, & Good, 1977), much less result in hospitalization, a hospital admission does not accurately reflect health status. More sensitive and specific measures are required.

One of the major limitations of the longitudinal study of personality and disease incidence was the use of the selected personality inventories. This study represented an exploratory effort using scales which were administered several years ago for the purposes of screening winter-over applicants and predicting performance in Antarctica. The FIRO-B was found to be a good predictor of adjustment on the ice among scientists but not among Navy personnel (Gunderson, 1974). Similarly, studies which have used the FIRO-B to predict psychological distress have produced mixed results.

Because measures of the social environment of study subjects subsequent to screening for Operation Deep Freeze were unavailable, we were also not able to control for the degree of person-environment fit. As Mischel (1968) asserts, personality traits generally predict specific behavioral outcomes only at low levels of efficiency; situational factors, on the other hand, are more influential in predicting criterion behaviors. A more precise assessment of the role of personality in moderating the effects of the winter-over experience would require either an idiographic approach to personality (Bem & Allen, 1974), the measurement of social climate (Kiritz & Moos, 1974), or some other means of controlling the situation in which personality traits are measured.

Likewise, we were unable to control for a potential confounding relationship between duty station environment and disease risk among the subjects in the control group. It is conceivable that other duty assignments which may have included a tour in Vietnam during this period were more stressful or hazardous than wintering over in Antarctica. However, because members of this group were assigned to duty stations throughout the world and thus exposed to a wide variety of environmental conditions, such control was not possible. Moreover, when compared with the relatively uniform stressful life experience of the winter-over personnel, such control was deemed to be unnecessary.

It is also possible that the results obtained in this study reflect the personality traits of a highly select group of individuals and thus cannot be generalized. However, the screening process is more noteworthy for screening out winter-over candidates with obvious physical or psychological limitations than for selecting individuals capable of adapting well to the Antarctic winter or any other stressful experience. In addition, by selecting a healthy group of subjects at baseline, we were able to control for the potential confounding effect of pre-life event health status on subsequent disease incidence.

Finally, these studies are constrained by the archival nature of the data. Since the time these data were collected, the stations themselves have undergone physical improvements; the social composition of winter-over crews has changed (including the presence of women and civilian support personnel); and changes in the larger Euro-American sociocultural system have led to differences in expectations and methods of coping with stress and isolation. Given these changes, we would expect that the microcultures of Antarctic research stations and the factors contributing to stress and adaptation in the Antarctic have changed, resulting in significant differences in the adjustment experience. However, research is required to determine if this, in fact, has occurred.

Despite these limitations, the results of these studies do have relevance for the space program with respect to the four objectives outlined earlier. For instance, they suggest that certain personality characteristics such as a need for achievement, internal locus of control, and social compatability should be assessed in a screening program designed to select individuals for extended missions in space. The experience in Antarctica can also be incorporated into a training program for these individuals. Such a training program would help to "innoculate" them (c.f., Meichenbaum, 1985) from potential adverse consequences of prolonged isolation, including significant decrements in health and performance. The human experience in the Antarctic also suggests that certain organizational structures may help to improve health and performance. The microcultures of Antarctic research stations may serve as a model for the organization of long-term manned space missions. These station microcultures provide or identify appropriate strategies for coping with the stress associated with the extreme environment and social isolation. These strategies include the types and networks of available social support; the emphasis placed on certain psychological resources such as an internal locus of control and self-reliance; and the commitment to the assigned task and to the social group.

Finally, our results suggest that there are no adverse long-term effects of prolonged isolation with respect to health and performance. However, participants of long-term missions in space should be closely monitored during the first year subsequent to mission completion in order to identify potential decrements in health and performance and initiate corrective or therapeutic measures. In addition, the process of readjustment itself may produce a positive benefit in terms of long-term health and performance. Follow-up assessments, using more sensitive measures of adaptation than hospital admissions or numbers of promotions and demotions, could determine if a positive benefit is derived from the combined experience of prolonged isolation and reintegration into society, what form this benefit may assume, and its mode of operation.

The studies described in this paper by no means satisfy the requirements of each of these objectives. However, they do suggest certain lines of inquiry for additional research. First, studies are required to provide an update of the human experience in the Antarctic necessary for an evaluation of social, cultural, and psychological factors influencing the processes of adaptation and adjustment. Second, new data obtained from ethnographic and longitudinal studies could be compared with archival data available at the

Naval Health Research Center to determine if the adjustment experience has indeed changed in the past 20 years. Third, research is needed to determine if and how the winter-over experience reduces the risk of neoplasms, endocrine, nutritional, and metabolic disorders, and diseases of the musculoskeletal system. Fourth, research is necessary to evaluate the lessons learned from the winter-over experience and the extent to which these lessons reduce the risk of subsequent illness. Fifth, the social and psychological characteristics which facilitate the acquisition and utilization of social supports to cope with stress in the Antarctic should be identified.

To pursue these lines of inquiry, however, a comprehensive program of social and behavioral research in the Antarctic is essential. An understanding of the processes of adaptation and adjustment requires the perspective and methods of several different disciplines including psychology, sociology, psychiatry, human ecology, and anthropology. The concept of coping, for instance, represents an area for the potential cross-fertilization of approaches in examining the role of personality, social support, environmental resources and demands, and values and rules of behavior comprising the station microcultures as moderators of the relationship between prolonged isolation and health and performance.

A comprehensive program must also reflect both theoretical and applied interests and be flexible enough to attain scientific results without undue interference with routine operations. Such objectives can only be met by establishing and maintaining an active dialogue among all concerned parties. As the studies summarized by this paper suggest, however, the potential benefits from this dialogue and the research it supports are enormous.

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The relationship between group adaptation and individual adjustment has been the focus of recent research on the long-term effects of prolonged isolation in the Antarctic. A series of studies conducted at the Naval Health Research Center examined the health and service records of enlisted Navy personnel who applied to the Operation Deep Freeze Program between 1963 and 1974. The objective of these studies was to determine if follow-up incidence rates and performance criteria were significantly different between a group of winter-over personnel and a control group of enlisted personnel who were screened and qualified for winter-over duty but assigned elsewhere. Results indicated that the overall incidence rate for the winter-over group was significantly lower than the rate for the control group. An increase in total disease incidence was observed among the winter-over group within a year of their return from the Antarctic, but this increase failed to attain statistical significance relative to the rate of the control group. In addition, individuals with high needs for achievement and control over others were found to be at reduced risk for long-term disease incidence.

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These results are examined in light of personality traits which facilitate adjustment to stressful life events and the sociocultural systems of Antarctic stations which support and promote values enabling personnel to adapt to prolonged isolation.

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