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# Influences on Dental Defects in Naval Personnel

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RECRUITING AND INDUCTION of large numbers of men into the military services has resulted in the accumulation of considerable information on the educational and medical status of the American people. Frequently, personnel drawn from the various regions of the country display marked differences. It is the purpose of this paper to present certain important regional differences in the dental status of men entering the Navy and to relate these differences to some simple sociological data.

To estimate the number of dentists required to treat a Navy of any given size, it is necessary to know the number of dental defects in various age groups as well as the rate of increase of dental defects with increasing age. Attention will be directed here only to the determination of the number of dental defects in naval personnel at the time of entry into the service. Interest in this topic came about as a result of the desire of the Dental Division (Bureau of Medicine and Surgery) to evaluate the dental needs of the service. Several excellent studies have been made in the past on the dental status of a given population of adults, but they have usually been limited to a study of only a small section of the country or a small number of cases (*1–4*). For the study conducted by the Dental Division a wealth of material was available.

Duplicate dental records of 69,584 men who were coming on active duty in the Navy in 1941–42 were coded and transferred to punch cards through the cooperative efforts of the Research Division, Bureau of Medicine and Surgery, Naval Dental School, and the Vital Statistics Division of the Bureau of Medicine and Surgery. These data were then sorted by the latter Division into the distribution of dental defects (a) in the entire sample, (b) by region of birth, and (c) by age groups.

[1] The material in this article should be construed only as the personal opinions of the writers and not as representing the opinion of the Navy Department officially.

## Sample of Personnel

The men comprising this sample were principally white enlisted volunteers, although a few men on fleet reserve status who were called to active duty were also included. Upon entering "boot camp" for training they were given a dental examination which supplied the data for this paper. Before reaching "boot camp," however, some men were eliminated at local recruiting boards for dental defects. At the time the present sample of men entered the service about 7 per cent had been eliminated for dental reasons in accordance with the dental standards of the service at that time. These applied to all regions, although it is probable that more men were screened out in some regions than in others. The effect of this screening is to decrease regional differences slightly, so it may be that, in the population at large, greater regional differences may exist than those noted here.

The dental standards at the time the men were examined required a total of 18 serviceable teeth. These teeth were to include two opposing molars on either side, four serviceable incisors, and good occlusion. The man had to be free from oral infections and to have suitable prosthetic replacements for any wide edentulous areas. Teeth with large cavities impossible to repair were not considered serviceable teeth (*7*).

The mean age of this group of men was 24 years, and about 82 per cent of the men were below 30 years of age; these data are very close to the age distribution of all enlisted men in the service at that time (*9*).

All the data on these men were divided into geographic regions according to place of birth. The states comprising each region of the country are shown in Fig. 1. The smallest number of men from any one region came from the mountain states. However, even this region contributed a sizable group of men—3,672, or slightly over 5 per cent of the total number of men in the sample who were born in this country (*8*). The basis for dividing the states into regions was one of

convention and followed that of previous papers on national dental problems (*6*). The slight differences in distributions of ages for the various regions were corrected, but this was almost without effect on the final picture of regional differences, because the groups of men from the various regions had almost the same age distribution.

### "The Average Man"

The mean number of simple and compound cavities was found to be about 10 per person, which is in striking contrast to the 5 fillings found per person (*10*). This means, in effect, that the "average man" required more dental attention upon entering the service than he had received up to that time. A similar finding has already been reported by the Public Health Service for children (*5*). It thus appears that, in any large portion of the population of this country, the amount of dental attention required is far in excess of that already rendered. The ratio of dental treatment required to dental treatment already rendered can be used as an index of dental attention, which, as will be shown later, varies considerably throughout the country (*10*).

It has been estimated that it would require .00406 dentist years per person to treat the defects found in the present study—a figure arrived at by dividing the total work done by naval dentists during a given period by the number of dentists on duty (*10*). In a similar manner the amount of time already expended per person could be estimated. The time received by the "average" person in treatment prior to entering the Navy was estimated at .00211 dentist years. The ratio of .00406 dentist years required to .00211 dentist years rendered indicates that almost twice as much time was required to treat the men at the time they entered the service as they had received in the entire period preceding the examination. It should be mentioned here that the estimated dentist years of work is based on a complete year, including holidays, leave, administrative duties, and other nonclinical functions, and thus represents the total work placed in a year, not the length of time it takes to perform a specific task (*10*).

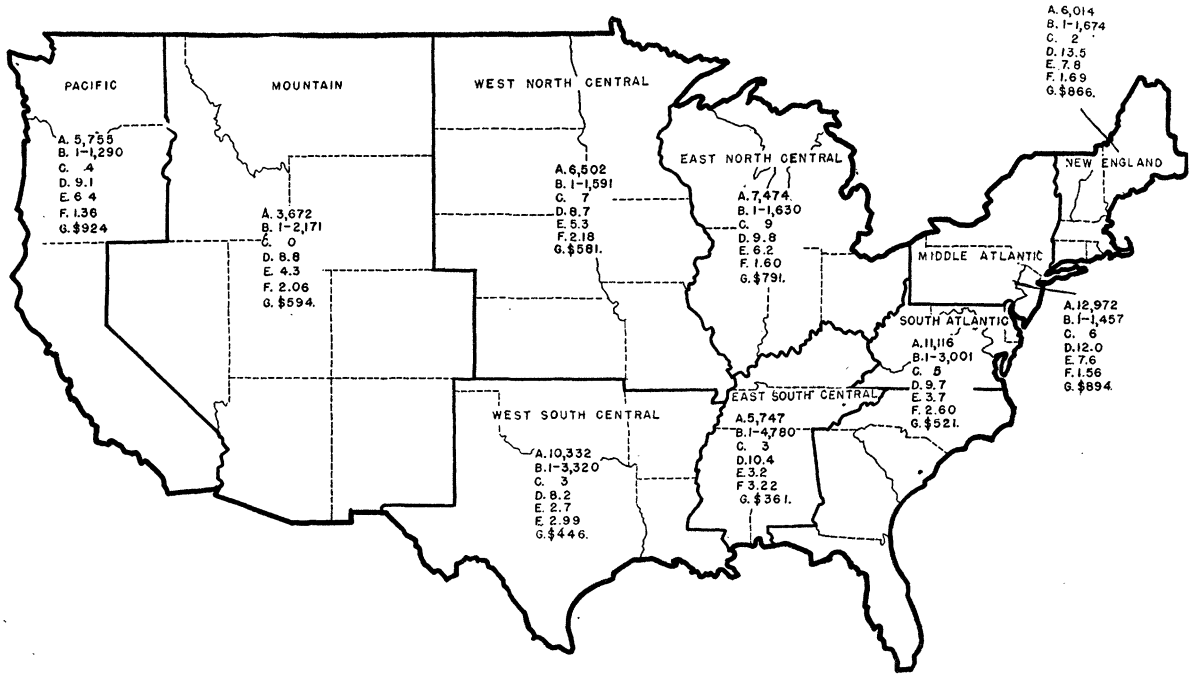


FIG. 1. Regional factors correlated with the dental status of 69,584 naval personnel examined in 1942. A—Number of cases; B—Dental ratio (dentist to population); C—Number of dental schools; D—Cavities (simple and compound); E—Restorations (fillings); F—Index of dental attention; G—Mean income.

Emphasis has been placed so far on the number of cavities and fillings per person, because these represent the greatest source of dental treatment in the age group studies; with increasing age more dentures would be required. Somewhat surprising is the fact that few teeth required extraction despite the large number of carious teeth, the mean number per person being about 0.2. In contrast, the mean number of missing teeth was 4.7 at the time of examination.

### Regional Differences

There were marked differences in the number of cavities per person when the personnel were grouped according to region of birth (*10*). For example, New England had a mean of 13.5 simple and compound

cavities per person, whereas the West South Central region had only 8.2 per person. Regional differences were found for other dental defects, and in general New England and the Middle Atlantic had the greatest number of defects per person, the East South Central and West South Central regions having the least number. The mean number of dental defects in men from each region can be seen in Fig. 1. Differences also appear in the number of fillings or restorations already placed. In fact, the regional differences are greater for fillings already placed than for the number of cavities present at the time of examination. Thus, New England, which had 64 per cent more cavities per person than the West South Central region, had 191 per cent more fillings per person. If number of cavities is added to the number of fillings per person to obtain the mean number of carious areas, it is found that New England tends to have about twice as many carious areas per person as the West South Central region, *i.e.* 21.3 vs. 10.9, respectively. This leads to the conclusion that New England has a much greater tendency to caries than the West South Central region, but in the former region a greater percentage of carious areas are filled.

It also appears that dental attention is not simply distributed according to regional needs. When the estimated time required to treat personnel from the various regions is divided by the estimated time already spent in treatment, an index of dental attention is defined which shows considerable variability among the regions. Thus, the Pacific Coast region had an index of 1.36, which means that personnel from this region required 1.36 times more dental work upon entering service than they had had up to that time. Personnel from the East South Central region, on the other hand, had an index of 3.22. The various indexes are presented in Fig. 1. It is apparent that many of the regions which have the best teeth inherently have unusually little dental attention. This large amount of variability suggests that some rather strong sociological forces must be operating within the country that result in a disproportionate concentration of dentists in some regions.

## Sociological Factors

In the Pacific Coast region, which had the most favorable dental attention index, there were 1,290 persons per dentist in 1940; the same region had a mean per capita income of $924. The region with the poorest dental attention index, the East South Central region, had 4,780 persons per dentist and a mean income of $361. When the nine regions are ranked in order from high to low for mean income, dental attention index, and number of persons per dentist, an almost perfect relation is described between these factors. One is led to conclude, therefore, that the dentists in this country are distributed according to the relative wealth of the regions, with the result that availability of dental attention is a function of regional wealth. The three regions which had a population load of more than 3,000 persons per dentist as well as the lowest mean income per capita were the adjacent southern regions of the country, the South Atlantic, East South Central, and West South Central regions.

The West South Central region appears as a paradox on first analysis. This has next to the largest number of persons per dentist and next to lowest mean income per capita, with the result that it has next to the poorest dental index. Despite this, however, personnel from this region have inherently the best teeth in the country when the total number of cavities are added to the total number of fillings already placed (Fig. 1). From this one may infer that the presence of dentists in a region has but slight effect on the dental status of persons from that region, and whatever the natural causes operating in the various regions, they seem more important than the number of practicing dentists. This is seemingly substantiated in the New England region, which has inherently the poorest teeth of all regions and almost twice as many dentists per capita as the West South Central region.

Before it is concluded that the presence of a large number of dentists in a region does not contribute to caries prevention, it should be mentioned that there appear to be so few dentists in the country that their contribution to preventive dentistry may be so small in proportion to the effect of natural factors that it tends to become obscured.

The total number of dentists in 1940 was 70,415, which yields a national ratio of 1 dentist per 1,870 persons. This is much lower than the ratio adopted by the Navy of 1 dental officer per 500 personnel. The scarcity is accentuated by the fact that it is questionable whether even the latter ratio is adequate to take care of all the dental defects in a group of that size. If we assume that 1 dentist per 500 persons is a reasonable ratio, then it is possible to estimate the number of dentists necessary in the entire country. Dividing the population of the nation by 500 yields a figure of 263,338 dentists, of which we now have 70,415, or about 27 per cent of those required. This estimate is only a very loose approximation, since the Navy deals only with an adult population and a select group. The qualifications that must be introduced by the inclusion of children and people with severe dental defects who would be rejected for military service are uncertain, and thus the estimate is most tentative.

Aside from the issue of the number of dentists needed by this country, the apportionment of existing dentists, poses an interesting problem. Two methods of apportioning dentists that immediately suggest themselves are (a) on a straight per capita basis and (b) according to the regional needs as indicated by data of this study.

To distribute the dentists on a straight per capita basis it is necessary only to divide the number of people in each region by 1,890 (the national ratio). This division yields the number of dentists that should practice in each region if they were distributed uniformly throughout the country.

To compute the distribution of dentists according to the dental needs of the various regions, the estimated mean time for treating personnel from a region (cavities + fillings) may be multiplied by the population of that region. This estimated time may be expressed as a percentage of the total estimated time to treat the nation. To arrive at the number of dentists per region, if they were distributed according to regional dental needs, this percentage is then multiplied by the number of existing dentists.

Table 1 lists the actual distribution of dentists in 1940 by regions (*6*), the distribution on a simple per capita basis, and the distribution according to regional needs.

TABLE 1

DISTRIBUTION OF DENTISTS OF U. S. IN 1940

| Region | Actual dentists | Calculated dentists | Calculated dentists per capita |
|---|---|---|---|
| N.E. | 5,038 | 6,058 | 4,512 |
| M.A. | 18,900 | 18,340 | 14,728 |
| E.N.C. | 16,327 | 14,686 | 14,240 |
| W.N.C. | 8,493 | 6,289 | 7,229 |
| S.A. | 5,606 | 8,217 | 9,532 |
| E.S.C. | 2,662 | 5,043 | 5,764 |
| W.S.C. | 3,934 | 4,897 | 6,987 |
| Mt. | 1,911 | 1,857 | 2,219 |
| Pac. | 7,544 | 5,028 | 5,205 |

## AGE DIFFERENCES

The effect of age on the incidence of dental defects might hold considerable significance for the military services, if only from the practical view of how much dental care would be required. When the present data were examined for the purpose of evaluating age differences, few, if any, marked changes were manifest in the age groups under consideration. This could be interpreted as further substantiation of the view that most dental destruction or disposition to destruction occurs in childhood (*5*). When the men were divided into age groups, the youngest group (17–19) appeared to require as much dental care upon entering the service as any age group up to 40. From a practical dental standpoint, therefore, there appears to be no reason for setting a low age limit upon recruits for the services, since about as much time will have to be spent in dental repair at all age levels below 40. As might be expected, the older groups tend to have more dental restorations placed before entering service.

## DISCUSSION

A nationwide shortage of dentists is indicated by the results of this study. The resulting widespread dental neglect is not limited to any region of the country, although rather large regional differences exist in dental attention. These are related to the number of practicing dentists in a region which, in turn, reflects the economic status of the community. The concentration of professional groups according to regional wealth is not unusual. The fact that dentists are so concentrated does mean, however, that they are not distributed according to regional needs. The presence of a large number of dentists in a region, as has been shown, will not assure the population that they will have inherently sound teeth. The past role of dentists in the population under study was apparently to check the advance of caries in teeth rather than to prevent beginning caries.

Most medical and educational advantages are believed to be held by regions with the largest incomes, in contrast to the present finding that the incidence of caries is lowest in regions of the country with small wealth. The dental superiority of the southern regions of the country is obscured by the absence of dental care to check the caries which do start. If existing dentists were distributed on a simple per capita basis throughout the country, personnel drawn from the southern regions would require considerably less dental care upon entering military service than those from other regions. A more equitable distribution of dentists would appear to be on the basis of regional dental needs. Thus, the number of dentists in New England, which totaled 5,038 in 1940, would drop to 4,512 if the existing dentists at that time were distributed on a simple per capita basis. With dental needs as the criterion, the redistribution of dentists would cause a rise to 6,058. This consideration does not in any way indicate the number of dentists actually required in New England if adequate dental care were available on the level accepted by the military services. Had adequate civilian care been available throughout the country in the years before the war, fewer dentists would have been required by the services. The number of dentists required in the services is thus not so much a reflection of unusually high standards, as it is a reflection of the lack of dental attention in the civilian population.

In conclusion, the study of naval personnel has shown not only that civilian dental care is not sufficiently available but also that the existing dental care is not distributed where it is most needed. The necessity for directing attention to caries prevention as well as to the repair of damage caused by caries has become obvious.

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# *Association Affairs*

## Call for Papers

*Persons desiring to present papers* at the Boston Meeting of the AAAS and its affiliated societies are requested to notify at an early date the secretaries of the sections and societies before which they wish to report their work. The secretaries will be aided in their acceptance of papers if each speaker will enclose with the notice an abstract describing the purpose of the investigation, the nature of the results obtained, and the relations of the results to earlier investigations. It is not necessary that those presenting papers be members of the Association.

Copy for the *General Program* of the meeting is due in the Washington office of the Association by 21 October; titles of papers should be submitted without delay to the secretaries in order that those accepted may be included in the printed program.

SECTION SECRETARIES

*Mathematics*—Prof. Raymond W. Brink, University of Minnesota, Minneapolis, Minnesota.

*Physics*—Dr. Joseph C. Boyce, New York University, New York City.

*Chemistry*—Office of the Administrative Secretary, American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D. C.

*Astronomy*—Dr. Charles C. Wylie, State University of Iowa, Iowa City, Iowa.

*Geology and Geography*—Dr. George W. White, The Ohio State University, Columbus, Ohio.

*Zoological Sciences*—Dr. J. William Buchanan, Northwestern University, Evanston, Illinois.

*Botanical Sciences*—Prof. George W. Martin, State University of Iowa, Iowa City, Iowa.

*Anthropology*—Dr. Marian W. Smith, Columbia University, New York City.

*Psychology*—Dr. Harold E. Burtt, The Ohio State University, Columbus, Ohio.

*Social and Economic Sciences*—Dr. Bruce L. Melvin, 1355 Ingraham St., N.W., Washington, D. C.

*History and Philosophy of Science*—Dr. Raymond J. Seeger, Wetherhill Rd., Washington, D. C.

*Engineering*—Prof. Frank D. Carvin, Newark College of Engineering, Newark, New Jersey.

*Medical Sciences*—Dr. Malcolm Soule, University of Michigan, Ann Arbor, Michigan.

*Subsection on Dentistry*—Dr. Isaac Schour, University of Illinois College of Dentistry, Chicago, Illinois.

*Subsection on Pharmacy*—Dr. Glenn L. Jenkins, Purdue University School of Pharmacy, Lafayette, Indiana.

*Agriculture*—Prof. E. E. DeTurk, University of Illinois, Urbana, Illinois.

*Education*—Prof. D. A. Worcester, University of Nebraska, Lincoln, Nebraska.

## Microbiological Section, Botanical Society of America

*The recently organized Microbiological Section* of the Botanical Society of America, Inc., will meet with the other sections of the Society at Boston on 26–31 December and will hold several sessions devoted to microbiology. Microbiologists wishing to become affiliated with the Section and to present papers at these sessions should communicate with the secretary, K. R. Raper, Northern Regional Research Laboratories, Peoria, Illinois.