Current Patterns of Acute Respiratory Disease in the
United States Navy and Marine Corps

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During 1974 there was an apparent decrease in the reported amount of acute respiratory illness in the Navy and Marine Corps. Streptococcal infections continued to be controlled by the selective use of prophylactic benzathine penicillin in recruit training centers. Influenza immunization limited the impact of that illness, and serogroup C polysaccharide vaccine reduced the amount of meningococcal disease among recruits. Although some of the data are contradictory there are indications that fully potent live adenovirus vaccines lessen the frequency and severity of respiratory illness in recruit populations. Continued epidemiologic study will be required to fill the gaps in our knowledge.

In 1880, Phillip S. Wales, Surgeon General of the Navy, reported that acute respiratory diseases, particularly epidemic catarrh (influenza), bronchitis, and pneumonia were the most common illnesses affecting the sailor (1). He noted, however, that rates for the U.S. Navy were lower than those observed in seamen of foreign naval services. His records reveal respiratory disease hospitalization rates of 14.8 per 1000 fleet personnel per year, with an overall annual incidence of 126 respiratory illnesses per 1000 men. By way of comparison, recent respiratory hospitalizations for active duty Navy and Marine Corps personnel approximate 20–23 per 1000 annually with a shipboard respiratory illness incidence of 1600–1800 per 1000 per year (2–4). The apparent differences are probably more closely related to better reporting and classification of disease than they are to actual changes in disease frequency. A fairer comparison may be observed by examining the mortality and disability rates of today's sailor and his predecessor of the 1880s. In the days of “iron ships and iron men” respiratory illness was responsible for a mortality of 77 per 100,000 per year with 88 per 100,000 annual disability separations. The most recent figures for the Navy and Marine Corps indicate a respiratory mortality of 1.5–3.0 per 100,000, and a disability discharge rate of 13/100,000 annually (2–4).

Of the epidemic respiratory diseases, none has had a greater total population impact than that of influenza. Early texts suggest that the disease was first seen in the United States about 1510, and that large epidemics occurred in Europe in 1782 and 1850 (5). Table 1 lists Navy and Marine Corps admission and mortality rates for influenza during several selected epidemic periods. At the close of World War I, the case mortality rate ranged around 3%. The decreased morbidity and mortality associated with this illness may be related to antigenic shifts, the recent availability of antibiotics and the use of antigen specific vaccines.

Much of our information on other respiratory pathogens affecting the Navy and Marine Corps comes from intensive investigations of illness in recruit populations.

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TABLE 1
Selected Influenza Admission and Mortality Rates Navy and Marine Corps—Rates/1,000

| Year | Admission rate | Mortality rate |
|------|----------------|----------------|
| 1917 | 42.0           | 0.004          |
| 1918 | 238.9          | 8.3            |
| 1919 | 68.2           | 1.9            |
| 1956 | 1.7            | 0.0            |
| 1957 | 72.8           | .006           |
| 1958 | 9.3            | .001           |
| 1967 | 5.7            | 0.0            |
| 1968 | 1.5            | 0.0            |
| 1969 | 3.2            | 0.0            |

These young men and women make up only 5% of the total active duty strength, yet they experience at least half of the acute respiratory disease (6). The stresses of recruit training, together with crowded living spaces and an increased opportunity for exposure to infection, provide an ideal environment for the epidemic spread of a number of specific bacterial and viral pathogens. The military importance of cerebrospinal meningitis was recognized in the early 1800s, but the meningococcal organism was not isolated until 1887 (7). Studies on Neisseria meningitidis in military recruits were first conducted by Glover during World War I. Streptococcal infections and their sequelae in recruits caused considerable administrative anxiety during World War II and prompted the development of preventive techniques during the late 1940s and 1950s (9). Research during the 1950s and 1960s uncovered adenoviruses and Mycoplasma pneumoniae as being of etiologic significance in recruit respiratory illness (10, 11). Rhinoviruses were also identified within the latter time interval, and although they occur in up to 20% of incoming recruits, they apparently cause less serious disease and are considered of secondary importance (12, 13).

CURRENT PREVENTIVE ROUTINES IN THE NAVY AND MARINE CORPS

The immunization and chemoprophylactic measures employed by various Navy and Marine Corps recruit centers are listed in Table 2. Naval Training Center (NTC), Orlando, Florida, and NTC, San Diego, California, do not routinely use bicillin prophylaxis. Our information suggests that streptococcal illness and its se-

| Naval training center | Prophylactic agent |
|-----------------------|--------------------|
|                       | Bicillin | Adenovirus 4/7 | Meningococcal group C | Influenza |
| Great Lakes           | Day 10   | Day 4          | Day 4                  | Days 18-19 |
| Orlando               | Not given | Day 2          | Day 2                  | Day 11     |
| San Diego             | Oct-May only | Day 1         | Day 1                  | Days 7-10  |
|                       | Days 7-10 |                |                       |            |
| Marine Corps recruit depot | Day 10 | Day 3          | Day 3                  | Day 3      |
| Parris Island         | Day 10   | Day 3          | Day 3                  | Day 3      |
| San Diego             | Day 10   | Day 3          | Day 3                  | Day 3      |

*Unofficial estimate reports about 30 culturally proven streptococcal cases per month. Last rheumatic fever reported 2 yr ago.*
quelae have not been a recent problem at either of these centers. At the remainder of the training camps, bicillin is given routinely to incoming personnel. Recent studies have demonstrated that less than 5% of graduates from these centers experience antistreptocytisin O seroconversion (14). Live adenovirus (Types 4 and 7) and serogroup C meningococcal vaccines are given early in all training schedules. Influenza vaccine is administered variably up to the third week of training and contains the most recent significant antigen. Immunization requirements have been modified this past year in that influenza vaccine is now mandatory only for recruits and specific "alert" forces.

RESPIRATORY DISEASE SURVEILLANCE DATA

Surveillance information for respiratory illness among Navy and Marine Corps personnel, as well as that of the other services, is subject to considerable administrative, diagnostic, and clerical bias. The most reliable data have been gathered from recruit populations; however, even these observations contain significant degrees of within and between group variation. In addition, differences in the experimental designs and the individual perceptiveness of researchers further confound correlation and interpretation. The data presented here should therefore be subject to close scrutiny.

RECRUIT DATA

Figure 1 illustrates the changes in respiratory illness at the Naval Training Center, Great Lakes, Illinois. The data suggest that there has been a decrease in the reported frequency of respiratory disease visits and pneumonia admissions. The recent increase in acute respiratory disease admissions may be an artifact of medical administrative change, or may reflect the presence of an as yet unidentified pathogen. The decreased ARD visits and pneumonia admissions correlate temporally with the use of the live adenovirus vaccines.

Morbidity data for all respiratory disease has been more difficult to obtain from the Navy and Marine Corps recruit camps in San Diego, California. It was possible, however, to reconstruct pneumonia admission rates for the past 4 yr (Table 3).

| Month | 1971   | 1972   | 1973   | 1974   |
|-------|--------|--------|--------|--------|
|       | NTC    | MCRD   | NTC    | MCRD   | NTC    | MCRD   | NTC    | MCRD   |
| Jan   | 2.1    | 7.8    | 12.6   | 16.1   | 27.2   | 9.6    | 14.0   | 4.3    |
| Feb   | 2.8    | 11.2   | 20.1   | 7.1    | 18.4   | 18.4   | 9.7    | 3.5    |
| Mar   | 3.1    | 11.9   | 19.2   | 4.2    | 17.3   | 4.1    | 5.7    | 4.2    |
| Apr   | 2.8    | 7.5    | 17.5   | 3.3    | 13.5   | 3.3    | 8.3    | -      |
| May   | 1.4    | 7.8    | 18.9   | 1.4    | 13.0   | 2.2    | 6.3    | -      |
| Jun   | 3.4    | 7.7    | 8.8    | 2.5    | 18.2   | 4.5    | 6.9    | -      |
| Jul   | 1.2    | 9.9    | 4.0    | 2.2    | 18.8   | 3.3    | -      | -      |
| Aug   | 1.6    | 6.3    | 5.7    | 1.4    | 20.3   | 4.6    | -      | -      |
| Sep   | 7.9    | 1.8    | 8.1    | 3.5    | 21.4   | 3.4    | -      | -      |
| Oct   | 6.3    | 4.1    | 13.0   | 3.0    | 36.1   | 3.1    | -      | -      |
| Nov   | 3.5    | 2.7    | 15.4   | 3.6    | 28.2   | 3.1    | -      | -      |
| Dec   | 5.9    | 3.2    | 21.0   | 4.0    | 16.6   | 5.7    | -      | -      |

N.B. 1. Underlined rates indicate periods during which adenovirus vaccine was administered.
2. Marine Corps recruits who are not significantly ill with a pulmonary infiltrate may be temporarily assigned to a light duty platoon (Medical Rehabilitation Platoon).
RESPIRATORY DISEASES AT RECRUIT TRAINING CENTER, GREAT LAKES, ILLINOIS, SEPT. 1972 thru OCT. 1974

population-weekly averages

respiratory disease admissions vs. admissions for all causes

pneumonia admissions vs. other ARD admissions

outpatient respiratory visits vs. total outpatient visits

period of use-fully potency adenovirus 47 vaccines

FIG. 1. The information gap between April and October was occasioned by the decommissioning of the Naval Medical Research Unit #4 in April and the reinstitution of data collection by the regional preventive medicine service.
In comparing Table 3 and Fig. 1, it will be noted that Navy recruits at San Diego exhibit pneumonia admission rates three to five times higher than those of their counterparts at Great Lakes. The Marine Corps recruits at San Diego also had higher admission rates for pneumonia than did the Great Lakes trainees, but the difference is less marked. Although one is tempted to conclude that adenovirus vaccines had a less favorable effect in the San Diego populations, it should be pointed out that variability in vaccine potency and utilization may offer a plausible explanation for the observed differences. The disparity in pneumonia admission rates between the San Diego Navy and Marine Corps recruits is less easily accounted for, especially when one considers that the camps are separated only by a chain link fence. One theory holds that the differences in morbidity are due to dissimilarities in training methods and personnel management at the two centers.

Information for the Recruit Training Camps at Parris Island, S.C. and Orlando, Florida, has been less complete. There has been an alleged decrease in the frequency of respiratory admissions and visits since live adenovirus vaccines have come into use; however, the reported 50% reduction in respiratory disease morbidity cannot be confirmed at this time.

**MENINGOCOCCAL DISEASE**

Perhaps the most impressive and best documented change during the past 2 yr has been the decreased frequency of illness due to Group C *N. meningitidis*. It should be recalled that between 1966 and 1971, this serogroup of meningococcus was identified as the etiologic agent in 80% of clinical cases. The Navy and Marine Corps began to routinely administer Group C polysaccharide vaccine to recruits during the summer and fall of 1972. Although carrier rates still range from 20 to 50% in our recruit populations, serogroup Y is now the predominant isolate. Similarly, Group Y meningococcus now appears to be responsible for most of the clinical illness. Table 4 records the changes which have occurred over the past 3 yr. The cases include all reported meningococcal disease in all Navy and Marine Corps personnel. Only two cases of Group A disease occurred during the period; one in Ethiopia and one in Morocco. The Armed Services, however, have been concerned with the recent epidemic of Group A disease in Brazil and with the increased incidence of this serogroup in Finland and the United Kingdom. Contingency stocks of Group A vaccine have been ordered, therefore, as a precautionary measure. Limited surveillance data from Great Lakes during the last calendar quarter of 1974 suggest that isolations of serogroups B and 29E may be occurring with increased frequency.

| TABLE 4 |
| Incidence Rates of Meningococcal Disease in Active Duty Navy and Marine Corps Personnel by Specific Serogroup 1972-1974 |
| Year | 1972 | 1973 | 1974 |
|---|---|---|---|
| Rate/100,000 | 3.3 | 3.3 | 2.0 |
| Number cases | 20 | 19 | 11 |
| Serogroup B | 1 | 1 | 1 |
| C | 2 | 0 | 0 |
| Y | 11 | 8 | 3 |
| Not specified and other | 6 | 10 | 7 |
| Deaths | 3 | 0 | 0 |
OUTPATIENT RESPIRATORY DISEASE

Accurately collated outpatient morbidity data were obtained for the entire Navy and Marine Corps to the end of fiscal 1974 (Table 5). The information is tabulated by fiscal rather than calendar quarter. The data again demonstrate the differences between Navy recruits and those of the Marine Corps. The variation, however, is less marked than that seen in Table 3. As expected the operating forces reported less frequent outpatient illness than did recruit populations. Increased recruit morbidity during the first and second quarters may reflect the seasonal influx of large numbers of susceptible personnel and the resultant increased opportunity for exposure.

INPATIENT RESPIRATORY DISEASE

Hospitalization rates for respiratory illness for fiscal 1973 and 1974 are seen in Table 6. Recruits were admitted more frequently than nonrecruit personnel. Acute lower respiratory diseases were the most frequent indication for admission. It is difficult with this crude data to assign any special importance to the administration of adenovirus vaccines which was begun early in the third quarter of fiscal 1973. It is possible that some of the vaccine lots were subpotent or that other pathogens have been responsible for the hospital admission.

COMMENT

Acute respiratory diseases appear to have decreased in the Navy and Marine Corps during 1974. Influenza and streptococcal illness have presented no major difficulty, and the use of polysaccharide vaccine has virtually eliminated Group C

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**TABLE 5**

Outpatient Morbidity from New Cases of Respiratory Disease in Navy and Marine Corps Personnel for Fiscal Year 1974 (Annual Rate/1000 Average Strength)\(^a\)

| Diagnosis by fiscal quarter | Navy recruits | Marine Corps recruits | All recruits | Non-recruits |
|-----------------------------|--------------|----------------------|-------------|-------------|
| **Influenza**               |              |                      |             |             |
| 1st qtr                     | 52           | 82                   | 66          | 137         |
| 2nd qtr                     | 498          | 410                  | 458         | 247         |
| 3rd qtr                     | 237          | 187                  | 221         | 283         |
| 4th qtr                     | 157          | 30                   | 109         | 200         |
| **Pharyngitis and tonsillitis** |          |                      |             |             |
| 1st qtr                     | 534          | 136                  | 355         | 182         |
| 2nd qtr                     | 887          | 115                  | 537         | 196         |
| 3rd qtr                     | 911          | 299                  | 714         | 253         |
| 4th qtr                     | 706          | 90                   | 474         | 198         |
| **Upper resp. inf.**        |              |                      |             |             |
| 1st qtr                     | 3548         | 988                  | 2391        | 521         |
| 2nd qtr                     | 5332         | 1579                 | 3629        | 631         |
| 3rd qtr                     | 4377         | 3230                 | 3386        | 731         |
| 4th qtr                     | 3392         | 1854                 | 2814        | 592         |
| **Other resp. infection**   |              |                      |             |             |
| 1st qtr                     | 126          | 121                  | 124         | 99          |
| 2nd qtr                     | 228          | 271                  | 247         | 99          |
| 3rd qtr                     | 166          | 208                  | 225         | 133         |
| 4th qtr                     | 230          | 278                  | 248         | 115         |

\(^a\)Adenovirus vaccines were in use through the entire time period. Influenza vaccine for the Fall and Winter of 1973 contained A2/England and B/Hong Kong components; it was given on a mandatory basis to "all" active duty personnel.
### Inpatient Respiratory Morbidity for Navy and Marine Corps Personnel for Fiscal Years 1973 and 1974 (Projected Annual Rates per 1000 Average Strength)

|          | Lower resp. inf. | Influenza | Upper resp. inf. | Streptococcal |
|----------|------------------|-----------|------------------|---------------|
|          | Navy             | Marine Corps | Navy             | Marine Corps | Navy             | Marine Corps |
| Recruits |                  |            |                  |               |                 |               |
| 1973     |                  |            |                  |               |                 |               |
| 1st qtr  | 353              | 57         | 7                | 0             | 91              | 3             |
| 2nd qtr  | 463              | 101        | 10               | 0             | 32              | 9             |
| 3rd qtr  | 453              | 140        | 9                | 6             | 21              | 17            |
| 4th qtr  | 194              | 91         | 3                | 1             | 10              | 6             |
| 1974     |                  |            |                  |               |                 |               |
| 1st qtr  | 183              | 62         | 8                | 1             | 17              | 5             |
| 2nd qtr  | 301              | 154        | 4                | 2             | 26              | 11            |
| 3rd qtr  | 261              | 102        | 1                | 2             | 25              | 30            |
| 4th qtr  | 168              | 91         | 0                | 0             | 111             | 17            |
| Non-recruits |            |            |                  |               |                 |               |
| 1973     |                  |            |                  |               |                 |               |
| 1st qtr  | 4                | 3          | 1                | 0             | 1               | 1             |
| 2nd qtr  | 6                | 6          | 1                | 0             | 1               | 1             |
| 3rd qtr  | 5                | 7          | 2                | 5             | 1               | 1             |
| 4th qtr  | 4                | 3          | 0                | 0             | 1               | 1             |
| 1974     |                  |            |                  |               |                 |               |
| 1st qtr  | 3                | 3          | 0                | 0             | 1               | 1             |
| 2nd qtr  | 4                | 3          | 0                | 1             | 1               | 1             |
| 3rd qtr  | 3                | 3          | 2                | 1             | 1               | 1             |
| 4th qtr  | 3                | 3          | 0                | 0             | 1               | 1             |

*aBased on ICDA Discharge Diagnoses; rounded to nearest whole number.

Meningococcal disease among recruits. There are also indications that fully potent live adenovirus vaccines have reduced the frequency and severity of clinical illness.

Substantial gaps in our knowledge still remain as to the etiologic importance of the rhinoviruses and *M. pneumoniae*, as agents of ARD in our populations. Further, preliminary data from transtracheal aspiration studies suggest that commensal infections with more than one organism may be responsible for some respiratory illnesses.

It is apparent that there are requirements for continuing research into the causes of ARD and the efficacy of various preventive measures. These investigative activities will necessitate the allocation of funds for sophisticated support laboratories and the development of cost effective, epidemiologically sound surveillance techniques. Without accurate information and on-going evaluation systems, we shall be forced to grope blindly for preventive solutions guided only by our anecdotal bias.

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