SHIP SIZE AS A FACTOR IN ILLNESS INCIDENCE

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Outpatient illnesses were examined in an effort to determine if disease and non-battle injury rates differ by ship size, and if so, whether the difference is constant across various operational theaters. Investigation of overall illness rates by ship size for East Asia, the Indian Ocean, and Europe revealed a lower rate for large ships (aircraft carriers) when compared with small ships (destroyers and frigates) for each of the theaters; these rate differences were significant for the East Asia deployment and the Indian Ocean region. Among major categories of disease, significantly higher rates aboard the small vessels were seen in at least two of the geographic regions for respiratory disorders, digestive diseases, and musculoskeletal problems. The diagnostic categories of infective and parasitic diseases, skin and subcutaneous disorders, as well as symptoms and ill-defined disorders were higher for small ships in two or more theaters with one of the rate differences reaching a level of significance. It was concluded that ship size is a factor in illness incidence and should be considered by medical resource planners when determining necessary medical supplies and required health care personnel. Keywords: military medicine, health surveys; (K7)
SHIP SIZE AS A FACTOR IN ILLNESS INCIDENCE

Introduction

Illness incidence is an important issue for the U.S. Navy due to its potential impact on operational readiness. The ability to predict illness rates for various operational scenarios allows projections to be made regarding the medical supplies needed as well as manpower requirements. Medical resource planning requires that information be available on all factors which influence illness incidence. A recent investigation delineated differences in shipboard illness rates for various operational theaters. Outpatient rates of illness, as computed from two independent sources of data, clearly demonstrated a lower rate of health problems among ships deployed to Europe than with East Asia deployments.

Previous research by Gunderson and Erickson investigating illness rates aboard destroyers and frigates indicated a similar influence of geographical region but found no systematic differences in morbidity rates between destroyers and frigates. Illnesses also have been examined aboard mid-sized ships (cruisers) as well as larger-sized vessels (aircraft carrier). These previous studies have looked at various sized vessels but none have collectively surveyed illness rates across small, medium, and large ships while controlling for geographical region.

The present study investigates the hypothesis that the internal environments associated with different sized vessels have an impact on the health problems of the deployed crew members. Specifically, outpatient disease and non-battle injuries will be examined to ascertain if illness rates differ by ship size, and if so, whether the difference is constant across operational theaters.

Method

Two separate sources of outpatient data were used in an effort to determine differences in illness rates by size of ship. The first set of sickcall data was from a series of deployments during 1967-1973 on which all outpatient visits were recorded. Included in these East Asia deployments were 11 destroyers and frigates, 1 cruiser, and 4 aircraft
carriers. The second source of illness data was a product of the Medical Services and Outpatient Morbidity Reporting System. The Monthly Morbidity reports, as they are commonly known, are completed by each ship and maintained at the Naval Medical Data Services Center, Bethesda, Maryland. Morbidity data collected during 1985 from two operational theaters were examined: Within the Indian Ocean the ships were 3 destroyer/frigates, 1 cruiser, and 2 carriers; the various sized ships deployed to the European theater were 5 destroyers/frigates, 3 cruisers, and 1 carrier. Illness data is reported in diagnostic categories corresponding to the *International Classification of Diseases* (ICD9). Command History data, maintained at the Naval Historical Center, Washington, D.C. were used to determine ship deployment locales and time frames. Only those illnesses occurring while the ships were within the specific theaters were used in the rate calculations.

Illness rates are computed per 1000 strength per day. For both data sources only the initial visit for a specific illness per individual enters into the rate calculations; no follow-ups or revisits for the same illness are used in the disease tallies. Illness rates for mid-sized ships (cruisers) are presented for comparison purposes, but, because destroyers/frigates and carriers represent the two extremes in ship size only these differences are tested. Ninety-five percent confidence limits based on the normal approximation to the poission distribution were calculated to determine if the rates of the smallest ships (destroyers/frigates) differed significantly from the largest ships (carriers). The Dunn method of adjusting the significance level for multiple comparisons has been applied.

**Results**

Frequencies and rates of medical disorders by ship size for East Asia, the Indian Ocean, and Europe are displayed in Tables 1-3, respectively. Also included are the number of man-days on which the rates were based.

In all three theaters respiratory disorders were higher on the smallest ships than on the largest ships; among the East Asia and Europe deployments these differences were significant. The subcategory contributing most prominently to these differences was upper respiratory infections.
The three geographical regions also yielded higher rates of digestive disorders aboard the small ships when compared with the carriers; these rate differences were significant for all theaters. Subcategories of illness were not recorded among the digestive disorders.

During the East Asia and Europe deployments the rates of musculoskeletal disorders were significantly higher among destroyers/frigates than carriers. Subcategories of musculoskeletal disorders occurring on these deployments were not available.

Within East Asia and Europe deployments the rates of musculoskeletal disorders were significantly higher among destroyers/frigates than carriers. Subcategories of musculoskeletal disorders occurring on these deployments were not available.

Within East Asia and the Indian Ocean, the infective and parasitic illness rates were higher on the destroyers/frigates when contrasted with the carriers; this difference was significant for the East Asia theater. The differences in this diagnostic category were mainly attributable to elevated rates of sexually transmitted diseases aboard the small ships. A significantly higher rate of incidence for the subcategory consisting of diarrhea, dysentery, and enteritis was seen on small ships in East Asia and large vessels in the Indian Ocean and European theater.

Within the East Asia and Indian Ocean regions, the category of Skin and Subcutaneous Tissue disorders yielded higher rates on the small ships when compared with the large vessels; this difference was significant for ships deployed to East Asia. Though not reaching a level of significance, rates of cellulitis were higher aboard destroyers/frigates for the two eastern theaters.

While only significant for the Indian Ocean region, the diagnostic category of symptoms and ill-defined disorders indicated higher rates for the small ships when contrasted with the carriers in all regions. Contributing to the rate differences in this category was the sub-grouping of headaches.

A nonsignificant trend of higher genitourinary disorder rates among destroyers and frigates than on carriers was witnessed across the three operational regions. The subcategory of urethritis was largely responsible for the differences within this diagnostic category.

The category of Accidents, Poisonings, and Violence yielded incongruous results across deployments. The rate for this category was significantly higher among small ships than for carriers in East Asia while the opposite held true for the ships deployed to Europe. Though unsubstantiated in other regions, two other significant results were found for a single theater among the major diagnostic categories. A higher rate of behavioral (mental)
disorders was evident on the small ships deployed to East Asia and carriers in the European theater yielded a higher rate within the diagnostic category of Endocrine, Nutritional, and Metabolic disorders.

The overall rates, composed of the total of the fifteen diagnostic categories, indicated a lower rate for the carriers when compared with the destroyers/frigates for each geographical theater; within East Asia and the Indian Ocean region these rate differences were significant.

**Discussion**

Overall illness incidence within East Asia and the Indian Ocean showed an inverse relationship between ship size and illness rate across the three ship groupings—the smaller the ship, the greater was the total illness rate. For the European theater, the largest ships exhibited a slightly lower rate than the smallest ships, however, the mid-sized ships were higher than both other sizes. The explanation for cruisers having a higher rate in this particular theater is not immediately apparent.

There were several significant findings apparent in contrasting health problems aboard destroyers/frigates with those occurring aboard carriers. Foremost was the trend of higher rates of infectious disease aboard the smaller ships. Most apparent were the elevated respiratory rates and digestive disorders but substantial differences also were seen for infective and parasitic rates, as well as skin disorders. These higher rates may be a result of working and living within a more closed environment as the spread of communicable diseases is facilitated by restricted environs. It should be noted, however, that this relationship between illness and ship size may not be one of direct linkage per se. Rather, higher rates of infectious disease may result from differing ventilation or air circulation system aboard the smaller vessels. Beyond the physical determinants of disease proliferation, Rahe has linked psychosocial stressors with various illnesses, including infections. Similarly, research investigating health and satisfaction aboard Navy ships found a positive correlation between perceived crowding and dispensary visits.
Also, it is very possible that the increased rates of small ships for the
category of symptoms and ill-defined, which is substantially accounted for by
a higher rate of headaches, is partially due to living and working in a more
closed environment.

Within the infective and parasitic disease category it must be noted that
much of the variance was due to sexually transmitted diseases. It is likely
that the higher rate of this type of disorder is due to the greater length of
time the smaller ships in this study stayed when visiting foreign ports.
This factor may also explain the elevated rates of genitourinary disorders,
much of which is accounted for by urethritis.

The last trend to be considered is that of higher rates of
musculoskeletal disorders seen on the small ships. While this too may be
related to the constrained space aboard destroyers and frigates, this
restrictiveness might have been expected to manifest itself with higher
accident rates aboard the small ships. In fact, carriers had higher accident
rates in two theaters than did the small ships. Higher rates of
hospitalization for accidents aboard carriers have been previously
documented\(^{12}\) and this may be due to the tempo of operations and nature of
work aboard these ships rather than linked directly to the ship size. Also,
likelihood of off-duty accidents aboard carriers would be greater because of
an increase in recreational areas accessible to crew members.

Medical resource planning requires that all relevant factors in illness
incidence be taken into account. In addition to theater of operation it is
apparent that illness rates vary with size of ship. Determinations of
medical supplies needed and health care personnel required should be made
with ship size considered as well as any other pertinent factors.
REFERENCES


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* Rates are per 1,000 strength per day

* Rate is significantly higher (95% confidence level) than for large ships
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* Rate is significantly higher (95% confidence level) than for large ships.
** Rate is significantly higher than for small ships.

Prices are per 1,000 strength per day.
### TABLE 3. ILLNESS INCIDENCE BY SHIP SIZE FOR EUROE DEPLOYMENT, 1995

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PROCES ARE PER 1,000 STRENGTH PER DAY
*RATE IS SIGNIFICANTLY HIGHER (95% CONFIDENCE LEVEL) THAN FOR LARGE SHIPS
**RATE IS SIGNIFICANTLY HIGHER THAN FOR SMALL SHIPS
Differences in illness incidence were found to exist between small ships (destroyers, frigates) of the U.S. Navy and the largest vessels (carriers). An examination of illnesses by ship size for East Asia, the Indian Ocean, and Europe revealed a lower overall rate for aircraft carriers when compared with destroyers and frigates for each of the theaters; these rate differences were significant for the East Asia deployment and the Indian Ocean region. Among specific categories of disease, significantly higher rates aboard the small vessels were seen in at least two of the geographic regions for respiratory disorders, digestive diseases, and musculoskeletal problems. Higher rates on small ships were also seen for the diagnostic categories of infective and parasitic diseases, skin and subcutaneous disorders, and symptoms and ill-defined. Ship size is a factor in illness incidence and should be considered by medical resource planners when determining necessary medical supply and manpower requirements.