INFECTIOUS DISEASE TRENDS IN THE U.S. NAVY, 1966-1984

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SUMMARY

Problem

Environmental and climatic conditions as well as demographic characteristics play an important role in the incidence of infectious disease. Research is needed to identify trends in infectious disease hospitalization rates as well as high risk groups in order for the Navy Medical Department to plan for the care of personnel and to anticipate future health care needs.

Objectives

The purposes of this study were (1) to analyze trends in infectious disease hospitalization rates from 1966 to 1984 in the U.S. Navy enlisted population and (2) to identify high risk groups for infectious disease on the basis of the factors of age, sex, race, and duty assignment.

Approach

Information selected from the medical inpatient data file, which is maintained at the Naval Health Research Center in San Diego, included the patient's age, sex, race, and duty assignment at the time of admission and the primary diagnoses for all infective, respiratory, and digestive hospitalizations from 1966 through 1984. After tabulating numbers of admissions by diagnosis, year of occurrence, race, sex, and age-specific interval as well as person-years at risk for each specific group, annual hospitalization rates per 10,000 strength were computed by sex for each year (1966-1984) and by sex, race, and age-specific interval across the 1974-1984 time period for the three major diagnostic categories and 16 selected diseases. Age-adjusted annual hospitalization rates for each disease category and specific diagnosis also were computed by sex and race. Ninety-five percent confidence limits were calculated to determine whether or not rate differences between groups were significant. Frequency and percentage distributions of each disease category and diagnosis were compiled for each duty assignment by sex and race; comparisons of proportions were conducted between the 1970s and 1980s.

Results

Although decreases in hospitalization rates were observed across the two decades for the three major diagnostic categories, the largest decline occurred for respiratory diseases. The disorders of acute upper respiratory

infection, diarrheal disease/gastroenteritis, pneumonia, and rubella accounted for much of this decline. In comparisons of rates by sex and race, large decreases across age intervals were noted in each of the four groups (male Caucasians, female Caucasians, male blacks, and female blacks) for the categories of infective and parasitic diseases and respiratory diseases. The highest hospitalization rates for almost all specific diagnoses were observed for 17- to 18-year olds; the recruit training centers accounted for the highest proportions of hospitalizations. Caucasian women had the highest rates, but large decreases were noted across age intervals for infectious mononucleosis, hypertrophy of tonsils, and diarrheal disease. They had significantly higher age-adjusted hospitalization rates than Caucasian men for all three diagnostic categories as well as for six specific diagnoses. Caucasian women also had significantly higher rates than black women for the category of respiratory diseases and the specific conditions of infectious mononucleosis and other upper respiratory diseases. While hospitalization rates for Caucasian men were significantly higher than those for black men for the category of diseases of respiratory system and for the specific conditions of rubella, infectious mononucleosis, pneumonia, other upper respiratory diseases, and appendicitis, black men only had higher rates than their Caucasian counterparts for sexually transmitted diseases. No differences in rates were observed between black men and black women.

Conclusions

While Navy women had much higher rates of infectious disease than men in the late 1960s and early 1970s, these differences had been greatly reduced by the 1980s. Explanations for the large decreases in women's hospitalization rates across the two decades included the larger number and better integration of women in the Navy, new medications and medical technologies, and a shift from inpatient to outpatient care. Differences across training centers were noted, with Great Lakes having the highest percentages of admissions.

Recommendations

The Naval Medical Command should be apprised of these results in order to better understand and meet the health care needs of all naval personnel. From the most recent data presented, hospitalization rates for infectious diseases appear to be only slightly affected by sexual or racial composition.

Infectious Disease Trends in the U.S. Navy, 1966-1984

Introduction

Navy personnel are exposed to a wide variety of environmental conditions including climatic extremes, pressure variations, stressful situations, close living quarters on ships and in recruit training, and travel to foreign lands where conditions might be unsanitary or a high level of endemicity exits.[1,2] These conditions can facilitate the outbreak and spread of infectious disease. In tropical environments such as Vietnam, for example, the incidence of malaria among Navy personnel was determined to be higher than rates reported elsewhere.[3] In Beirut, Lebanon, diarrheal diseases accounted for 96.5% of the 287 cases of infectious diseases (2% of all personnel) reported during a military operation from August to November 1982.[4] In another study, the most prevalent conditions identified during a cold weather exercise were upper respiratory infections, primarily the common cold, which accounted for 24% of the total cases reported.[5] Other studies examined fluctuations in hepatitis morbidity during 1971 to 1982 among U.S. Army personnel stationed in Europe;[6] the incidence of acute respiratory disease (12% of all hospitalizations) at a major U.S. Army basic and advanced training center in Georgia;[7] and factors associated with the incidence of gastrointestinal disease aboard Navy ships.[8]

This brief review has shown that environmental and climatic conditions can impair a combatant's health status which, in turn, could adversely affect performance and the outcome of a mission. In their study of the impact of disease on European history from prehistory times to the "flu" pandemic of 1918-1919, Aker and Cecil cited,[9] as one of many examples, Napoleon's defeat in Russia which they attributed in part to the fact that, by the time Napoleon reached Moscow, seven of every 10 soldiers in the army's central force had fallen to typhus. Other more specific and recent research findings indicated that physical performance was significantly weakened by a viral infection, and measurements of isometric muscle strength were consistently depressed during the fever state of the infection.[10]

In addition to environmental and climatic factors, demographic characteristics play an important role in the incidence of infectious disease in

Navy settings. For example, sex differences in the utilization of health care services for treatment of infectious and chronic conditions have been reported in both the military[11-13] and the civilian sectors.[14-17] Age and duration of active duty also have been examined as contributing factors in elevated rates of hospitalization for infectious disease among Navy personnel.[12] Other factors, such as the shift from a predominantly white male organization to one that includes larger proportions of women and various racial groups, also may have influenced hospitalization rates.[12,18,19]

The purposes of this study were (1) to analyze trends in infectious disease hospitalization rates from 1966 to 1984 in the U.S. Navy enlisted population and (2) to identify high risk groups for infectious disease on the basis of such factors as age, sex, race, and duty assignment. Results of this research will provide the basis for the Naval Medical Command to anticipate the health care needs of a Navy force that may undergo changes in composition.

Methods

Data for this study were extracted from the naval enlisted service history and medical inpatient data files maintained at the Naval Health Research Center (NHRC), San Diego, CA.[20] Information selected from the segment of medical inpatient records, which were obtained from the Naval Medical Data Services Center, Bethesda, MD, consisted of the patient's age, sex, race, and duty assignment at the time of admission and primary diagnoses for all infective, respiratory, and digestive hospitalizations. Admissions to all naval medical inpatient facilities throughout the world during the period of January 1966 through December 1984 were included. Three diagnostic coding systems were involved: Department of Defense Disease and Injury Codes (used from 1965-1969); Eighth Revision International Classification of Diseases, Adapted for Use in the United States (used during 1970-1979); and International Classification of Diseases, Ninth Revision, Clinical Modification (used from 1980-1984). NHRC has developed a common diagnostic coding system which incorporates the three different nomenclatures and includes almost 1,000 specific diagnostic categories.[20] During the first decade, the diagnoses of diarrheal disease and gastroenteritis/colitis were

combined into one diagnosis; beginning in 1974, the two conditions were separated and included in different diagnostic categories.

Numbers of hospitalizations by diagnosis were tabulated according to three specific groupings. In order to compute rates and to examine trends across the two decades, frequency distributions were compiled by sex and year of hospitalization (1966-1984). To perform the more specific comparisons, frequency distributions of infectious disease hospitalizations for 1974 to 1984 were compiled for the groups of Caucasians and blacks by sex and the age intervals of 17-18, 19-20, 21-22, 23-24, 25-29, 30-34, 35-39, and 40 years and older. For comparisons by active duty locations, frequency and percentage distributions of each disease category and diagnosis were compiled for each duty assignment by sex and race; comparisons of these percentages were conducted between 1974-1979 and 1980-1984 in order to identify changes in percentages of admissions across both duty assignments and time segments.

Population figures were obtained from quarterly reports of the number of U.S. Navy personnel who served on active duty for each year from 1966 to 1973. For 1974 to 1984, population figures were extracted from the enlisted service history segment of the NHRC computerized data system. The numbers of active duty men and women were averaged separately across quarters for each of the 19 years to obtain person-years at risk. During the 1974 to 1984 time frame, person-years at risk were compiled by age interval for Caucasian men, black men, Caucasian women, and black women.

Annual hospitalization rates per 10,000 strength were computed by sex for each year as well as by sex, race, and age-specific interval for the three major diagnostic categories and 16 selected diseases. Age-adjusted annual hospitalization rates for each category and specific diagnosis during 1974 to 1984 also were computed by sex and race, using the total Navy population of men and women separately as standard populations and the direct method of age adjustment.[21] Ninety-five percent confidence limits were calculated to determine whether or not rate differences between groups were significant for the 1974 to 1984 time period.

Results

Trends in Hospitalization Rates, 1966-84

During the first decade, the highest rates among the three diagnostic categories were observed for diseases of the respiratory system; beginning in 1978 for men and 1980 for women, digestive disorders accounted for the highest rates. Graphic presentations of these rates as well as decreases with time for each category can be seen in Figures 1-3. The rate differential between men and women for each category narrowed beginning in 1976 and continued decreasing to the end of the time period under study.

The large declines in hospitalization rates across the decades were primarily attributed to decreases for such specific disorders as acute upper respiratory infection, diarrheal disease/gastroenteritis, pneumonia, and rubella. During the first decade, both women's and men's rates were the highest for acute upper respiratory infection; by the end of the second decade, however, rates for this condition as well as pnuemonia were approximately one-tenth of the earlier rates. Women's rates, for example, declined from 114.7 per 10,000 in 1974 to 1.4 in 1984 for acute upper respiratory infection and from 94.7 to 9.4 for pneumonia. Other results showed that the number of admissions for rubella was 3,026 from 1974 to 1979 which contrasted with only 24 cases in the 1980 to 1984 time frame. Also, men's hospitalization rates for malaria and tuberculosis were the highest during 1966 to 1970 when the Navy's involvement in the Vietnam conflict and the Far East was the heaviest. Rates for viral hepatitis fluctuated across the decades of this study; duty assignments with the highest proportions of hepatitis hospitalizations included various types of ships (auxillary, destroyers, and carriers) and the Philippine Islands.

Hospitalization Rates by Sex, Age, Race, and Duty Assignment, 1974-84

As shown in Tables 1 to 4, large rate decreases across age intervals occurred in each of the four groups for the categories of infective and parasitic diseases and diseases of the respiratory system as well as the subcategories of acute upper respiratory infection, pneumonia, rubella, and other viral diseases. The highest hospitalization rates for these categories and disorders were observed for the age interval of 17 to 18 in each of the four groups. Duty assignments with the highest proportions of admissions for

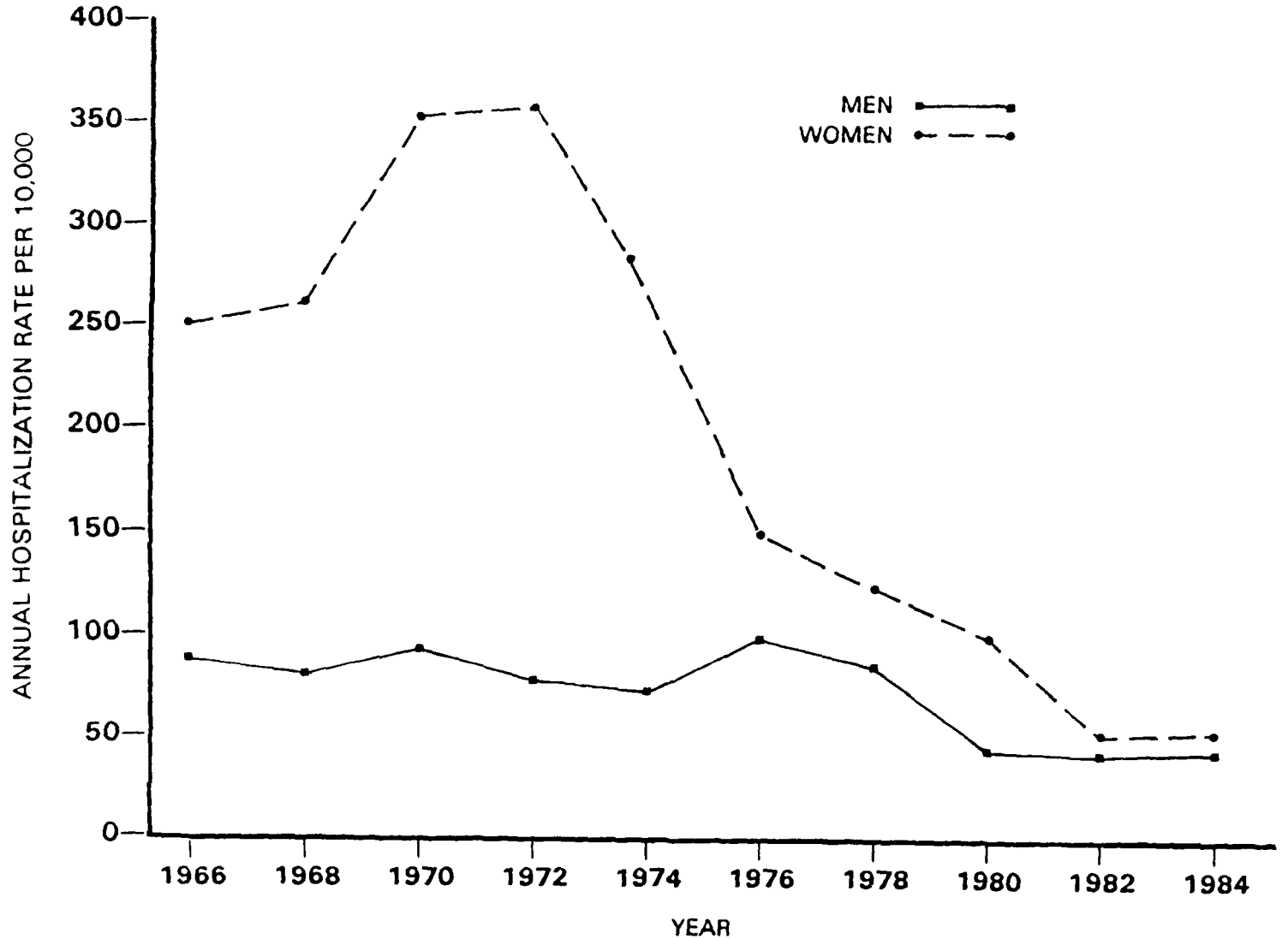

Figure 1. Annual hospitalization rates per 10,000 for infective and parasitic disease among U. S. Navy personnel (only even years are plotted)

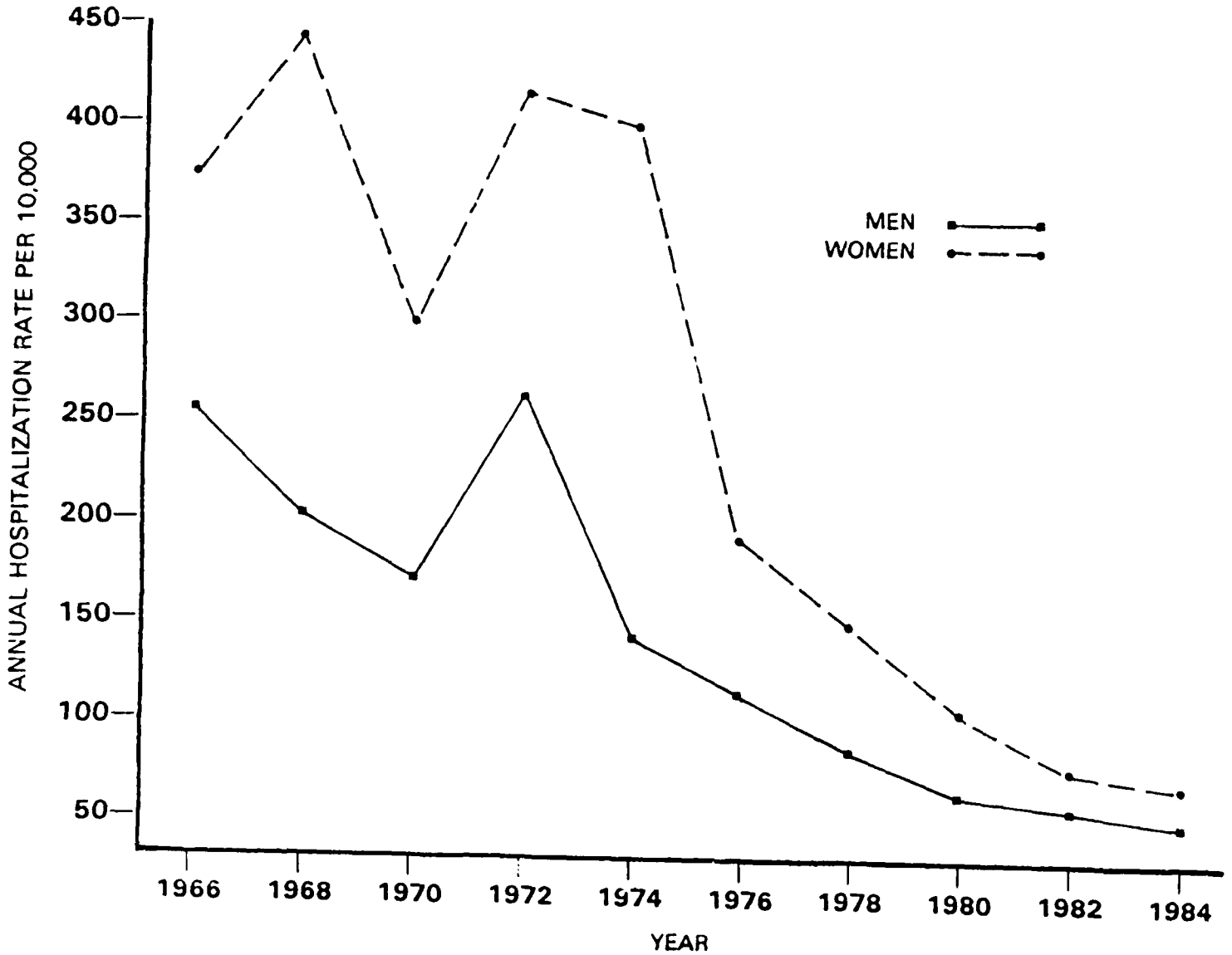

Figure 2. Annual hospitalization rates per 10,000 for diseases of the respiratory system among U. S. Navy personnel (only even years are plotted)

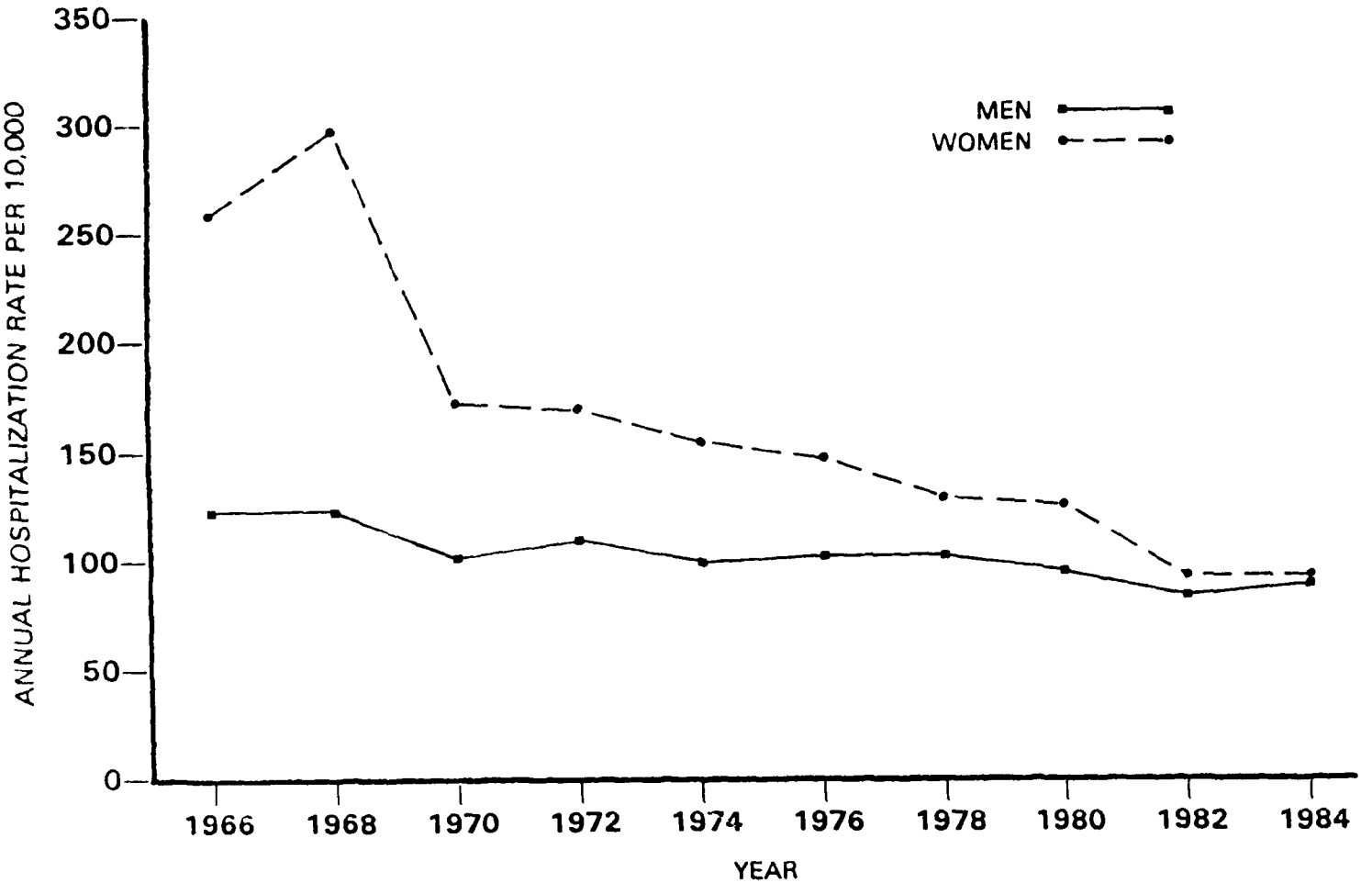

Figure 3. Annual hospitalization rates per 10,000 for diseases of the digestive system among U. S. Navy personnel (only even years are plotted)

these conditions were the recruit training centers; for example, across the four groups from 90 to 100% of all rubella hospitalizations and 74 to 92% of all admissions for acute upper respiratory infection occurred during recruit training in 1974 to 1979. From 1980 to 1984, proportions of admissions for these disorders at the training centers dropped significantly; the highest percentages of admissions for these conditions were observed at Great Lakes.

Decreases also were noted across Caucasian women's age intervals (Table 2) for infectious mononucleosis, hypertrophy of tonsils, and diarrheal disease. Increases in rates with age were observed among Caucasian and black men for tuberculosis, other diseases of the upper respiratory tract, and the category of digestive disorders; the latter probably reflected the age-related increase in hospitalizations for hernias. Duty assignments that accounted for the highest proportions of hospital admissions for digestive disorders among men included carriers (the USS Kennedy in particular), all other ships, and the recruit training center at Great Lakes. For women, the highest proportions were observed at several duty stations throughout the southern part of the United States, the Great Lakes Service School Command, and the recruit training center at Orlando.

Rate Differentials in Hospitalizations, 1974-84

Caucasian Men and Women: In comparing the confidence limits in Table 5, Caucasian women had significantly higher age-adjusted hospitalization rates than men for all three diagnostic categories as well as for the specific diagnoses of diarrheal disease, infectious mononucleosis, other viral diseases, hypertrophy of tonsils, other diseases of the upper respiratory tract, and gastroenteritis and colitis. There were no diseases with a significantly higher rate for men than women.

Black Men and Women: As contrasted with the sex differential in rates noted for Caucasians, rates for blacks did not differ significantly between men and women for any category or specific diagnosis.

Caucasian and Black Men: Age-adjusted hospitalization rates for Caucasian men were significantly higher than those for black men for the category of diseases of the respiratory system and the specific diagnoses of

TABLE 1 - Annual Hospitalization Rates among U.S. Navy Caucasian Men by Age and Diagnosis, 1974-84

Diagnosis	Rate per 10,000 by Age							
	17-18	19-20	21-22	23-24	25-29	30-34	35-39	≥40
Infective and Parasitic Diseases	227.8	94.2	68.4	53.3	41.5	26.0	19.5	20.9
Diarrheal disease	20.5	11.0	9.3	7.9	6.4	4.0	3.1	4.6
Tuberculosis	0.4	0.4	0.6	0.5	0.6	1.2	2.0	2.7
Rubella	57.2	8.7	2.6	1.4	0.6	0.2	0.1	0.2
Viral hepatitis	12.0	12.4	13.3	10.7	8.6	5.0	2.6	2.3
Infectious mononucleosis	18.4	15.5	10.3	5.9	2.9	1.0	0.5	0.3
Other viral disease	52.0	17.1	11.9	10.0	8.3	4.6	3.0	3.1
Malaria	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0
Sexually transmitted diseases	2.5	3.7	4.4	3.9	3.3	2.3	1.4	1.8
Diseases of the Respiratory System	296.0	109.5	86.1	73.7	60.2	46.9	48.9	57.1
Acute tonsilitis	15.8	5.7	3.5	3.2	1.5	0.9	0.4	0.1
Acute upper respiratory infection	74.0	15.4	6.3	3.6	2.0	0.7	0.6	0.5
Pneumonia, all types	116.0	26.3	13.6	10.8	8.9	7.8	6.8	7.1
Bronchitis	16.4	3.8	2.2	1.5	1.5	1.0	1.2	2.2
Hypertrophy of tonsils	10.0	14.1	14.6	10.3	7.3	3.3	1.7	0.7
Other diseases of the upper respiratory tract	3.5	5.9	7.3	7.5	5.3	5.1	6.6	7.4
Diseases of the Digestive System	105.2	92.4	90.2	84.9	83.6	91.4	129.8	185.6
Appendicitis	22.8	8.0	14.8	12.5	10.9	8.4	7.9	7.2
Gastroenteritis and colitis	3.5	3.8	3.7	3.4	3.2	1.8	1.4	0.8

TABLE 2 - Annual Hospitalization Rates among U.S. Navy Caucasian Women by Age and Diagnosis, 1974-84

Diagnosis	Rate per 10,000 by Age							
	17-18	19-20	21-22	23-24	25-29	30-34	35-39	≥40
Infective and Parasitic Diseases	252.0	155.5	104.9	91.9	61.0	37.0	31.0	-
Diarrheal disease	42.2	30.0	22.5	20.3	15.1	8.8	0	-
Tuberculosis	0	0	0.8	0.2	0.4	0	0	-
Rubella	33.6	8.0	3.9	1.5	0.8	0.7	0	-
Viral hepatitis	9.3	8.1	7.1	7.4	7.5	2.7	2.8	-
Infectious mononucleosis	58.0	32.0	13.1	10.4	5.4	2.7	5.6	-
Other viral disease	45.8	30.7	23.5	24.0	12.4	12.1	8.5	-
Malaria	0	0	0	0	0	0	0	-
Sexually transmitted diseases	6.4	5.5	4.6	3.0	1.5	0.7	2.8	-
Diseases of the Respiratory System	309.9	172.1	128.8	108.5	91.5	75.4	56.5	-
Acute tonsilitis	18.6	10.4	4.9	3.2	1.3	1.4	2.8	-
Acute upper respiratory infection	94.5	19.7	9.8	6.4	6.5	4.0	0	-
Pneumonia, all types	80.2	28.4	19.1	18.8	15.5	13.5	5.6	-
Bronchitis	17.9	8.3	4.3	4.7	4.4	4.0	2.8	-
Hypertrophy of tonsils	37.9	53.7	32.5	19.6	10.0	2.7	0	-
Other diseases of the upper respiratory tract	3.6	8.6	16.6	14.4	13.4	8.8	2.8	-
Diseases of the Digestive System	114.5	133.6	122.2	113.7	113.5	114.5	96.0	-
Appendicitis	17.2	18.4	15.1	11.9	13.2	7.4	2.8	-
Gastroenteritis and colitis	10.0	9.1	7.7	6.9	9.6	9.4	2.8	-

TABLE 3 - Annual Hospitalization Rates among U.S. Navy Black Men by Age and Diagnosis, 1974-84

Diagnosis	Rate per 10,000 by Age							
	17-18	19-20	21-22	23-24	25-29	30-34	35-39	≥40
Infective and Parasitic Diseases	163.9	81.0	65.3	66.2	50.5	39.2	28.0	30.9
Diarrheal disease	13.8	8.1	4.7	6.7	4.9	3.4	1.8	0.8
Tuberculosis	0.9	1.7	1.4	1.8	1.4	1.7	2.4	3.4
Rubella	24.2	3.2	1.1	0.6	0.1	0	0	0
Viral hepatitis	7.8	10.1	12.7	12.5	8.8	6.0	3.8	2.6
Infectious mononucleosis	4.4	4.1	2.5	1.4	1.1	0.2	0.7	0
Other viral disease	50.6	18.8	13.2	14.0	8.0	5.8	3.8	4.3
Malaria	0	0.1	0	0	0	0.5	0	0
Sexually transmitted diseases	5.6	11.1	11.0	9.8	8.2	5.1	2.8	4.3
Diseases of the Respiratory System	231.8	97.7	77.3	62.6	51.2	45.0	43.8	52.4
Acute tonsilitis	17.6	6.0	5.0	3.5	2.5	0.7	0.4	0
Acute upper respiratory infection	71.9	14.6	7.5	3.8	2.5	0.7	0.4	0.8
Pneumonia, all types	62.8	22.0	14.6	11.0	10.0	5.1	4.9	6.9
Bronchitis	11.0	3.8	1.6	1.1	1.4	1.0	1.4	1.7
Hypertrophy of tonsils	9.7	17.5	18.3	12.0	8.8	6.8	2.8	4.3
Other diseases of the upper respiratory tract	2.5	2.3	3.3	2.1	2.6	3.9	3.5	5.2
Diseases of the Digestive System	114.0	101.7	104.7	104.2	100.6	97.7	144.7	153.0
Appendicitis	13.2	11.8	8.4	8.7	5.4	4.4	2.8	0.8
Gastroenteritis and colitis	0.9	3.0	3.6	2.5	2.6	1.4	2.4	0.8

TABLE 4 - Annual Hospitalization Rates among U.S. Navy Black Women by Age and Diagnosis, 1974-84

Diagnosis	Rate per 10,000 by Age							
	17-18	19-20	21-22	23-24	25-29	30-34	35-39	≥40
Infective and Parasitic Diseases	133.3	105.3	73.2	55.2	55.9	37.0	23.3	-
Diarrheal disease	9.5	24.8	10.7	6.7	15.0	7.4	0	-
Tuberculosis	4.8	0	1.0	1.3	3.2	0	0	-
Rubella	19.0	5.2	2.0	0	0	0	0	-
Viral hepatitis	0	2.1	5.9	6.7	4.3	7.4	0	-
Infectious mononucleosis	9.5	2.1	3.9	2.7	0	0	0	-
Other viral disease	38.1	21.7	15.6	8.1	14.0	7.4	0	-
Malaria	0	0	0	0	0	0	0	-
Sexually transmitted diseases	19.0	11.4	8.8	8.1	3.2	3.7	0	-
Diseases of the Respiratory System	171.3	81.6	84.9	57.9	61.3	51.8	46.6	-
Acute tonsilitis	19.0	11.4	7.8	0	4.3	11.1	0	-
Acute upper respiratory infection	52.4	15.5	7.8	2.7	4.3	3.7	-	-
Pneumonia, all types	38.1	11.4	4.8	12.1	8.6	3.7	0	-
Bronchitis	19.0	4.1	6.8	2.7	2.2	0	0	-
Hypertrophy of tonsils	9.5	17.6	20.5	16.2	16.1	11.1	0	-
Other diseases of the upper respiratory tract	4.8	1.0	5.8	4.0	1.1	7.4	0	-
Diseases of the Digestive System	90.4	106.3	116.2	76.7	102.1	81.4	116.6	-
Appendicitis	9.5	10.3	13.7	4.0	9.7	0	0	-
Gastroenteritis and colitis	0	2.1	11.7	1.3	3.2	7.4	0	-

TABLE 5 - Age-adjusted Hospitalization Rates per 10,000 among U.S. Navy Personnel by Race, Sex, and Diagnosis, 1974-84

Diagnosis	Rate and Confidence Interval by Race and Sex							
	Caucasian Men		Caucasian Women		Black Men		Black Women	
	Rate	Confidence Interval	Rate	Confidence Interval	Rate	Confidence Interval	Rate	Confidence Interval
Infective and Parasitic Diseases	69.1	66.8- 71.3	109.0	98.3-119.8	66.5	60.0- 73.1	75.3	47.6-103.1
Diarrheal disease	8.6	7.8- 9.4	22.4	17.6- 27.2	5.9	4.0- 7.8	14.5	0- 34.0
Tuberculosis	0.8	0.5- 1.0	0.3	0- 0.8	1.7	0.5- 2.8	1.4	0- 4.5
Rubella	6.8	6.0- 7.6	5.3	2.5- 8.0	2.8	1.2- 4.3	2.8	0- 8.0
Viral hepatitis	9.8	9.0- 10.6	7.2	4.6- 9.9	9.4	7.1- 11.6	4.4	0- 9.2
Infectious mononucleosis	8.1	7.4- 8.9	17.5	13.0- 21.9	2.1	1.1- 3.2	2.5	0- 6.7
Other viral disease	13.3	12.3- 14.3	23.4	18.4- 28.3	14.5	11.4- 17.6	16.0	6.0- 26.0
Malaria	0.1	0- 0.2	0	0- 0	0.1	0- 0.3	0	0- 0
Sexually transmitted diseases	3.3	2.8- 3.8	3.7	1.8- 5.7	8.8	6.2- 10.4	8.3	1.1- 15.5
Diseases of the Respiratory System	92.2	89.5- 94.9	134.3	121.7-146.9	79.6	72.2- 87.0	76.7	53.6- 99.8
Acute tonsilitis	3.9	3.3- 4.4	5.8	3.2- 8.3	4.5	2.8- 6.2	7.4	0.2- 14.5
Acute upper respiratory infection	10.8	9.8- 11.8	15.3	10.6- 19.9	10.8	7.9- 13.7	10.6	0- 21.3
Pneumonia, all types	21.2	19.8- 22.5	23.5	18.0- 29.0	16.4	13.4- 19.7	10.1	1.4- 18.8
Bronchitis	3.1	2.6- 3.7	6.1	3.2- 9.0	2.6	1.2- 4.0	4.7	0- 10.5
Hypertrophy of tonsils	9.7	9.0- 10.5	29.0	23.9- 34.0	12.2	9.7- 14.7	16.6	7.5- 25.7
Other diseases of upper respiratory tract	6.1	5.4- 6.8	12.2	8.6- 15.8	2.9	1.4- 4.4	3.3	0- 8.0
Diseases of the Digestive System	96.2	93.4- 99.1	120.8	108.7-133.0	108.0	99.1-116.8	100.8	69.5-132.1
Appendicitis	13.6	12.6- 14.6	14.5	10.5- 18.4	7.9	5.8- 10.0	9.1	2.5- 15.7
Gastroenteritis and colitis	3.1	2.7- 3.6	8.5	5.3- 11.6	2.6	1.4- 3.8	4.8	0- 9.6

rubella, infectious mononucleosis, pneumonia, other diseases of the upper respiratory tract, and appendicitis. Rates for sexually transmitted diseases were significantly higher among black men than their Caucasian counterparts.

Caucasian and Black Women: Caucasian women had significantly higher age-adjusted hospitalization rates than black women for the category of diseases of the respiratory system and for the specific conditions of infectious mononucleosis and other diseases of the upper respiratory tract.

Discussion

Results of this study showed that hospitalization rates for almost all infectious diseases decreased across the two decades, particularly for women. Their rates for acute upper respiratory infection, pneumonia, diarrheal disease, rubella, and infectious mononucleosis declined significantly to a point where, of the five conditions, the only significant difference in rates between men and women by 1984 was observed for diarrheal disease.

The following explanations were proffered as possible reasons for the large declines in women's admission rates. First, with an increase in the number of Navy enlisted women on active duty, from less than 2% in 1973 to almost 9% in 1984, the prescription of treatment in an inpatient medical facility may not have been as feasible as when the number of enlisted women was smaller. That is, with fewer women, they might have been treated more deferentially in the 1970s than 1980s. Moreover, the factor of proximity probably contributed to this decrease in that women were more likely to be assigned to a shore-based duty station near an inpatient medical facility during the 1970s or until 1978 when sea duty assignments were opened to women. Second, treatment modalities have changed with the development of new medications and equipment technologies which undoubtedly lessened the need for inpatient therapy. Third, a cost containment policy may have been enacted whereby personnel, particularly women, were no longer as likely as in the past to be hospitalized for an acute condition (e.g., acute upper respiratory infection). Treatment for such disorders perhaps has been shifted predominantly to outpatient from inpatient medical facilities. Also, a presidential directive was mandated that stipulated a 3% reduction in injury/illness costs per year, beginning in 1983. On the basis of such

explanations and results, the trends toward a leveling off in women's rates of infectious disease hospitalizations would be expected to continue in the future.

Another important outcome of this study was the finding that age and the environmental factor of recruit training were associated with higher hospitalization rates for almost all respiratory and infectious diseases. The most vulnerable age of susceptibility among Navy enlistees was 17 to 18 years, the most common ages of entry into active service. A major reason for the higher proportions of hospitalizations observed during recruit training was the constant introduction of new individuals to an environment that tended to perpetuate such endemic conditions as acute upper respiratory infection, pneumonia, rubella, and other viral diseases. The large decrease in hospitalization rates across age intervals indicated that after recruit training enlistees were exposed to fewer environments where a high level of endemicity existed and/or their immune systems became increasingly more effective in warding off infectious diseases through the ages of the 20s, 30s, and 40s.

Differences in the percentages of admissions also were noted across the three recruit training centers. Comparisons of hospitalizations by disease showed a large decrease in the proportions of admissions for the San Diego and Orlando centers from the 1970s to the 1980s while Great Lakes experienced a smaller decline.

Some enlistees, however, were more susceptible than others to the communicable conditions endemic to recruit training. Caucasian women had the highest hospitalization rate of acute upper respiratory infection while Caucasian men had the highest rate of pneumonia. This difference provided support for other findings that showed men's admission rates to be higher for serious and chronic conditions as contrasted with women's higher rates for acute disorders.[14,15]

Caucasian women, moreover, had elevated hospitalization rates, when compared with black women and both men groups, for diarrheal disease and infectious mononucleosis, both of which have been labeled as stress

related.[22,23] In accepting the concept of stress as an intervening causative factor in illness incidence, one would conclude that the recruit training experience was especially stressful for Caucasian women. Because of the small number of black women in a predominantly Caucasian male Navy, on the other hand, one would also postulate that black women would have higher rates for stress-related disorders than their white counterparts. Moskos,[24] however, reported that black women were far more likely than white women to complete their enlistments in the Army. He stated that black women indicated that they were better able than white women to withstand the physical demands of Army life and seemed to have more "street savvy" as far as having a sense of understanding how to survive effectively in the system. Another consideration was that to many blacks "the grass is not necessarily greener in civilian life." Moskos' explanations provided a basis for purporting that the Navy recruit training experience might be less distressing for black than Caucasian women, which in part may account for their lower admission rates.

Other rate differentials specifically associated with race were the higher hospitalization rates observed for rubella and infectious mononucleosis among Caucasian men and women. Blacks had very low rates for these diseases, a finding that probably reflected a greater susceptibility among Caucasians.[6] Rates for rubella among Caucasians, however, showed a very dramatic decrease beginning in 1980, which corresponded with the large decline observed in the civilian community. The effectiveness of this nation's immunization program in significantly lowering rates of measles no doubt accounted in part for the large drop in the Navy's rates. Another consideration was that since 1980 only the most serious cases of rubella resulted in a hospitalization in naval medical facilities, thereby reflecting a change in treatment policy.

Aside from the factors of age, sex, race, policy changes, and innovations in medications, the final consideration to be discussed was the impact on hospitalization rates of epidemics and duty assignments other than recruit training. Results of this study, for example, pointed up the occurrence of a natural epidemic, as can be inferred from the peaks in rates of respiratory diseases during 1972 to 1973. Moreover, rates of malaria and tuberculosis were the highest during the years of the Vietnam conflict. Rates of viral

hepatitis fluctuated throughout the two decades of this study, which corresponded with data reported on Army personnel.[6]

In conclusion, results of this study showed that the incidence of infectious disease was associated with age, sex, race, and environmental conditions. If the composition of the Navy changes with increases in the number of women serving in the Navy, we can anticipate only a slight increase in overall hospitalization rates for infectious diseases, primarily during recruit training.

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The purposes of this study were (1) to analyze trends in infectious disease hospitalization rates from 1966-1984 among U.S. Navy enlistees and (2) to identify high risk groups for infectious disease on the basis of such factors as age, sex, race, and duty assignment. Results of the trend analyses showed that hospitalization rates for almost all infectious diseases decreased across the years, particularly for diarrheal disease, pneumonia, rubella, and acute upper respiratory infection. Caucasian women had significantly higher age-adjusted rates than their male counterparts for the three major infectious disease categories--infective, respiratory, and digestive--as well as for several specific diseases. Hospitalization rates of black women did not differ significantly from those of black men. The age group at highest risk for almost all infectious disease was the 17-18 year interval, the recruit training phase of military service. The decreasing rates of hospitalizations seemed to reflect the influence of a changing population, treatment modalities, and health care policies in the U.S. Navy.

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