



Dr. Bawden

A survey of periodontal disease in a state population — An emphasis on children

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Abstract

Two surveys of dental disease in the North Carolina population were conducted fourteen years apart (1963 and 1977). The data collection methods were carefully standardized and were shown to be directly comparable.

The results provide information on caries (DMFT), periodontal disease (PI), and oral hygiene (OHI-S) in the general population and in subgroups according to age, race, sex, geographic location, urban versus rural, socio-economic status, fluoride exposure, and other relevant variables. Of greater importance, comparison of data from the two studies allows identification of trends in dental disease patterns and, to some extent, dental care.

Results show that dental caries prevalence is declining in the population 30 years and younger as a result of water fluoridation. However, the prevalence of periodontal disease has increased sharply in the population, especially in certain groups. This increase extends into the five to 19 year age group where subgroup patterns show pronounced differences. Changes in oral hygiene status are in the same direction.

Introduction

Epidemiological study of dental diseases can provide information on the prevalence of these diseases in a population and on the pattern of their occurrence in subgroups of a population with regard to age, race, sex, socio-economic status, geographic location and other relevant variables. It is also possible to compare the findings with respect to one dental disease index

with data pertaining to another index of oral condition to determine what relationships might exist. Such epidemiological studies thus provide important information on the dimensions of dental health problems in the population, patterns of occurrence, identification of target populations, and sometimes offer information as to the etiology of a condition.

In addition, if two epidemiological studies are conducted properly on a population at two points in time, valuable information on trends in disease patterns can be obtained. Information on trends is often more useful than is a simple measurement of disease prevalence in the population at one point in time, particularly with respect to planning for the prevention and treatment of dental disease.

In 1960-63, Fulton and Hughes conducted the first comprehensive epidemiological study of dental health in a statewide population¹. That landmark study received wide recognition for its excellence, and it was used extensively as the data base for planning for dental disease prevention and dental health care delivery in North Carolina for over a decade. In 1976 the dental profession in the state recognized the need for a state dental manpower study and undertook an extremely complex, four part investigation of: (1) dental disease in the population; (2) factors influencing demand for dental care; (3) distribution of dental health manpower; and (4) the productive characteristics of the dental care delivery system². The effort was administered by the Dental Foundation of North Carolina and was financed, for the most part, by the W. K. Kellogg Foundation. Participating in the study were the North Carolina Dental Society, the North Carolina State Dental Board, the Dental Health Section of the Department of Human Resources, the Research Triangle Institute, and the University of

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A major component of the Manpower Study was a repeat of the original Fulton and Hughes dental health survey of the North Carolina Population³. The data were collected so that direct comparisons could be made between the two studies conducted fifteen years apart. The findings are of considerable interest. It is our purpose to review briefly with you how these two epidemiological studies were conducted and to present selected findings — particularly as they relate to periodontal disease in children.

Methods and Materials

The original statewide study conducted by Fulton and Hughes from 1960 to 1963 provided descriptive epidemiological information on the prevalence of dental caries, periodontal disease and oral hygiene in relation to ten biological, ecological and social variables in a sample of 7,236 individuals, representative of the state's 1960 population of over 4 million people. The 1976-1977 study was a replication of the original survey, and was carried out in the following manner.

The measurement of dental health relied on three indices.

- (1) The Decayed-Missing-Filled Teeth Index (DMFT) as developed by Klein, Palmer and Knutson⁴: The index is a conservative underestimate of dental disease and is almost exclusively a measure of dental caries experience in younger age groups. In middle age and older, periodontal disease plays an increasing role in contributing to scores.
- (2) The Periodontal Index (PI) described by Russell⁵: The index is constructed by assigning one of five possible numerical scores to the periodontal structures surrounding each erupted permanent tooth and then dividing by the number of scores.
- (3) The Simplified Oral Hygiene Index (OHI-S) as developed by Greene and Vermillion⁶: This index is calculated through the scoring of the quantity of oral debris and calculus present on six particular teeth. Each of these teeth is assigned a debris score and a calculus score ranging from 0 to 3. The OHI-S score represents the sum of the debris and calculus scores.

Data were also collected on each subject with respect to urbanity-rurality, geographic region, systemic fluoride exposure, size of household, household member status, race, age, sex, education, occupation and source of income. The interviews and examinations were conducted in a uniform and standard manner. The dental examinations were performed with the aid of a dental mirror, No. 23 explorer and a flashlight. The examiners were assisted by recorders who

directed the light and recorded the information.

The sample used for the study was selected by the Research Triangle Institute (RTI) from their North Carolina General Purpose Household Sample. RTI had selected the sample for the original study and had analyzed those data to determine if the sample size could be reduced in the second survey. It was shown that a sample less than half the size of the original one would be adequate. Thus, one in every 1,350 North Carolinians residing in households was to be examined. The sample selection process was complicated, but resulted in a stratified, probability sample.

Of the 1,373 occupied households, exams and interviews were obtained in 92.4%. Only 5.7% of the households refused to participate. Of the people residing in the acceptance households, 94.9% were examined, for a total of 3,454 individuals on which data were collected. Refusals were evenly distributed throughout the sample. The low refusal rate is remarkable and represents proper orientation of the examining teams, skill and persuasiveness on the part of the examiners, and cooperation from local authorities.

The sample was compared to census estimates from the North Carolina Department of Human Resources and it was shown to be an accurate representation of the population. Age, race and sex distributions varied by less than 2% from the census data.

Geographic, economic and time constraints required that a number of examiners be used to collect the information. The household cluster locations extended to the far reaches of the state, covering an area of approximately 49,000 square miles.

Fortunately, it was possible to draw on the considerable resource of dental public health manpower in North Carolina to complete the formidable task of data collection. A seven-day training course was held in May of 1976 at the UNC Schools of Public Health and Dentistry to familiarize the surveyors with the study, to achieve maximum reproducibility of field examinations and to identify examiner bias. Twenty-eight dentists, 22 hygienists and one dental assistant were trained at that time. The training sessions were conducted according to standard methods and included clinical examinations on actual patients to provide a measure of examiner reliability and to identify any examiners who deviated significantly from the expected norm.

A high degree of reliability was achieved among the examiners with respect to all three indices. There was close agreement between dentists and hygienists and no systematic bias was discernible. Thus, while it was planned that data collection be carried out by dentist-hygienist teams, it was possible to use hygienists as examiners in remote sections of the state when necessary. Two recent dental graduates waiting to begin

specialty programs in the fall were enrolled in the training course and employed to cover areas of the state where no other trainees were located and to assist in locations where special problems were encountered.

The data were recorded on forms specially designed for the original survey to insure consistency of data collection methods. All of the survey information was collected between June of 1976 and the end of February, 1977. Approximately two years were required for data entry and analysis, and for the results to be prepared for presentation along with the findings from the other components of the manpower study.

Results

The findings with respect to periodontal disease in children should be put in the context of other information generated by the study. Although data concerning the DMFT Index — its pattern in the young population, estimates of needed care, and a variety of other considerations — were of considerable interest, I will take time to focus on only one dimension of the findings relative to dental caries. Figure 1 is a comparison between mean DMFT scores at various ages taken from the 1960-63 study and from the 1976-77 study. In the population 30 years-of-age and under, DMFT scores are uniformly and significantly lower in the latest survey than observed in the original study. Analysis of the data showed this effect to be a direct result of increasing fluoridation of municipal water supplies in the state over the last 20 years. Figure 2 compares the D, M and F components of the total DMFT scores from the two studies and it can be seen that the untreated caries is a lesser proportion of the

total DMFT now than it was 15 years ago. Not only is the caries rate going down in the young population, a decreasing share of the caries is left untreated.

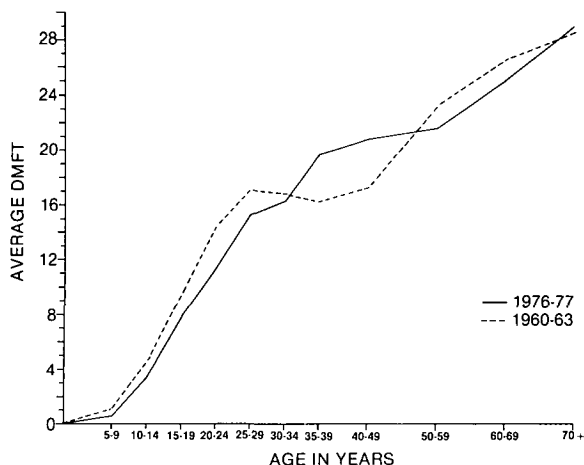
The data from the 1976-77 survey were collected long enough before the Statewide Preventive Dentistry Program for children was implemented to eliminate any impact from it. The Preventive Program is directed toward increased municipal water fluoridation, installation of school water fluoridators, a massive school fluoride rinse plan, an improved dental health education curriculum in the schools, and public education through the communications media. We predict that this program will have important effects in further reducing the prevalence of dental caries in the population in the next decade.

Thus, we feel that the dental caries problem in North Carolina is coming under relative control and that appropriate steps have been taken to continue progress in that direction at a substantial rate.

On the other hand, the situation with respect to periodontal disease is quite a different story. Figures 3, 4, 5 and 6 compare periodontal index scores according to age from the two surveys in population subgroups defined by sex and race. Figure 3 shows that, in white males, PI scores are slightly higher in the 1976-77 study at most ages, and that the difference appears in the youngest age groups. In Figure 4, we can see that the same situation was found in white females. The startling trends were seen in the nonwhite population, however. Figure 5 shows that PI increases in nonwhite males are large and start in the youngest age group. In Figure 6, it can be seen that a similar situation prevailed in nonwhite females.

It is clear that periodontal disease is on the increase

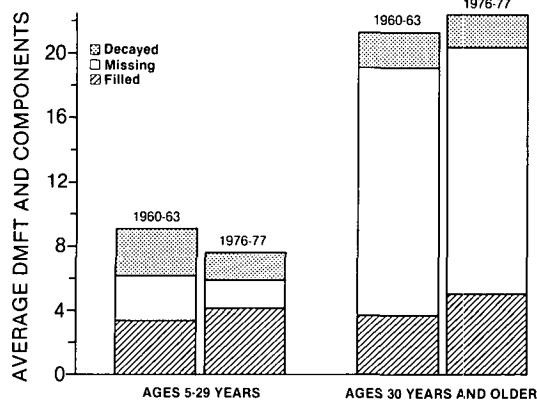
AVERAGE DMFT FOR ALL PERSONS AGE 5 AND OLDER, NORTH CAROLINA, 1960-63 AND 1976-77



NOTE: Age-specific scores for 1960-63 have been adjusted to the race and sex distribution of the 1976-77 sample.

Figure 1. Mean DMFT scores by age in the 1960-63 and 1976-77 surveys.

AVERAGE DMFT AND COMPONENTS FOR ALL RACES, AGES 5-29 YEARS AND 30 YEARS AND OLDER, NORTH CAROLINA, 1960-63 AND 1976-77



NOTE: Scores for 1960-63 have been adjusted to the age, race and sex distribution of the 1976-77 sample.

Figure 2. Comparison of the mean D, M, and F component scores in selected age groups from the 1960-63 and 1976-77 surveys.

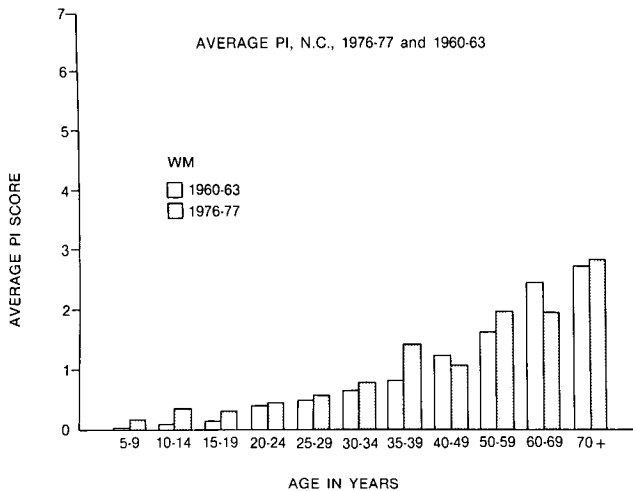


Figure 3. Comparison of PI scores in white males by age group in the 1960-63 and 1976-77 surveys.

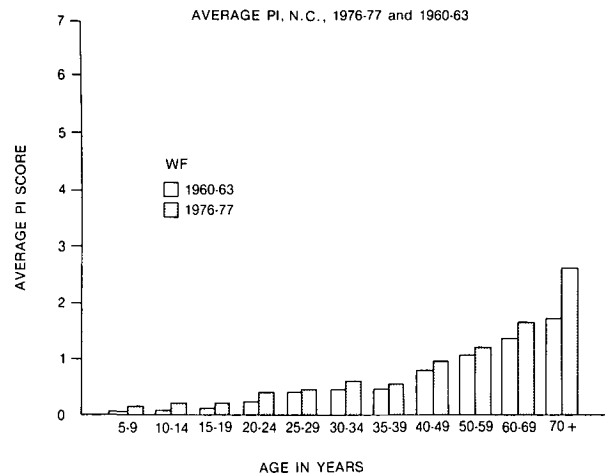


Figure 4. Comparison of PI scores in white females by age group in the 1960-63 and 1976-77 surveys.

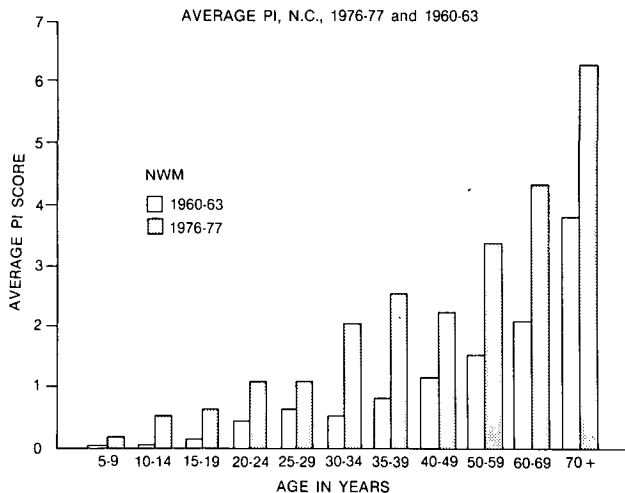


Figure 5. Comparison of PI scores in nonwhite males by age group in the 1960-63 and 1976-77 surveys.

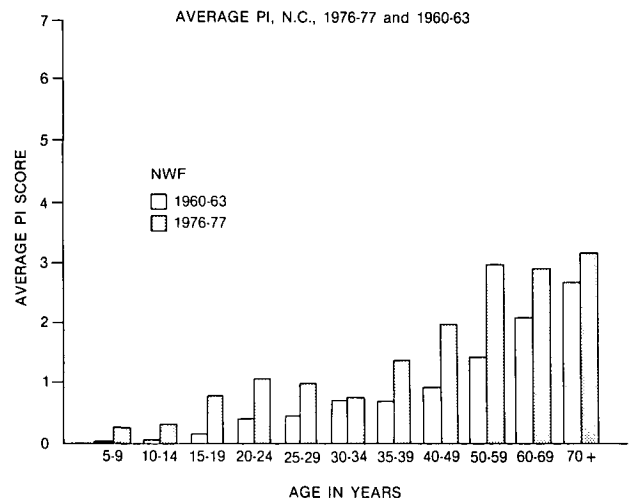


Figure 6. Comparison of PI scores in nonwhite females by age group in the 1960-63 and 1976-77 surveys.

in the North Carolina population, particularly in the nonwhite population, and that the increase starts with the youngest reported age group (five to nine years of age). Fortunately, as can be seen in Figure 7, virtually all of the periodontal disease observed in the age groups 20 years and under can be reversed by improvement in personal hygiene and dietary habits, and a minimum amount of professional care.

Turning to the OHI-S scores, the same trends can be seen, except that the differences between the two surveys are even more remarkable in the younger age groups. Figure 8 shows that for white males increased OHI-S scores in the 1976-77 survey are most obvious in the five to nine age group and that the trend continues through the teens. In Figure 9, we can see that white females expressed the same pattern. Figures 10 and 11 show that the same increases occurred in the younger age groups with respect to nonwhite males

and females, but that the differences continued throughout adulthood.

There can be no doubt that the oral hygiene status of North Carolinians was worse in 1976-77 than it had been in 1960-63 — a rather discouraging observation when one considers that efforts had been expended by public health officials and private practitioners over those 15 years to improve the oral hygiene habits of the population. We find it difficult to believe that personal oral hygiene habits are worse now in the young population than they used to be, although that is a possibility. We have considered other etiologic factors and feel that dietary changes offer the most plausible explanation for the startling increase in OHI-S scores. However, we have no way to test this hypothesis on the basis of our current data, and we are searching for some means of exploring the thesis. In the meantime, we can only speculate.

One is also struck by the fact that PI and OHI-S scores fluctuate in a quite similar manner, an observation reported by several other investigators. The relationship between oral hygiene and periodontal disease is clear.

Discussion

We feel the two studies of dental disease conducted 15 years apart in the North Carolina population have provided us with some important observations concerning dental disease in our population:

- (1) First, while dental caries is still a long way from being eliminated as a major public health problem, its prevalence is decreasing, and recently implemented programs should result in substantial additional decreases in the future. It is interesting that estimates generated using data from our companion study on the productive capacity of the practice system in the state indicate that the dentists can treat all of the new dental caries appearing in the population each year. Of course, not all of this need will be expressed as effective demand for care. So, capacity to treat dental caries is not a problem when the state is considered in its entirety. Maldistribution of dental manpower obviously results in isolated areas of inadequate capacity to meet the demand for treatment of caries. But I must say that such areas are becoming rather scarce. In the opinion of these authors, dental caries is no longer our most serious long-range dental health problem in North Carolina.
- (2) On the other hand, periodontal disease looms as the major dental public health problem which must now be addressed. It is obvious that prevalence of the disease is increasing, most particularly in the nonwhite population, and in young people in general. It was discouraging to learn from our dental practice survey that general practitioners in North Carolina spend less than 2% of their time treating periodontal disease. Their hygienists, of course, spend most of their time delivering such services, but essentially at the preventive level. The practitioners either fail to recognize periodontal disease, they or their patients choose not to treat it, or they refer it to a periodontist.
- (3) The third major observation is that the oral hygiene condition of the population is getting worse. And, the trend is most obvious in the younger age groups. One can reasonably conclude that the trend in OHI-S scores is responsible in large part for the increase in PI scores.

The implications of these three major observations are rather profound and come to bear on the dental profession and its various components in our state in

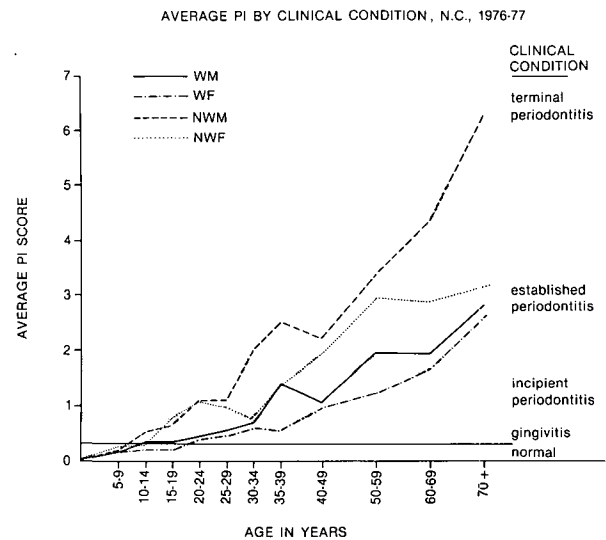


Figure 7. Estimation of clinical periodontal disease classification on the basis of PI scores.

the following manner:

- (1) The School of Dentistry must reorient its educational programs in an effort to focus the graduates' attention on the periodontal disease problem as the area of major concern in the future. In view of the data I have presented here, a considerable part of this task will fall on the Department of Periodontics — a department which has not traditionally concerned itself much with periodontal disease. In our school, and I think in most schools, this will not be easy as we have a long tradition of philosophical dominance by our restorative departments. I feel that our graduates have the knowledge and clinical experience they need to address the periodontal disease problem. The failure to do so is a matter of attitude.
- (2) The public must be educated to the changing nature of their dental health problems. It would be nice if someday in the future patients would routinely ask, "Doc, how are my gums?" rather than "Do I have any cavities?" That task is probably more formidable than trying to change attitudes in the faculty and the profession.
- (3) The community of dental science must intensify its quest to better understand the etiology, prevention and treatment of periodontal disease. The big problem is that we do not have a conveniently applied, inexpensive and highly effective preventive weapon to use as is the case with fluorides in the prevention of dental caries. In short, we need a "breakthrough." A heavy investment of funds in such research is obviously warranted.
- (4) The dental profession at large must carefully consider the problem, then plan and implement programs designed to deal with periodontal dis-

ease over the long haul, using the best methods available to us at the time. The profession in North Carolina has been quite successful in mounting such a program against dental caries and should now apply this experience to the periodontal disease problem.

- (5) Finally, more to the point of this conference, the problem of periodontal disease in our population is increasingly a problem of young people — of children. Periodontal disease is reversible at that stage and should be attacked then. This is where changes in public awareness and personal habits should be affected. This is where, in our opinion, the best opportunity exists.

In summary, we know what our major dental public health problem in our population in North

Carolina is. It is periodontal disease, not caries. We know that the problem is increasingly one of childhood. The challenge is one which the dental profession must address. Particularly, dental science and dental education must seek solutions to what is evolving into a problem of epidemic proportions in certain segments of our population.

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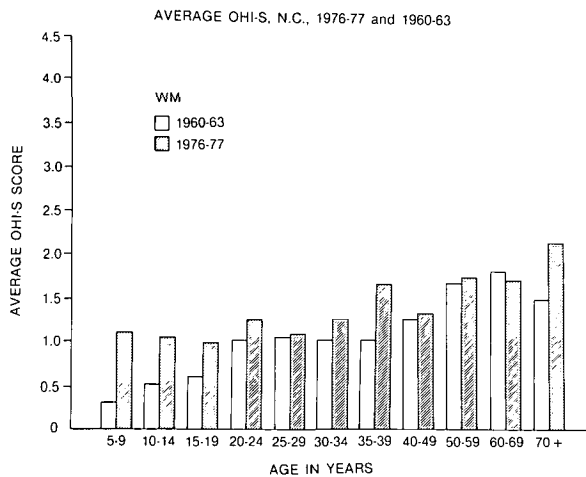


Figure 8. Comparison of OHI-S scores in white males by age group in the 1960-63 and 1976-77 surveys.

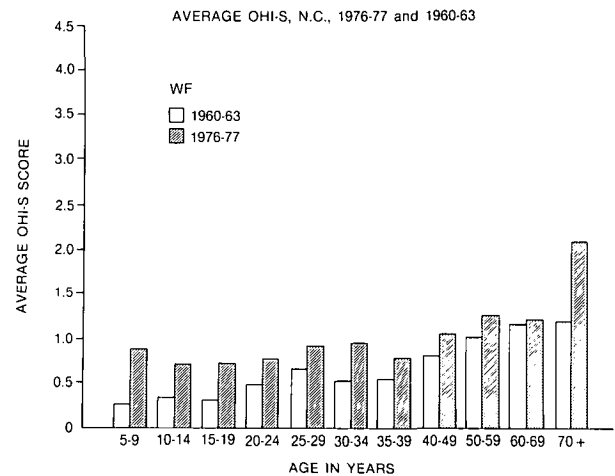


Figure 9. Comparison of OHI-S scores in white females by age group in the 1960-63 and 1976-77 surveys.

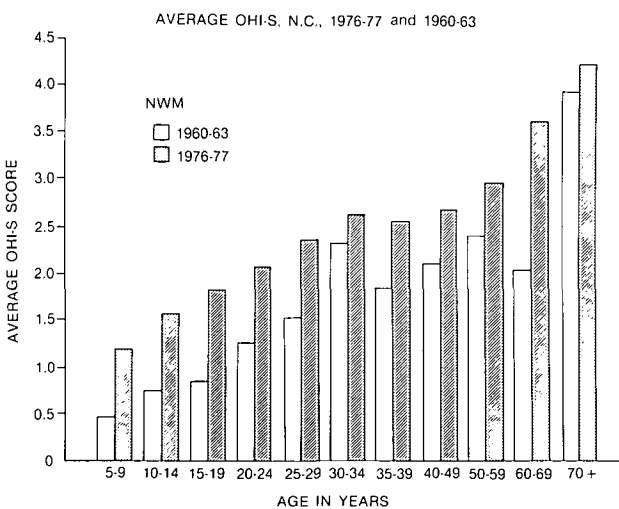


Figure 10. Comparison of OHI-S scores in nonwhite males by age group in the 1960-63 and 1976-77 surveys.

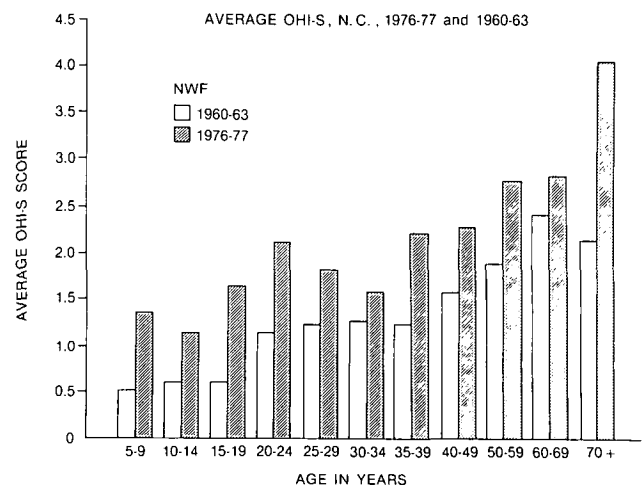


Figure 11. Comparison of OHI-S scores in nonwhite females by age group in the 1960-63 and 1976-77 surveys.

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