

the Journal
of the
American College
of Dentists

Dental Research Now and Ahead
Orthodontic Patient Cooperation
Dentistry in the Americas
Faculty Manpower and Prevention
Further Dental Student Studies

OCTOBER 1968

the Journal of the American College of Dentists

A QUARTERLY PRESENTING IDEAS IN DENTISTRY

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Editorial

A Time for Change

I have been associated with the JOURNAL OF THE AMERICAN COLLEGE OF DENTISTS for 14 years; from 1938 to 1943 as a contributing editor, and since 1959 as Editor. During my tenure as Editor an editorial policy evolved.

The JOURNAL presented papers and discussion that considered the broad problems and realities of the profession: comment on numerous aspects of dental education, and of dental research; studies by social and behavioral scientists that focused on the dental scene, particularly on the dental student; significance of federal health legislation; expansion of the role of dental auxiliaries; status of prepayment and insurance plans for providing dental care to more people; discussions on professional relations; need for more career guidance programs; problems between specialists and general practitioners; development of continuing education programs; dental practice and education in other countries; and occasionally dental historical items.

The general policy of the JOURNAL, in the nine volumes of 1960-1968, has been to attempt to view the changing professional scene, to publish papers that interpreted that scene that other dental periodicals usually did not present, and to explore the future. To some extent, I think, that aim was reached.

And now my editorship comes to a close, as does my association with the College as Assistant Secretary. After the death of my wife earlier this year, continuing to live in St. Louis was not a happy situation. I resigned my position July 31 and accepted a professorship at the University of Missouri at Kansas City. My new duties began September 1, although I edited this October number of the JOURNAL to complete Volume 35.

Naturally this change was made with some regrets. Yet it is also pleasant to resume teaching, and to look ahead for the first time in 40 years and have no editorial deadlines to meet.—*T. F. McBride*

Dental Research: Current Progress and Responsibilities Ahead

SHOLOM PEARLMAN, D.D.S., M.S.

This report reviews what dentistry has accomplished in developing research over the past few years, places these developments in perspective against the background of certain salient needs of society, and raises some questions of responsibility and of accountability that command the concern of the profession, in view of the rapidity with which society and health service are undergoing change today.

THE growth and progress of dental research cannot really be measured except by counting and weighing the new knowledge which it has produced. The counting can be done fairly easily, for we can tally the number of reports and the publications, the number of research workers in dentally-related fields, the number of projects underway, the amounts of money, the number of facilities and so forth. But the weighing of these items—in terms of their actual usefulness to the scientific community, to the educational sphere, to the health professions in general or to society as a whole—is not susceptible to objective procedures.

For there are no objective standards by which any of these factors can be given a value; the evaluation of a research project or publication is always subjective. To the scientist working at the frontier of our ignorance, it may be the most world-shaking development since

Dr. Pearlman is Consultant for Program Development at the new University of Colorado School of Dentistry, Denver. He was formerly Secretary of the Council on Dental Research of the American Dental Association.

Dr. Pearlman was named winner of the 1967 Research Medal Award given by the Association of Dental Alumni of Columbia University; he was cited for his distinguished activity in promoting the objectives of dental research at the ADA and in many national and international endeavors.

The Award was presented February 9, 1968, at Alumni Day ceremonies at Columbia's School of Dental and Oral Surgery. This paper was read on that occasion.

Prometheus; to the congressman looking for practical results, the same research may be the most ridiculous waste of time, effort, and money since that long-forgotten government authorized and appropriated funds for the construction of the Tower of Babel. And there are people in high places today who are almost convinced that some of the selfsame scientists, engineers, educators, and businessmen who promoted and sold the "Babel Project" to the people of that time are sitting on advisory councils and congressional committees in Washington today, either in reincarnation or as holdovers from that Great Society of the Past.

These viewpoints are in contrast. Our profession itself contains many contrasts and contradictions. And our entire society is replete with examples of striking contrasts that make it difficult to know where we are going and what we ought to do first. It is clear that we have to collect and digest a great deal of information before we can make any reasonably wise judgments in these important matters—and the judgment of research activity is not excepted in that assertion. Reliable figures and statistics need to be compiled, even though we are already so heavily saturated with questionnaires and statistics that the thought of continual pressure for more surveys and more data and more analytical printouts appears distasteful.

Figures and statistics are still the best readily available means of evaluating progress with any semblance of objectivity. In reviewing those that follow, it should be borne in mind, however, that the numbers cannot tell us what we really need to know about the phenomenon; and that while statistics don't lie, statisticians occasionally do—or at least they make mistakes.

Table I* summarizes the fiscal history of the extramural grants and awards program of the National Institute of Dental Research (NIDR) over an 11-year period, from 1956-1966 inclusive. The U.S. Public Health Service is the greatest single source of support for research related to oral health and disease. Its efforts, which the American Dental Association has supported and supplemented with vigorous programs of its own, account for the spectacular expansion of dental research and the improvement of the scientific quality of that research in the past decade or two. Both the Division of Dental

* Tables may be found beginning on page 312. Figures begin on page 319.

Health and the NIDR make grants for research; the Division's program, though growing in size and scope, is still comparatively small. The fiscal record of the NIDR, as seen in the last column, looks most impressive and the profession may rightfully be proud of it.

In Figure 1, the last column of Table 1 is converted to graphic form to show more clearly the dramatic rate of growth that we have achieved. In 11 years the appropriation has multiplied more than 33-fold. The 1956 grants budget supported only a few fellowships and less than ten individual research projects; today there are hundreds of projects.

Progress is reflected also in the membership records of the International Association for Dental Research (IADR), to which most dental scientists belong. While the membership figures in Table 2 include a few hundred non-Americans and a few dozen scientists who are now inactive, they do not include many hundreds of people who worked in NIDR-supported programs or who were or are still in training on NIDR funds. These shortcomings notwithstanding, it is worth noting that the membership count in the IADR more than doubled in the same period; from about 900 to over 2,000 members. It will probably increase at a geometric rate within the next few years as some of the young people now in training qualify and apply for membership.

In Figure 2 the appropriations for NIDR research grants alone, exclusive of the funds for fellowships and training, have been split away from the total for comparative purposes. Again, we see a very comfortable rate of growth.

Let us see how our progress compares to that of other health sciences and areas of special professional interest. Figure 3 shows the fiscal history—for Research Grants only—of all of the National Institutes of Health (NIH) from fiscal year 1956 to fiscal year 1964. In 1964 alone, the NIH total for this category of support was about \$450 million dollars; the total NIH budget in that year—for all grants and for all intramural research, for construction and for administrative activities—approached \$1 billion. A striking contrast is evident, for not only is the curve for NIDR essentially flat, but at its highest level it reaches only \$8.4 million—almost exactly the point where the National Heart Institute was nearly 10 years earlier. It would be facetious to point out that while in that time the NHI

made less than a 10-fold increment, the NIDR budget grew 20-fold—that NIDR is well ahead of the game on percentage points.

The numbers of individual grants that were made from these budgets are plotted in Figure 4. The comparisons are not critically meaningful because the amount of funds for a single grant can vary from \$2,000 to more than \$1 million. But, the contrast is still clear, as might certainly be expected from the budget history.

Table 3 summarizes the total grants and awards appropriations for NIDR for the 10-year period 1957 through 1966. The United States invested \$100 million in this program alone in that period, to finance nearly 7,000 awards of various kinds for dental research. I can make no comparison with the total cost of oral disease over the same period because I have no figures for it. But, regardless of any comparison, \$100 million is a very substantial investment and it is fair to ask what visible effect the investment has produced.

Qualitatively, we might review the many advances in the disclosure of new and better knowledge about the problems that are dentistry's special responsibility. But instead, let us look only at manpower, as a quantitative index of our present situation as a profession. Again some comparisons may be drawn, but some of them will be of questionable validity or questionable consequence.

The tabulation in Table 4, compiled from various sources which were developed at different times, gives some idea of how the army of biomedical personnel is distributed as between practicing physicians and supporting research personnel in all fields of biomedical research—between service and science. The dates for the various figures are different but in selecting the data a deliberate effort was made to minimize the evident contrast rather than to load the issue in the other direction. This table indicates that there is roughly one "biomedical" research worker for every 7 active physicians in the field; and there is one Ph.D. scientist in health research for every 9.5 physicians in the field.

In contrast, Table 5, there is only one "dental" research investigator for every 44 "active non-federal dentists" in the field, and only one Ph.D. for every 53 such dentists. In a very crude and approximate way, this tells us numerically where we presently stand as a profession. One well may ask if it is fair to try to segregate dental considerations in this artificial manner; for much of biomedical re-

search is also dental research in that at any moment a scientist who is working in an area remote from the traditional dental sphere may produce precisely the piece of information that our own "biodental" community will recognize to be the essential key to the solution of the problem of dental caries, periodontal disease, oral cancer, malocclusion, or some other of our special responsibilities. Still, we would move more rapidly if we had many, many more research people identified closely with dentistry, imbued as we ourselves are imbued, consciously or unconsciously, with a dedication to the objectives of dentistry in relation to society and continually searching and "scouting" for answers to dental problems. And it would certainly be of benefit to improve the ratio of Ph.D.'s to dentists for these figures essentially indicate that dentists are still doing most of the research work in scientific specialties where the full strength of highly sophisticated experts should be brought into play.

The graph in Figure 5 shows the distribution, by doctorate degrees, of 1,288 dental professional investigators who were identified as doing research in the 49 dental schools of the United States in 1965 and 1966. These figures exclude facilities like the NIDR itself, Eastman Dental Center and the group at the University of Rochester, the Forsyth Dental Center in Boston, and dental research facilities in hospitals, for example. The 1,288 doctors may be thought of as the "hard core" of dental investigators in the schools, according to the Dental Research Information Center which made the surveys. At that time, only 27 per cent of the investigators had the Ph.D. degree compared with 69 per cent who had the dental degree alone or in combination with the M.D. degree. Only 20 per cent of these investigators had the Ph.D. degree alone; 6.4 per cent had both the D.D.S. and the Ph.D.—less than 100 persons in a population of nearly 100,000 dentists.

We have a considerable gap to reduce. But we can nevertheless take justifiable pride as a profession in the remarkable progress we have made from where we stood 20 years ago.

As noted, the total NIH budget for a single year passed the \$1 billion level a few years ago. The cumulated multibillion dollar total of NIH funds over the past ten years or so represents a monumental investment in the nation's health. What have we as a nation accom-

plished with these billions? How should we measure that accomplishment?

In his recent book, *The Coming Revolution in Medicine*,* Rutstein writes (p. 5):

"We hear a great deal about relative costs, the availability of beds, use of laboratory services, the required number of physicians and paramedical and ancillary personnel, and the size of budgets. But these measures do not really evaluate effectiveness. In the final analysis, the effectiveness of a health program must be measured by a decrease in disease, disability, or untimely death, or the program is of no practical use. The laboratories, the men in the white suits, the budgets, are all parts of the machine and, of course, must be brought together in an effective way. But we must not become so interested in the machine itself that we forget what it was made to do—to keep people well."

Rutstein suggests that our most valid indices of national progress in health are life expectancy and infant mortality. "Life expectancy at birth is a theoretical estimate in a particular year of the average length of life of a newborn baby" (Ibid. page 11). It expresses "the burden imposed upon us by all fatal illnesses throughout our lifetime." Though life expectancy is one of the better indices we have, it is still a crude one. It does not take into account such things as non-fatal illness, for example. Figures 6 and 7 (Ibid. page 13 and 14) show that life expectancy has improved quite substantially in this country during the past 50 years. But it has leveled off almost to a halt in the past 20 years.

How does our progress compare with that in other countries? Rutstein has tabulated data, based upon United Nations statistics for the year 1959 (Table 6), in which the United States ranks 13th with respect to life expectancy for newborn males. In 1965 (Table 7) we had dropped to 22nd place; in 7 years, 9 other countries had surpassed the United States in terms of improving male life expectancy. The figures for females (Table 8) show a drop from 7th to 10th place in the same interval. We ought to be doing better than that.

* Rutstein, David D. "The Coming Revolution in Medicine." Cambridge: Massachusetts Institute of Technology Press, 1967.

A more sensitive index of the effectiveness of medicine in society is infant mortality. This can be changed by such things as sanitation, nutrition, and education as well as by direct maternal and pediatric care. "In a sense," says Rutstein, the infant mortality rate reflects "what a society under the guidance of its physicians will do for its mothers and babies" (Ibid. page 12). Figure 8 shows the remarkable improvement in the infant mortality rate over the past 50 years in this country. But note that the rate for non-whites is still nearly twice the rate for whites; this gap seems now to be widening each year, instead of closing. Compared with other countries our record again leaves much to be desired. In 1959, the United States was 11th in rank; in 1965, as shown in Table 9 (a) (b), we were 18th.

There are many reasons for this paradox, but the main point is that other countries are applying scientific and technological advances in health much more earnestly and much more effectively than we are—notwithstanding the fact that they are far less affluent than we are. Rutstein makes a powerful and most eloquent plea for the application of "operations research" techniques to the entire problem of health in this country.

We have no reliable indices like life expectancy or infant mortality with which to measure the effectiveness of dentistry in fulfilling our mission in society. We are presently working on the vast epidemiological and logistical problems of how to assess the oral health status of large populations, and we are even beginning to evolve standards with which to make our measurements more meaningful and reproducible from one study to another—if and when we can find enough manpower to do the studies.

In the meantime, the best substitute index now available on a world-wide basis seems to be the ratio of dentists to population. It will be recognized at once that this index is crude indeed, for it gives no indication of our effectiveness in controlling disease but only indicates how many professionally qualified people have been identified within a particular region. All the same it is the only index for which reasonably clear-cut information exists, even though the standards that define the term "dentist" are not uniform from one country to another.

The following Tables utilize data that were selected from a larger Table, compiled by the American Dental Association's Bureau of

Economic Research and Statistics, which in turn is based upon information in the United Nations Statistical Yearbooks.* The full Bureau tabulation will be published in the American Dental Directory, 1968.

In Table 10 is a listing of the countries and territories with a dentist-to-population ratio of 1:2000 or better. (The population figures are estimates for 1965.) Note that, as with life expectancy and infant mortality, Norway and Sweden are better off than the United States, by this index too.

Though the overall ratio for the U.S.A. is 1:1700, only about 80 per cent of the 114,000 dentists are available to the public. In sparsely settled regions, such as the American West and Southwest, there are pockets where the ratio is about the same as the general global figure, approximately 1:5000; and there is one Negro dentist for every 10,000 Negro citizens, approximately—a fact that still retains considerable health significance in many parts of the country.

At the other extreme, displayed in Table 11 are nine countries in which the dentist-to-population ratio is less than 1:1,000,000. The human picture reflected by these statistics is hard indeed to visualize, for such astronomical numbers tend to blunt the imagination. Assume, however, that there are 10 million people in Greater New York City and that there are only ten dentists to serve them; and that one of the ten, of course, is likely to be occupied full-time in public health administration so that he cannot be counted upon for direct contact with patients. That is roughly the situation in Afghanistan, and the remaining 55 million people represented in Table 11 are even less favorably served.

The next tabulation, Table 12, shows how the dentists of the world are distributed, the size of the populations they serve and the dentist-to-population ratio by which this ranking was made. Overall, the average population per dentist for the 2.4 billion people covered in the ADA Bureau's master table is 5,635, and nearly half the population does not enjoy even that ratio, unfavorable and inadequate though it is.

* I should like to acknowledge the assistance of the staff of the Bureau, and particularly to thank Joan DeMuro, of the Dental Research Information Center, who extracted the material and compiled all the tables except Dr. Rutstein's.

Finally, in Table 13, we may observe how many countries fall into the various categories when the data are stratified by arbitrary ranges of the ratio.

I wonder how often, in one of these countries—some just a little south of our own borders—a child dies of an acute infection originating in a tooth that could not be treated in time because the attention of a dentist or a physician or even a witch-doctor could not be secured when it was needed. Carl Sebelius recounts that one morning, when he was travelling for the World Health Organization several years ago, his party came to a remote village where several families were clustered before a health center. He was told that they had come from miles around and were waiting for the dentist. When he asked what time the dentist would arrive he was told that the dentist was expected in about 8 days. It is difficult to evade the feeling that there are people waiting there again today, and that they are waiting for me, for you, and for the man in the white lab coat too.

Anyone who thinks that these problems of dental care are peculiar only to the underdeveloped countries may visit the Appalachian area some week-end and count the number of teen-agers he sees who have lost all of their teeth before finishing high school. He might also examine the mouths of a few dozen military recruits selected from all over this nation—inspect them at random as they come through the dental clinic during their physical examinations at the "boot camp"—and see what oral conditions prevail among these healthier-than-average representatives of American youth. By the standards of Burma, perhaps, we are far ahead of the game. But by the standards of health care that we ourselves have established for our own people we are certainly not doing an effective job. It makes no sense to argue that treatment is available to everyone in the United States and that we are meeting the demand. We are accountable to these people, professionally, morally and also financially and it is up to us—not to them—to see that everyone receives the health care to which he is entitled, and to wipe out oral disease entirely if we can.

Now it is obvious that we cannot in the foreseeable future produce enough dentists to meet the world's needs which have just been outlined.

Even fluoridation, 65 per cent effective in reducing decay when it can be applied to a community water supply, is not an effective weapon against the disease in many parts of the world because it cannot be instituted. Last summer, the Pan American Health Organization convened a workshop of Latin American sanitary engineers in Cincinnati at which the participants were urged to include fluoridation equipment and service in all public water projects in which they might become involved. These intelligent and perceptive gentlemen listened with great courtesy. But then they pointed out that fluoridation in many of their countries is a luxury that has to be weighed against more critical considerations than the reduction of tooth decay. As one engineer put it, "When we have the money our main job is to make the water 'wet': if we can get another \$5,000 it is more important to lay more pipe for a few hundred more families so they don't have to walk 2 miles to the open ditch for a drink."

Fluoridation, moreover, though unquestionably effective against dental caries, exerts little if any control over periodontal disease which is far more prevalent in some parts of the world. How is fluoridation likely to reduce the oral cancer rate in those parts of India where it now accounts for 50 per cent of all fatal malignancies, compared to about 5 per cent in this country?

And what good is a therapeutic dentifrice, or a preparation for self-application overnight, to a society that looks upon a toothbrush as a novelty for the whole family to enjoy?

We must increase and intensify our basic research efforts to expedite the search for the fundamental knowledge which will lead us to develop methods for the effective prevention of dental disease on a mass basis. And we must produce more D.D.S.-Ph.D.s and other scientifically-trained dentists to lead and inspire the hundreds of top-flight scientists whose talents we have still to recruit for these efforts. Only in this way can we hope to forge the tools for prevention in good time, and to develop ever greater academic and practical sophistication, intellectual enrichment, and social accomplishment within our own profession.

But it is now time to put equal effort into a different line of research whose urgency is already critical. We must devote the same kind and the same degree of dedicated attention to research on two

things: 1) the effective implementation and application of preventive measures when they eventually are elucidated and developed in the future; and 2) the effective distribution and delivery of available treatment, care, and dental health education right now.

Rutstein notes that "operations research is useful in the kinds of major decisions that often face the medical administrator"; and the same applies for dentistry. Such major decisions are (Ibid. page 51):

"1) How does one assess the relative needs for, and the values of, alternative programs that must draw upon limited resources in funds, material, and trained manpower?

"2) How shall available resources be best allocated and applied once a decision on priorities has been made?

"The same questions have been answered in military situations and in industry. In public health a beginning has been made, . . . (*for example*): Operations research analysis of many possible applications of the limited health resources and manpower . . . led the WHO to support a BCG vaccination program in India . . . rather than the search for and isolation of the infectious cases."

The theory and the technology of biomathematics and systems analysis are well advanced and we have only to take advantage of them to clarify objectively the best alternatives for dealing with our own problems and responsibilities in dentistry. The Federal Dental Services have made a start in this direction to use their own resources more efficiently. The Division of Dental Health also has made some commendable starts, in the public sector.

But before we can take full advantage of this approach we must open our own minds to the, perhaps, radical possibilities that operations research may recommend to us. To quote one final time from the "gospel according to Rutstein" (Ibid. page 148):

. . . let us not continue to emulate the intoxicated gentleman who late one night was crawling on his hands and knees under a street light looking for his wallet. "Did you lose it here?" asked a passer-by. "No," said the drunk, pointing off in the direction of the other side of the street, "but it's dark over there."

We must be prepared to look in every reasonable place and direction for our answers. That is part of our professional obligation and of our accountability to the society in which we live.

I believe that dentists themselves should provide the leadership in mapping the future for our profession. I believe that the objective of our plans for the future must be centered in the needs of society and not in the preservation of certain professional privileges and prerogatives that society has accorded to us, in trust but not in perpetuity. And I believe further that events are taking their course with unusual rapidity today, which makes our position more critical and precarious with every day's delay.

All of which may be summed up in the words of a great Jewish sage who flourished several centuries ago:

"If I am not for myself, who will be for me?
And If I am for myself alone, what am I?
And if not now,—when?"

Permission has been granted by Dr. David D. Rutstein to use some of the Tables and Figures from his book, "The Coming Revolution in Medicine."

TABLES

TABLE 1

APPROPRIATIONS FOR THE EXTRAMURAL GRANTS AND AWARDS
OF THE NATIONAL INSTITUTE OF DENTAL RESEARCH FOR
THE FISCAL YEARS 1956 THROUGH 1966

<i>Fiscal Year</i>	<i>Type of Award or Grant</i>			<i>Total Appropriations</i>
	RESEARCH GRANTS	FELLOWSHIP AWARDS	TRAINING GRANTS	
1956	\$ 439	\$ 100	\$	\$ 539
1957	2,692	497	500	3,690
1958	2,827	500	449	3,756
1959	3,461	400	650	4,511
1960	4,508	650	1,125	6,283
1961	5,535	856	2,972	9,362
1962	6,580	810	4,015	11,405
1963	8,831	1,202	5,858	15,891
1964	8,115	1,359	4,367	13,840
1965	8,438	1,254	5,113	14,805
1966	10,286	1,442	5,127	16,855

(in thousands of dollars)

Source: Reports of Congressional appropriations committees, in various years.

TABLE 2

NUMBER OF MEMBERS
INTERNATIONAL ASSOCIATION OF DENTAL RESEARCH

<i>Year</i>	<i>Number</i>
1936	400 (est.)
1946	627
1956 (Dec. 1)	869
1966 (Mar. 1)	1902
1967 (Mar. 1)	2292

TABLE 3

TEN-YEAR SUMMARY OF THE APPROPRIATIONS FOR THE
EXTRAMURAL GRANTS AND AWARDS OF THE NATIONAL
INSTITUTE OF DENTAL RESEARCH FOR THE FISCAL
YEARS 1957 THROUGH 1966

<i>Type of Grant or Award</i>	<i>Total Appropriations</i>	<i>Total Number of Grants and Awards</i>
Research Grants	\$ 61,273,367	3,625
Fellowship Awards	8,968,960	2,451
Training Grants	30,175,398	841
Totals	\$100,417,725	6,917

TABLE 4
ESTIMATED RESOURCES OF PHYSICIANS AND
SUPPORTING RESEARCH PERSONNEL IN UNITED STATES

A) Active physicians 1965	278,000 ¹
B) "Biomedical" research workers (1960)	39,700 ²
C) With doctorate degrees*	29,400 ²
Ratios: A/B = 7 A/C = 9.5	

References:

1. *Report of Nat. Adv. Comm. on Hlth. Mpr.* (1967).
 2. *Resources for Med. Research*. PHS publicn. No. 1001 (1963).
- * Approximately 70% have Ph.D.; pool includes some active physicians.

TABLE 5
ESTIMATED RESOURCES OF ACTIVE DENTISTS AND
SUPPORTING RESEARCH PERSONNEL IN UNITED STATES

A) Active nonfederal dentists (1965)	86,300 ¹
B) "Dental" research investigators (1965)	1,956 ³
C) With doctorate degree**	1,621 ³
Ratios: A/B = 44 A/C = 53	

References:

1. *Report of Nat. Adv. Comm. on Hlth. Mpr.* (1967).
 3. *Dental Res. Info. Ctr.* (unpublished data) (1964-66).
- ** Approximately 35% have Ph.D.; pool includes some active dentists.

TABLE 6
EXPECTATION OF LIFE AT BIRTH: MALES
1959*

Country	Latest Year Reported	Years of Life
Norway	1951-55	71.11
Netherlands	1953-55	71.0
Sweden	1957	70.82
Israel (Jewish population)	1959	70.23
Denmark	1951-55	69.87
New Zealand (European population)	1950-52	68.29
England and Wales	1959	68.1
Canada	1955-57	67.61
Northern Ireland	1957-59	67.44
Czechoslovakia	1958	67.23
Australia	1953-55	67.14
West Germany	1958-59	66.67
UNITED STATES	1958	66.4

TABLE 7
 EXPECTATION OF LIFE AT BIRTH: MALES
 1965*

<i>Country</i>	<i>Latest Year Reported</i>	<i>Years of Life</i>
Netherlands	1956-60	71.4
Sweden	1962	71.3
Norway	1951-55	71.1
Israel (Jewish population)	1963	70.9
Iceland	1951-60	70.7
Denmark	1956-60	70.4
Switzerland	1959-61	69.5
Canada	1960-62	68.4
New Zealand (European population)	1955-57	68.2
England and Wales	1961-63	68.0
Northern Ireland	1961-63	67.6
Greece	1960-62	67.5
Eastern Germany	1960-61	67.3
Spain	1960	67.3
Czechoslovakia	1962	67.2
France	1963	67.2
Japan	1963	67.2
Australia	1953-55	67.1
Puerto Rico	1959-61	67.1
Malta	1961-63	67.0
West Germany	1960-62	66.9
UNITED STATES	1963	66.6

* Year of Tabulation (from Rutstein, David D., 1967, *Coming Revolution in Medicine*).

TABLE 8
EXPECTATION OF LIFE AT BIRTH: FEMALES

<i>Country</i>	<i>Latest Year Reported</i>	<i>Years of Life</i>
1959*		
Norway	1951-55	74.70
Sweden	1957	74.29
Netherlands	1953-55	73.9
England and Wales	1959	73.8
Canada	1955	72.92
Australia	1953-55	72.75
UNITED STATES	1958	72.7
1965*		
Sweden	1962	75.4
Iceland	1951-60	75.0
Netherlands	1956-60	74.8
Switzerland	1959-61	74.8
Norway	1951-55	74.7
Canada	1960-62	74.2
France	1963	74.1
England and Wales	1961-63	73.9
Denmark	1956-60	73.8
UNITED STATES	1963	73.4

* Year of Tabulation (from Rutstein, David D., 1967 *Coming Revolution in Medicine.*)

TABLE 9A
 INFANT MORTALITY RATES, 1959
 (Deaths under one year per 1,000 infants born alive)

Sweden	16.6
Netherlands	16.8
Norway	18.7
New Zealand (excluding Maoris)	19.9
Australia	21.5
England and Wales	22.2
Switzerland	22.2
Denmark	22.5
Finland	23.6
Czechoslovakia	25.8
UNITED STATES	26.4

From Rutstein, David D., 1967, *Coming Revolution in Medicine*.

TABLE 9B
 INFANT MORTALITY RATES, 1965
 (Deaths under one year per 1,000 infants born alive)

Sweden	14.2*
Netherlands	14.4
Norway	16.8*
Finland	17.4
Switzerland	17.7
Denmark	18.7
England and Wales	19.0
Australia	19.1*
New Zealand	19.5
Japan	20.4*
Czechoslovakia	21.2*
France	22.1
Israel (Jewish population)	22.7
Scotland	23.1
West Germany	23.9
Belgium	24.0
Canada	24.7*
UNITED STATES	24.8

* Rate for 1964.

From Rutstein, David D., 1967, *Coming Revolution in Medicine*.

TABLE 10
COUNTRIES WITH DENTIST-TO-POPULATION
RATIOS OF 1 TO 2,000 OR BETTER

<i>Country (Year)</i>	<i>Number of Dentists</i>	<i>Population per Dentist</i>	<i>Estimated Population*</i>
Falkland Islands (1965)	2	1,000	2,000
West Berlin (1964)	1,726	1,300	2,202,000
Norway (1963)	2,618	1,400	3,723,000
Sweden (1963)	5,600	1,400	7,734,000
Monaco (1956)	14	1,600	23,000
UNITED STATES (1966)	114,308	1,708	195,205,400
Denmark (1963)	2,681	1,800	4,758,000
Argentina (1962)	11,584 (Reg)	1,900	22,352,000
Bermuda (1964)	25	1,900	48,000
Germany, Federal Republic of (1964)	30,321	1,900	56,839,000
Total	168,879	1,734	292,886,400

Source: Bureau of Economic Research and Statistics, American Dental Association.

* Population figures are United Nations estimates for 1965.

TABLE 11
COUNTRIES WITH DENTIST-TO-POPULATION
RATIOS OF 1 TO 1,000,000 OR LESS

<i>Country (Year)</i>	<i>Number of Dentists</i>	<i>Population per Dentist</i>	<i>Estimated Population*</i>
Afghanistan (1962)	15	1,003,400	15,051,000
Niger, The Republic of (1964)	3	1,109,300	3,328,000
Somalia (1960)	2	1,250,000	2,500,000
Malawi (1965)	3 (PHS)	1,313,300	3,940,000
Mali, The Republic of (1964)	3	1,525,300	4,576,000
Ethiopia (1961)	14	1,614,300	22,600,000
Chad, Republic of (1964)	2	1,653,500	3,307,000
Nepal (1965)	5	2,020,000	10,100,000
Upper Volta (1964)	2	2,429,000	4,858,000
Total	49	1,434,000	70,260,000

Source: Bureau of Economic Research and Statistics, American Dental Association.

* Population figures are United Nations estimates for 1965.

TABLE 12
DENTIST-TO-POPULATION RATIOS BY GLOBAL REGIONS*

<i>Global Region</i>	<i>Number of Dentists</i>	<i>Population per Dentist</i>	<i>Estimated Population</i>
North America	125,857	2,300	294,528,400
Europe	122,963	3,300	408,465,000
Oceania	5,252	3,300	17,332,000
U.S.S.R.	64,700	3,500	224,764,000
South America	39,077	4,300	166,127,000
Asia	59,690	16,400	976,225,000
Africa	3,482	86,500	285,392,000
Total	421,021	5,635	2,372,833,400

Source: Bureau of Economic Research and Statistics, American Dental Association.
* Incomplete (e.g. does not include the People's Republic of China).

TABLE 13
DISTRIBUTION OF COUNTRIES BY DENTIST-TO-POPULATION RATIOS

<i>Ratios (Reciprocal)</i>	<i>Number of Countries</i>	<i>Estimated Number of Dentists</i>	<i>Estimated Total Population</i>
1-10,000	71	397,358	1,128,287,400
10,001-50,000	45	15,433	271,277,000
50,001-100,000	13	7,326	578,738,000
100,001-500,000	28	545	118,607,000
500,001-1,000,000	9	310	205,664,000
1,000,001+	9	49	70,260,000
Total	176	421,021	2,372,833,400

Source: Bureau of Economic Research and Statistics, American Dental Association.

FIGURES

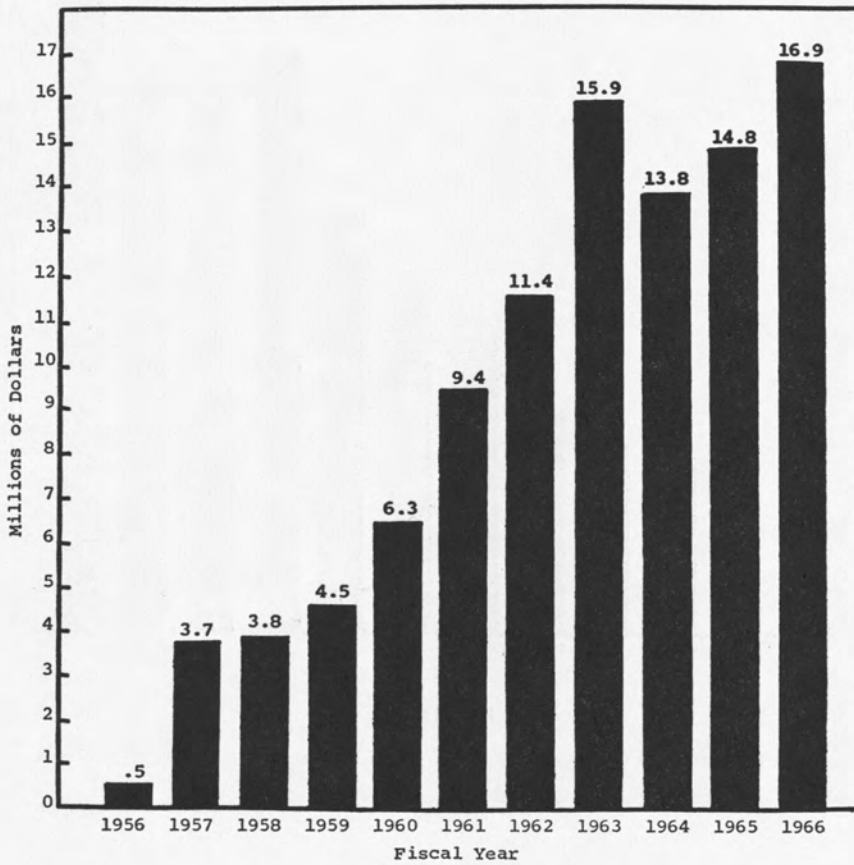
APPROPRIATIONS FOR THE EXTRAMURAL GRANTS AND AWARDS
OF THE NATIONAL INSTITUTE OF DENTAL RESEARCH FOR
THE FISCAL YEARS 1956 THROUGH 1966

FIGURE 1

Source: Reports of Congressional appropriations committees, in various years.

APPROPRIATIONS FOR THE RESEARCH GRANTS OF
THE NATIONAL INSTITUTE OF DENTAL RESEARCH
FOR THE FISCAL YEARS 1956 THROUGH 1966

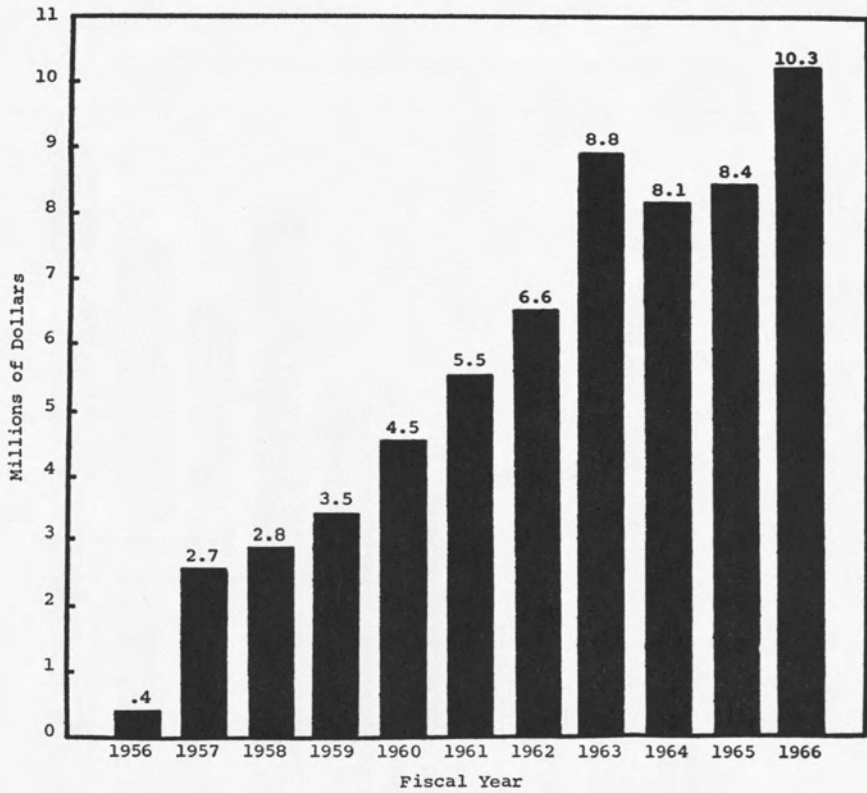


FIGURE 2

Source: Reports of Congressional appropriations committees, in various years.

DOLLAR AMOUNTS (IN MILLIONS) OF RESEARCH GRANTS,
BY INSTITUTE OR DIVISION, 1956-1964

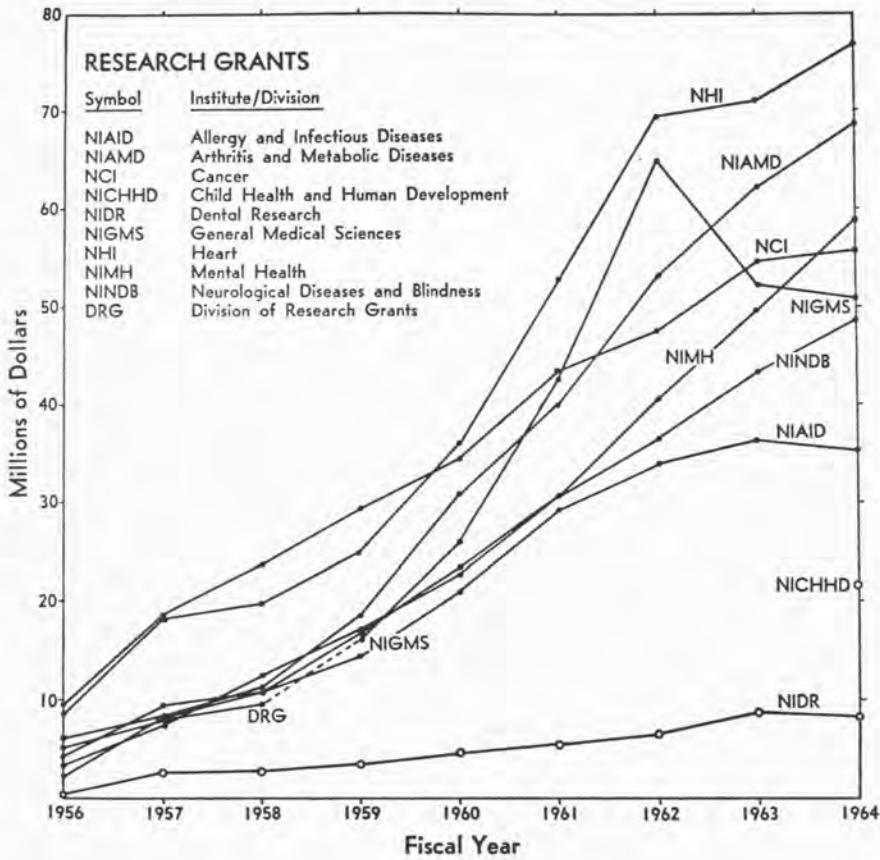


FIGURE 3

Source: Testimony of the American Dental Association before Congressional Committees, 1965.

NUMBER OF RESEARCH GRANTS, BY INSTITUTE OR DIVISION, 1956-1964

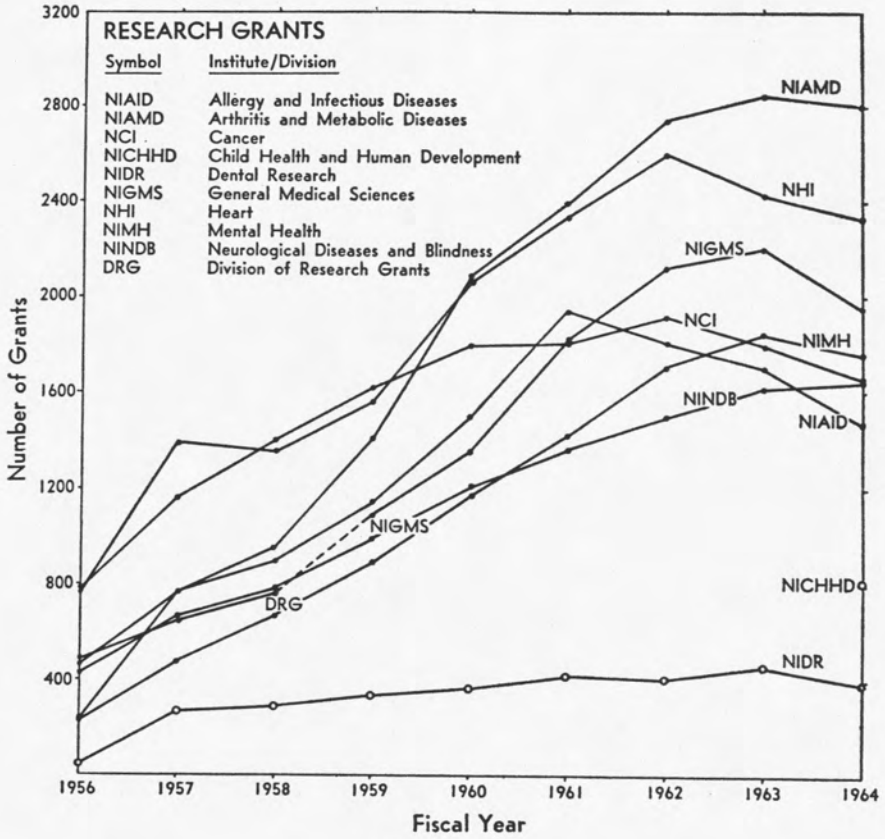


FIGURE 4

Source: Testimony of the American Dental Association before Congressional Committees, 1965.

DISTRIBUTION OF DENTAL INVESTIGATORS
WITH DOCTORATE DEGREES

Percentage

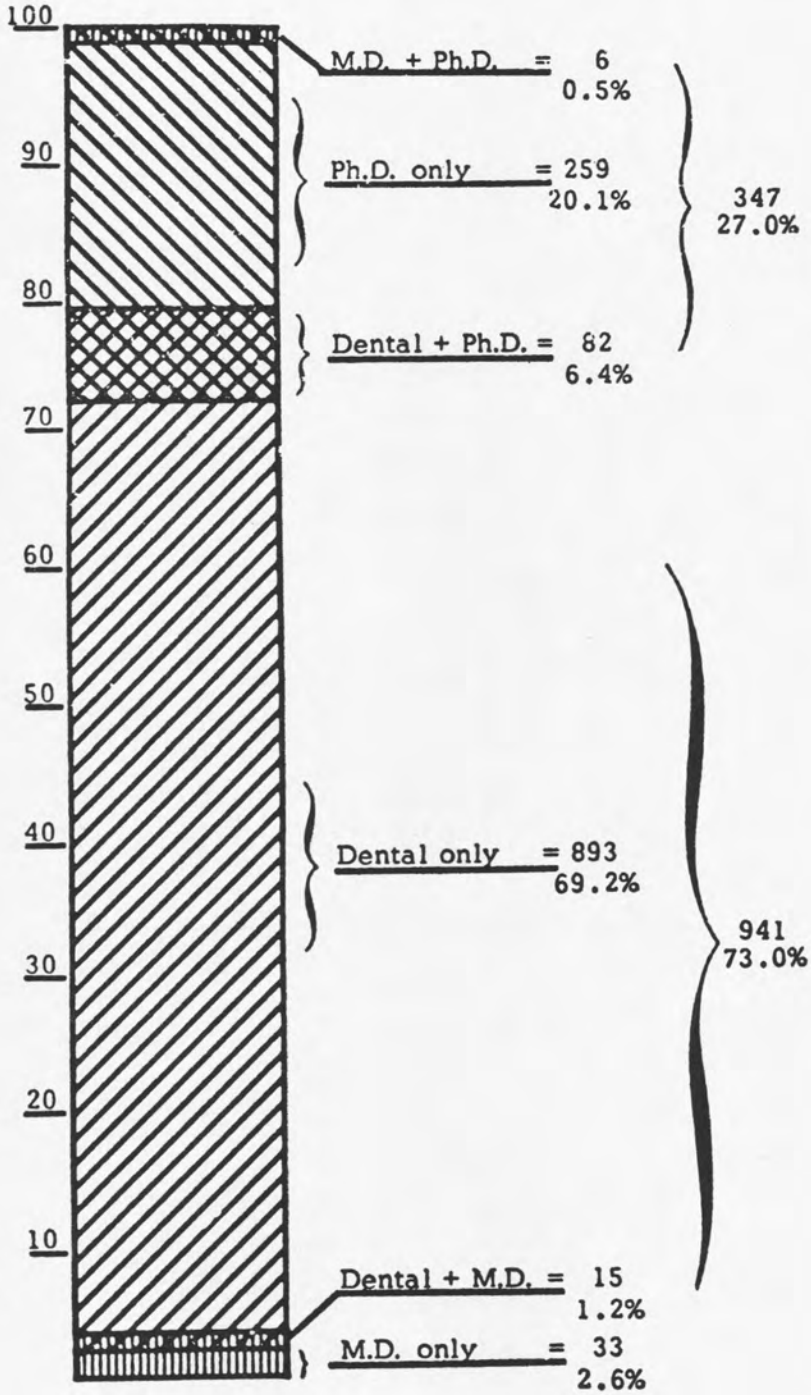


FIGURE 5

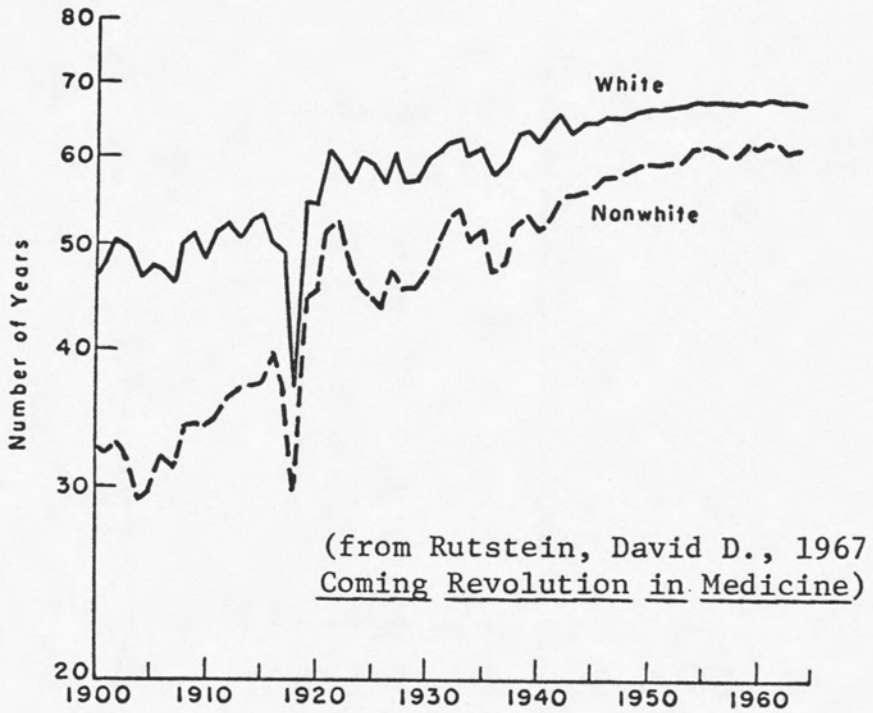


FIGURE 6

Expectation of life at birth in the United States, 1900-1964: Males. (Data includes all states after 1933.)

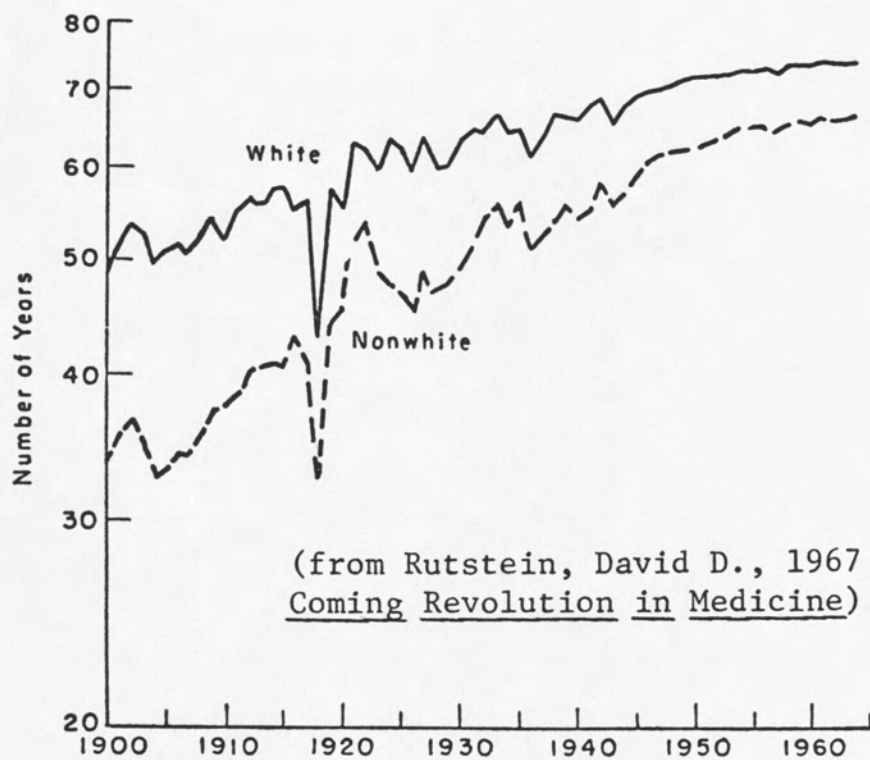


FIGURE 7

Expectation of life at birth in the United States, 1900-1964: Females. (Data include all states after 1933.)

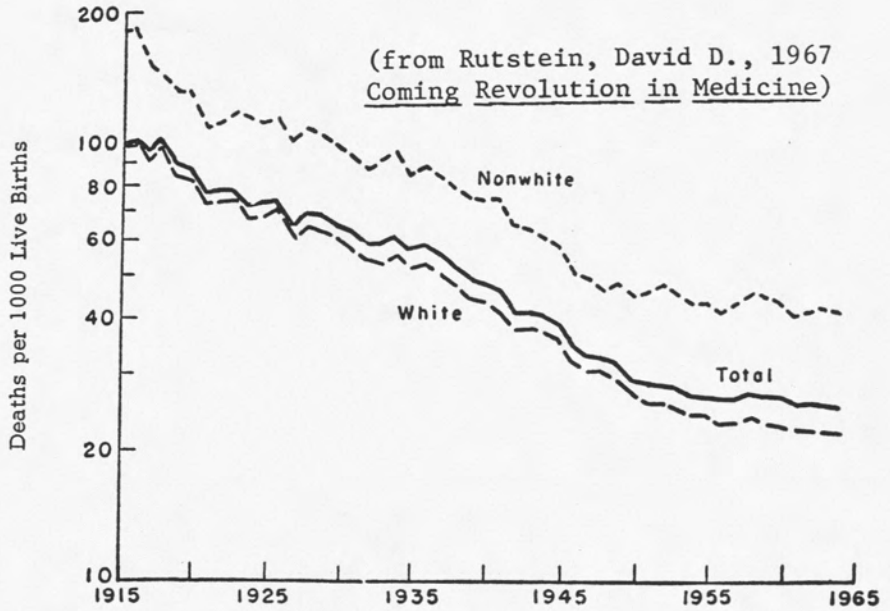


FIGURE 8

Infant mortality rates in the United States, 1915-1964. (Data include all states after 1933.)

Patient Cooperation in Orthodontic Treatment

LEONARD H. KREIT, M.Ed., Ph.D., CHARLES BURSTONE, D.D.S.,
and LLOYD DELMAN, D.D.S.

THIS paper reports part of a project in which an attempt is being made to construct a personality test which can be administered to patients prior to their being treated by the orthodontist. By utilizing such a personality test, it is hoped that the orthodontist can identify potentially uncooperative patients, obtain insight into why these patients are likely to be uncooperative and use this insight to motivate the patients to cooperate in the treatment procedures.

One hundred and twenty dentists rated more than 2,700 patients on the degree of cooperation they manifested in their orthodontic treatment. Of the 120 dentists who rated the patients, 114 were graduate orthodontic students of 14 dental schools, while 6 were orthodontists with private practices in Indiana.

Each dentist rated his patients on the degree of cooperation using the following criteria: wearing of the headgear appliance, wearing of elastics, breaking appointments, being late for appointments, oral hygiene, and breakage of appliances. In addition, the dentists were asked to evaluate the "general cooperation" of their patients by taking into account the patient's cooperation on the criteria listed above. For each criterion, the dentist evaluated the patient's cooperation by rating him as: 1. excellent, 2. good, 3. fair, 4. poor, 5. very poor.

RESULTS OF RATINGS

An abbreviated version of the results of the ratings made by the dentists is presented in this section:*

Dr. Kreit is Educational Consultant, Indiana University School of Dentistry; now Research Psychologist, Education Research Program, Dental Health Center, San Francisco.

Dr. Burstone is Professor of Orthodontics, Indiana University School of Dentistry. Dr. Delman is Assistant Professor of Orthodontics, Indiana University School of Dentistry.

* A complete report is available and will be sent upon request. (Dr. Kreit, Dental Health Center, 14th Avenue and Lake Street, San Francisco, Calif. 94118.)

1. The majority of patients (71 per cent) were rated as good or excellent in general cooperation; only 8 per cent were rated as being uncooperative (poor or very poor), with 21 per cent being rated as "fair."

2. Girls were rated as being better patients than boys in most aspects of cooperation. However, the difference in cooperation between boys and girls was not large.

3. Slightly better cooperation was elicited when patients wore elastics than when patients wore headgear. The difference, however, was not large enough to cause the orthodontist to favor elastics over headgear if the case would best be treated by the latter technique.

4. There was a low but statistically significant association between the number of hours the patients were required to wear their headgear and how well they cooperated. Patients who were required to wear the headgear less than 10 hours per day or more than 16 hours per day were more often rated as "excellent" in wearing of headgear than patients who were required to wear the headgear from 10 to 16 hours per day.

5. There is a moderate to high association between cooperation in various aspects of treatment; the patient who is very cooperative in one phase of treatment is usually cooperative in other phases of treatment and vice-versa for uncooperative patients.

6. Clinic patients were rated as more cooperative than were patients in private practice. This difference may reflect the fact that the clinic patients were, in fact, more cooperative. On the other hand, it may be due to the superior ability of experienced orthodontists to identify lack of cooperation on the part of patients, particularly in wearing of headgear and/or elastics where the difference between the ratings is greatest.

TEST RESULTS

Of the 2,710 patients rated on cooperation, 1,386 took the personality inventory. The inventory consisted of 287 questions. The questions were phrased as statements to which the patient responded by answering either "yes" or "no." Two examples of questions, typical of the type which appeared on the test are: "I enjoy doing homework," and "I always finish any job that I begin."

An item analysis was performed on the test to determine which

questions were effective in differentiating between cooperative and uncooperative patients on the various criteria of cooperation (i.e., wearing of headgear, oral hygiene, etc.).

Patients were randomly assigned to two groups, using stratified sampling techniques, each school or private dentist being considered as a unit. The first group included 983 patients; the second included 403.

To be designated as an "effective" question, the chi square statistic for the question had to attain significance at the .05 level in at least one of the two groups, and the .10 level in the other. The probability of any question being designated as "effective" on the basis of chance alone was a minimum of one out of two hundred.

"The effective" questions uncovered by the item analysis present an interesting profile of the kinds of patients who are likely to be uncooperative (or cooperative) in their treatment. Because of the high correlation between the various criteria of patient cooperation, only two of the more important ones will be discussed in this paper: general cooperation, and wearing of the headgear appliance.

GENERAL COOPERATION

The most salient characteristic of patients rated as being uncooperative in "general cooperation" is the existence of a poor relationship with their parents. Uncooperative patients are more likely than cooperative patients to criticize their mother for "constantly bugging them about different things."* They are more likely than cooperative patients to feel that their mother is too strict, their "folks criticize them a lot," give them too little freedom, and think their grades in school are not high enough. Perhaps their poor relationship with their parents accounts for the fact that they are more likely than cooperative patients to feel they "get a raw deal from life."

Cooperative patients are more likely than uncooperative patients to endorse positive statements about their parents; they feel that "most adults understand kids their own age" and "discuss things that are bothering them with their parents."

* The reader should be aware that the majority of uncooperative patients did *not* have a poor relationship with their parents; the statement merely signifies that of those patients who have a poor relationship with their parents, the majority are rated as being uncooperative.

The existence of a healthy child-parent relationship may be related to the acquisition of standards of right and wrong on the part of cooperative patients. Cooperative patients claim they do their homework even if they know their teacher will not check it and state they would not sneak into a movie, even if they knew they could get away with it. Uncooperative patients are more likely than cooperative patients to require the presence of an authority to enforce ethical standards of behavior. Nonetheless, it is of interest to note that cooperative patients are more apt than uncooperative patients to make the unlikely claim that they "always brush their teeth after every meal." (Cooperative patients are likewise more apt to claim they "brush their teeth immediately after breakfast" than are their uncooperative counterparts.)

Uncooperative patients are more apt to "like to dress in sharp clothes" than the cooperative ones. Perhaps in order to support their tastes, they more often have a part-time job after school than do the cooperative patients. Finally, the uncooperative patients are more likely than cooperative patients to feel that their "friends often make fun of what they have to say," in spite of the fact that more often than cooperative patients, they "usually go along with the latest teen age fads."

WEARING OF HEADGEAR

The main reason for lack of cooperation in wearing of headgear appears to be the temporary detrimental effects of the appliance to the patient's personal appearance. For example, since teenagers are in the process of becoming interested in members of the opposite sex, they are naturally more concerned about their appearance than pre-adolescent youngsters; patients above 13 years of age tend to be more uncooperative in wearing of the headgear than younger patients. Further evidence of the relationship between concern for appearance and cooperation in wearing of headgear is seen by the fact that patients who say they like to wear "sharp" and "expensive" clothing and who say they go out on dates tend to manifest a lack of cooperation in wearing of the headgear appliance (what good is wearing sharp, expensive clothing when one's appearance is marred by wearing headgear?).

Patients who are cooperative in wearing headgear appear to be somewhat conventional and conforming in their behavior. They are

more likely than uncooperative patients to assert that they "always do what their teachers tell them to do," always brush their teeth after every meal, and eat breakfast almost every day. Such patients are more likely than the more unconventional noncooperators to express a wish to "enter the medical or dental profession when they grow up."

Patients who do not cooperate in wearing the headgear appliance do not seem to be the kinds of people who can persist in an activity in the face of difficulty, as evidenced by their statement, "I often stop working on something before I am finished." They admit more often than cooperative patients that they are often late for appointments for no good reason. They show some evidence of a poor relationship with their parents and lack of acquired standards of behavior in stating that their parents think their grades in school are not high enough and that they would sneak into a movie if they knew they would not be caught.

DISCUSSION

The description of the cooperative vs. uncooperative orthodontic patient suggests ways for the dentist to elicit greater cooperation from patients. For example, the parent-child relationship is correlated with cooperation. Therefore, the dentist would probably do well to attempt to alleviate any conflicts which may exist between the parent and the patient as regards orthodontic treatment. Education of the parent or patient regarding the importance of treatment, and informing the patient and parent of the change in occlusion and appearance which can be expected may be one approach to removing the conflict and facilitating better cooperation by the patient. (The orthodontist can probably do little to improve the overall relationship between the parent and the patient, which may be the key variable in preventing good cooperation from occurring.)

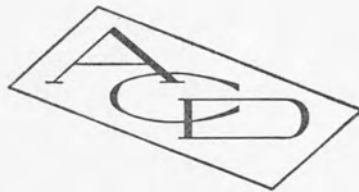
It would seem likely that orthodontists could motivate patients to wear headgear by stressing the improvement in the patient's appearance which results from conscientious wearing of the appliance. For older, more intelligent patients, the orthodontist might do well to remind the patient that failure to wear his headgear as instructed will result in a prolongation of the time required to wear it.

The relationship between acquisition of standards of right and wrong and patient cooperation suggests that orthodontists should be

vigilant in reinforcing patient behavior. For example, the orthodontist should "reward" cooperative patient behavior as soon as possible after he observes it, by expressing his approval or praising the patient; conversely, the orthodontist should "punish" undesired patient behavior by promptly and consistently expressing his disapproval of it. Of the two procedures, most psychologists would agree that the positive reinforcement would be more significant in altering the patient's behavior.

In spite of the efforts which can be made to elicit patient cooperation, the orthodontist may well fail, through no fault of his own, to achieve this objective. This may be due to the lack of a casual relationship between a patient's personality and cooperation shown by him in treatment. And even if one assumes the existence of a causal relationship between personality and cooperation, there is little the orthodontist can do to change the patient's personality.

Nevertheless, early identification of potentially uncooperative patients may help the orthodontist to achieve better patient cooperation. Future research efforts may be directed toward determining if (and how) this can be done.



Dental Activities of the Pan American Sanitary Bureau

DARIO RESTREPO, D.D.S., M.P.H.

DENTISTRY in the Americas presents a multifaceted situation. In the United States, for example, there is a high prevalence of the two most common forms of dental disease, caries and periodontal disease. Each inhabitant of this country has an average of about four teeth that need restoration, a total of over 700 million unfilled cavities. Almost 50 per cent of North Americans 50 years of age also have some form of periodontal disease.

With a per capita gross national product of over \$2,500.00, there is no doubt that this country would have the financial resources to pay for adequate dental care for all its inhabitants. The dentist to population ratio in the United States also is favorable compared to other countries in the world, the ratio being approximately one dentist for every 2,000 persons.

In spite of these advantages, less than one-half of the population of this country visit the dentist at least once a year. About one-third of the people have not visited the dentist for five years, and almost one-fifth have *never* visited the dentist.

In Latin America, the dental health problems take on even more dramatic proportions. In some areas, for example, children at 8 years of age have more than 50 per cent of teeth present in the mouth affected by dental caries. At 12 and 14 years of age children can be seen with dental caries in 60 per cent of their permanent dentition. In some countries, persons at ages 22-24 have an average of over ten teeth that have been affected by dental caries.

It has been said that there is not one country in the world that can halt the advance of dental caries solely through therapeutic dental techniques whether they be carried out in government institutions or by professionals in private practice.

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This paper was presented at the 108th Annual Session of the American Dental Association, Washington, D.C., 1967.

In addition to the widespread problem of dental disease in Latin America, other factors add to the difficulties encountered in efforts aimed toward improving dental health. Briefly stated, these factors include the following: First, the limited number of dentists. It is estimated there are only some 50,000 dentists in all of Latin America to care for more than 200 million persons. Also, there is an irregular distribution of these dentists from country to country and even within the same country. In one country, for example, there are areas in which there is one dentist per 5,000 inhabitants, and other areas with more than 500,000 inhabitants without a single dentist.

A second factor is the lack of social responsibility on the part of dentists. This is the result of excessive technical training and the lack of humanistic and community understanding.

A third factor is the growing demand for dental services on the part of certain segments of the population and the lack of attention to such demands on the part of dentists both in private practice and in public agencies.

Another factor is the limited number of hours of dental services available for the care of large groups in the population urgently in need of attention, and the limited supply of instruments and equipment for those services that are available.

A fifth factor contributing to the dental health problems in Latin America is the inadequacy of human resources, particularly well trained auxiliary personnel. Only in one Latin American university is there a regular course in training dental assistants and dental laboratory technicians. In another university, with assistance of the Pan American Health Organization, an experimental program has been initiated aimed at the adequate training of auxiliary personnel in a short time.

Another factor is that preventive measures now are used only on a limited scale in Latin America. Of the total population, the percentage of people who receive fluoridated water is only 4 per cent and, of the urban population supplied with water, less than 14 per cent receive the benefits of fluoridation. Topical applications of fluorides are used only to a small extent in private practice and in health service programs.

A seventh factor, relating to dental education, is the presence of a philosophy of dental education which tends to create a group of

professionals who are not adjusted to reality in some Latin American areas.

Another factor relates to professors in the dental schools, their limited numbers, the scarcity of training centers for professors, the lack of a policy of continuing education for professors, and the lack of educational principles for the transmission of knowledge and skill.

A ninth factor is the lack of coordination and integration of the curriculums in the dental schools.

Another factor is the great number of dental students who drop out during the years of professional education.

An eleventh factor is the lack of plans for expansion and improvement of the facilities and equipment in the dental schools.

Finally, there is the high cost of dental education and the high cost of dental facilities, equipment, and materials which are reflected in professional fees which, in turn, cannot be paid by a large part of the population.

These are but some of the major factors that have contributed to the limitations faced by the profession in providing to the community the extent of services that the dental profession should provide and wishes to provide. As a result of these problems, dentistry has not been considered as a priority health service by either the people or the governments in almost all the countries of Latin America.

In these countries, dental care is provided by private practitioners as well as by governmental health agencies. The majority of the population who are fortunate enough to receive dental care do so from governmental services.

However, the dental programs of health agencies can provide only limited dental services, generally extractions and emergency services, for specified segments of the population. Some countries also may have programs of restoring teeth for small groups of students.

In summary, dental care in Latin America is limited, as is medical care, by cultural, economic, and social factors. These include: 1) limited supply of professional and auxiliary personnel; 2) limited community purchasing power; 3) irregular distribution and stratification of the profession within the community; and 4) poor public understanding of the role played by oral health in general health.

Despite the multiplicity and severity of the aforementioned problems, however, the past twelve years have seen the initiation and

expansion of the Pan American Health Organization/World Health Organization (PAHO/WHO) program for the improvement of oral health and the development of the dental profession in Latin America. This program has drawn support from many dental and other health related institutions, organizations, and agencies such as the American Dental Association, the W. K. Kellogg Foundation, the United States Public Health Service, several dental schools, as well as many individual dental leaders and educators.

In 1955 this Organization began its activities in the field of dentistry. Since then the Organization's activities in this field can be divided into three stages. The first or *exploratory* stage, from 1955 to 1958, was dedicated to a study of dental health problems in the region. One of the more important findings of this study was that not one of the existing schools of public health in Latin America offered special training in public health for dentists. Of all the countries in Latin America, there were only 34 dentists trained in public health, and the majority of these had received their training in the United States during the previous 20 years. As a result, the dental health programs in Latin America lacked a true public health orientation and approach. Based on these and other findings during the exploratory phase, the following fields of activity were selected: 1) The training of dentists in public health in order to direct principal dental public health programs of those member countries who lacked this type of personnel; 2) Incorporate the teaching of preventive and social dentistry in the curriculums of the dental schools; 3) An expanded use of mass measures of prevention of dental disease; 4) Establish programs for the training of dental auxiliary personnel and conduct experimental programs in the development of new types of auxiliary personnel; and 5) Promote the incorporation of dentistry as an integral part in national health plans.

As a result of the findings and analysis of the exploratory stage, the second and third stages of this Organization's programs were developed. The second, or *public health education* phase, from 1958 to 1961, was principally dedicated to the education of dentists in public health. Activities in this area have continued up to the present time. The third stage, from 1962 to the present time, has been dedicated to the *promotion of program activities* in dental health, dental research, and dental education at local, regional, and national levels in Latin America.

At this time, I would like to take the opportunity to explain some of the specific programs in which the PAHO has been engaged.

In 1958, with the assistance of the Organization and the W. K. Kellogg Foundation, a regional center for training in dental public health was established at the School of Public Health of the University of São Paulo, Brazil. From that time and until 1965, 119 dentists had received training in dental public health. These dentists were administrators of health programs as well as teachers in dental schools and almost one-half of these graduates received fellowships from this Organization. Over 90 per cent of these graduates currently are engaged in public health programs or teaching in dental schools. The success of this program can be seen from the fact that dentists with specialty training in public health now are working in every country of Latin America.

An International Center for Dental Epidemiology and Applied Research also was established in 1965 at the University of São Paulo in Brazil, in collaboration with the Division of Dental Health, U. S. Public Health Service, and the W. K. Kellogg Foundation. The purpose of this Center is to serve all of Latin America in the following ways: 1) Provide advanced training to public health dentists in dental epidemiology and research methods; 2) Promote the standardization and utilization of dental epidemiologic methods; 3) Serve as a clearing house and information center in the field of dental epidemiology and research; and 4) Promote, conduct, and provide advisory services in dental research (epidemiological, clinical, social, and laboratory) related to the cause, prevention, and control of dental disease. This Center recently completed its first International Course on Dental Epidemiology and Applied Research. Twelve leading public health dentists from seven Latin American countries attended this intensive seven-week course.

Another PAHO program relates to the high priority given by the Organization to the prevention of disease. We have long been interested in extending fluoridation to urban and rural areas in Latin America that are not now benefiting from this measure. In Latin America, the fluoridation of public drinking water has been much slower than in the United States, with only 4.2 per cent of the population now benefiting from this measure, and there is urgent need to hasten the process as a means of combating dental caries. The program was begun this year with the holding of an intensive train-

ing course for Latin American sanitary engineers and other key personnel of the Ministries of Public Works at the Robert A. Taft Sanitary Engineering Center in Cincinnati.

During the second year of the program, there will be two regional courses for local personnel, one for the local Central American countries and Panama, and one for the Caribbean Area. In the second and third years there will be twenty similar courses in universities throughout Latin America.

The second phase of this program will be dedicated to the promotion of fluoridation in the Latin American countries. To this end, advisory and technical services will be provided to Latin American governments by the Pan American Sanitary Bureau. One dentist and one sanitary engineer have been appointed specifically by the Sanitary Bureau for this project.

The program is expected to receive additional support from international loan agencies to help finance the installation of fluoridation equipment in Latin America as an extension of their assistance for the general installation and improvement of public water systems.

This program is being sponsored jointly by the PAHO and the W. K. Kellogg Foundation. The United States Public Health Service, the American Dental Association, and the Inter-American Association of Sanitary Engineers also are cooperating.

This Organization also is collaborating in programs to assist Latin American countries in the identification of their national dental health problems and their available dental resources in order to make possible the integration of dentistry within national health plans. Thus, in Colombia, dental aspects of health were included in a national survey related to health, human resources in health, and medical education. Also, in Venezuela, activities have been initiated in the coordinated development of dental health programs and dental education in that country. Plans now are being carried out for a study that will measure the dental health status of the country's population, identify factors contributing to the state of dental health, such as social, anthropologic, economic and other factors, determine the country's human and material resources in dental health, and analyze dental practice and dental education in Venezuela. Following this study, now scheduled for completion in 1968, activities will begin for nationwide comprehensive and integrated planning and

implementation of activities by the organized dental profession, the country's three dental schools, and the national health services.

Insofar as our activities in the field of dental education are concerned, we have found that there exists a close correlation between education in general, dental education, and the social and economic development of a country. However, there are some dental schools whose teaching programs do not prepare the students for the realities they will face in their future professional practice. General problems in dental education in Latin America include the small number of trained teaching personnel, lack of integration and coordination of the preclinical and clinical disciplines, the lack of correlation in the teaching of basic sciences, lack of correlation between basic and clinical sciences, and high cost of instruments and equipment which results in limited training in their use and limited effectiveness in professional practice. In efforts to strengthen dental education in Latin America, three Latin American Seminars on Dental Education have been conducted. These Seminars were organized and carried out by this Organization in collaboration with the W. K. Kellogg Foundation. Representatives of 85 dental schools in Latin America attended.

These Seminars considered various problems in dental education in Latin America and formulated recommendations for the solution of these problems. Based on the recommendations of these Seminars, dental schools in various Latin American countries have initiated changes in their dental educational programs.

At the same time, this Organization has pursued efforts to ensure that an association of dental schools in Latin America could carry out the recommendations of the three Seminars. Toward this end, the Organization collaborated in the creation of the Association of Latin American Dental Schools (ALAFD) and assisted in the conduct of three international courses on dental education by ALAFD. For the last two years, two generous grants from the American Dental Association have been supporting the central office of ALAFD.

Another important area of activity of this Organization in the field of dental education has related to the establishment of departments of preventive and social dentistry in the schools of dentistry in Latin America. The first of these departments, experimental in nature, was created in Colombia in 1962, and its influence now can

be seen in dental schools in several other Latin American countries. The incorporation of the teaching of preventive and social dentistry in each year of the curriculum has made possible the increased participation of dental students and recent dental graduates in activities aimed at solving local and national health problems.

In the field of dental research this Organization is supporting a variety of activities.

I already have referred to the International Center for Dental Epidemiology and Applied Research in São Paulo, Brazil. This Center is involved in training as well as investigations in dental epidemiology.

In accord with priorities set by the PAHO/WHO, we are currently involved in operational research into the extension of dental services to a greater percentage of the population. Two centers relating to this area are being established in Latin America. One will conduct research into social and economic factors involved in the provision of dental care, the other will conduct research and training in dental productivity.

We are in the process of conducting the first continent-wide study of dental auxiliary education and utilization in Latin America.

We also are providing support to a research effort with major implications for the prevention of dental caries in large population groups in Latin America.

As you know, the ingestion of suitable concentrations of fluoride in drinking water has become an accepted procedure for dental caries control. However, in some regions of the world including Latin America, a great number of people live in rural areas and, in only a very few of the rural areas is there a potable water system. Also, in these areas, the people are generally in a low-income group and dental care service is not readily available. These factors warrant the development of some alternate method of providing fluorides. Other avenues have been suggested for adding fluorides to the diet, and one measure that could serve for large numbers of the population, in Latin America and other areas, is the use of common table salt.

To further pursue the feasibility of salt fluoridation, the PAHO, first, was instrumental in the development of a process to create a stable, homogeneous mixture of sodium fluoride in crude table salt. The Organization then assisted the School of Dentistry of the Uni-

versity of Antioquia, Colombia, in developing an application for a study grant from the National Institutes of Health of the U. S. Public Health Service. The grant subsequently was awarded for the development of a salt fluoridation program over a five-year period. The long-term objective of this research plan is the development of salt fluoridation as a practical mass method for caries prevention.

The specific objectives of the project are: (1) To study the effectiveness of common salt as a vehicle in the fluoridation programs for dental caries prevention; (2) to compare the effectiveness of sodium and calcium fluoride as salt additives in caries prevention; and (3) to establish optimum levels of fluorides in salt for general, safe application.

The results of the Colombian salt experiment thus far have been quite satisfactory. The communities are aware that they are receiving fluoridated salt and their acceptance of the salt has been excellent. It is interesting to note that the communities consider the quality of flow of the fluoridated salt to be better than in the non-fluoridated common salt they previously consumed. Many of the questions scientists had, such as uniformity and stability of fluorides in the salt, daily intake, optimum doses of fluorides, etc., have been resolved in the Colombian experiment. In a few years complete evaluation of this measure will be available. If salt fluoridation could show its efficacy as water fluoridation does as a preventive measure, we hope that millions of people will receive the benefits of this measure soon.

These activities that I have just described are activities of the Pan American Sanitary Bureau which is the Secretariat of the Pan American Health Organization and also the Regional Office for the Americas of the World Health Organization.

As you may know, WHO began its activities in 1948, and currently will celebrate its twentieth anniversary of work in the promotion of world health.

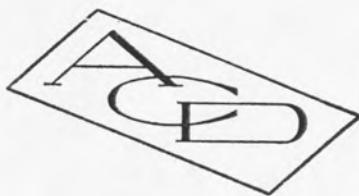
During the first ten years of WHO's operation, from 1948 to 1958, dental health activities in the Region of the Americas were begun. These initial efforts, from 1955 to 1958, signaled the start of joint planning of international dental activities in this hemisphere. The second ten years, from 1958 to the present, have seen a marked increase in multilateral and bilateral international cooperation.

Of particular significance have been the growing interest and

support of the American Dental Association, the W. K. Kellogg Foundation, the United States Public Health Service, and several dental schools.

We expect that the coming years will show increasing dental health activities in this hemisphere, focusing on coordinated and integrated planning and implementation of efforts to promote dental health.

It is hoped that in the development of dental health and the dental profession, the dentist, who also must play an active role as a citizen and leader in his community, can indeed fulfill the challenge as stated by an outstanding international leader of the profession, the Secretary of the American Dental Association, Dr. Harold Hillenbrand when he said that "in each area of human activity there is a need for men with professional education and imagination, so that they may take part in the solution of the crises of the world. When a large number of dentists become a part of this group, then, undoubtedly, the image of dentistry will shine even more, not only in the country but in the entire world."



Educational Problems With Future Dental Practice Trends

GERALD R. GUINE, D.D.S., M.P.H.

PRESENT PROBLEM

DENTAL examinations indicate that the 111 million adults in the United States have a total of two and one-quarter billion decayed, missing, or filled teeth. Translation of these data, expressed as average, reveal over 133 million decayed teeth alone, without regard to the number of tooth surfaces involved. At least one in four adults has no natural teeth remaining in either one or both jaws. In addition, about three of every four adults with natural teeth remaining show some evidence of gingivitis or destructive periodontal disease (1).

If one adds to these figures the recognized and measured dental needs of children (to age 20), the total dental problem of the nation reaches staggering proportions. The average boy or girl of 15 in this country has eleven decayed, missing, or filled permanent teeth. Each of our 5-9 year olds has an average of three unfilled cavities. It has been further determined that 80 per cent of our young people under the age of 20 need fillings, and neglected tooth decay accounts for more than 75 per cent of the tooth loss among Americans of ages 15-24.

In the past, any progress in the control of dental diseases has spread out over periods of decades, and occurred in several stages, each corresponding to a phase in the growth of dental science. Interpretation of the vast amount of dentistry as a health service indicates a great need for changing the repair and replacement concept to a disease control approach, and emphasis on preventive practices with concurrent and continual professional growth.

Young aptly states: "We know that dentists have been trained for competent clinical performance, but we would now like to assure ourselves that the dentists in practice will apply what they have learned and that they will be good clinical dentists. We hope that

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they will see an obligation and sense a source of satisfaction in providing leadership in the health affairs of the community in which they practice. Finally, we hope that our graduates will be articulate and intelligently functioning members of a proud health profession" (3).

In view of this potential complete new direction in the total practice of dentistry, dental educators met at a Workshop on Community Dentistry, at the University of Kentucky, April 10-13, 1967, to evaluate the activities of 13 schools of dentistry previously awarded financial support to strengthen and expand their curriculum on community related subjects. Specific aspects of "planning, organizing, operating, and evaluating" the emerging teaching programs of preventive dental practices were closely scrutinized. While there has been considerable amount of discussion about the philosophical concepts of preventive dental practices and course content, it was generally agreed that the curriculum of all schools of dentistry should be revised placing increased emphasis on this topic.

WHOSE RESPONSIBILITY?

However, a recent survey reflecting the current dental faculty manpower, the major teaching responsibilities, the amount of time involved as a faculty member, and the other related characteristics indicates an alarming shortage of experienced faculty presently responsible for these related topics of preventive dentistry, community health, public health, and/or social dentistry.

Only 16 of the 52 schools of dentistry having students presently enrolled have faculty identified as devoting *full time* to the theme of preventive dentistry or a related major teaching area (4). Table 1 reflects these characteristics in detail. Only three of these schools of dentistry are located west of the Mississippi River basin. Twenty-six individuals reported in the survey devoting full time, reflect a wide variety of graduate educational preparation (Table 2) with about half possessing a master's degree in addition to the dental degree. Table 3 indicates the percentage of teaching responsibility in these areas by part time faculty.

A study conducted in December 1964 could identify 114 dentists in the nation then holding a Master in Public Health degree. Over 40 of these were part of some federal governmental agency full time, with the remaining 70 available for employment on local or state

TABLE 1

Major Teaching Area	% Time Involved	Earned Degree Type(s)*					Full-time Total
		(1)	(1 & 2)	(1 & 4)	(4)	OTHERS	
Community Health	100	3	—	4	1	1	9
	70	—	—	—	—	—	
	30	1	—	—	—	—	
	20	5	—	1	—	—	
	10	—	—	2	—	1	
Preventive Dentistry	100	4	1	4	1	—	10
	40	—	—	1	—	—	
	30	1	—	1	—	—	
	20	2	—	—	—	—	
Public Health	100	1	—	4	—	1	6
	30	—	—	1	—	—	
	20	—	—	3	—	—	
	10	3	—	11	—	2	
Social Dentistry	100	—	—	—	1	—	1
	20	1	—	1	—	—	
	10	2	—	—	—	—	

Full-time Total 26

* Earned Degree Key

- (1) D.D.S. or D.M.D.
- (2) Ph.D. or equivalent.
- (4) M.A., M.S. or equivalent.

TABLE 2

Major Teaching Area	(1)	Number and Type Earned Degree Full-Time Faculty*					TOTALS
		(1 & 4)	(1 & 2)	(1, 2 & 4)	(4)	(2, 4 & 6)	
Community Health	3	4	—	1	1	—	9
Preventive Dentistry	4	4	1	—	1	—	10
Public Health	1	4	—	—	—	1	6
Social Dentistry	—	—	—	—	1	—	1
Total	8	12	1	1	3	1	26

* Earned Degree Key

- (1) D.D.S. or D.M.D.
- (2) Ph.D. or equivalent.
- (4) M.A., M.S. or equivalent.
- (6) Foreign Dental Degree.

TABLE 3

<i>Major Teaching Area</i>	<i>Characteristics of Part Time Faculty</i>					<i>Total</i>
	PERCENTAGE OF TEACHING RESPONSIBILITY					
	70%	40%	30%	20%	10%	
Community Health	1	—	1	6	3	11
Preventive Dentistry	—	1	2	2	—	5
Public Health	—	—	1	3	16	20
Social Dentistry	—	—	—	2	2	4
Total	1	1	4	13	21	40

governmental levels or in educational institutions (5). Seventy-four were listed as active diplomates of the American Board of Dental Public Health in the Fall of 1967.

An inventory of reported dental faculty in October 1963 presented an estimate of 988 additional full time faculty needed between November 1963 and October 1969 to maintain the 1963 ratio of student-faculty-teaching responsibilities (6-7). There were reported 1,469 full time and 2,403 part time dental faculty with an additional 305 faculty involved in auxiliary type student preparation programs.

These additional needed faculty are largely the result of the expanding physical facilities of the existing dental schools. Grant support through such channels as Public Law 88-129, as of June 31, 1966, approved and funded to 13 universities almost forty million dollars; this will create 402 new student places (8).

EDUCATIONAL CHALLENGE

Even with the current emphasis on increasing the preventive theme in the curriculum, it appears future faculty development on this theme is of equal importance. There are twelve Schools of Public Health in the United States that offer a recognized curriculum leading to the Master of Public Health degree. Increased emphasis must be developed to provide for future need. H.E.W. Assistant Secretary Lee stated in April 1967 that we must devise new curriculums and produce the teachers who can direct the new educational programs (9). In addition, it becomes more apparent that certain expertise in dental related administrative activities as well as teaching and research is needed. Educational preparation of the dentist

usually prepares him for technical-clinical aspects and generally involves little of the social and management-administrative aspects.

Today's pattern of life and society's demand for certain health rights amplified by the changing population characteristics clearly indicates the health professions must review past accomplishments, present needs, and future directions to be taken.

Calisti (10) offers a "dynamic response" to these kinds of challenges through the following steps:

1. Revising the undergraduate curriculum to make it more responsive to the emerging social and economic trends which are changing the patterns of dental practice.

2. Establishing graduate programs which will strengthen the training and research potential of preventive dentistry, and enhance its scientific basis.

3. Establishing regional centers of Dental Public Health Education for graduate training, continuing education, and research.

4. Creating a national organization to give voice to the rapidly progressing movement of dental public health education.

Further discussion and specific delineation on these suggestions and numerous others is vitally needed. Who will assume the leadership to initiate the giant, bold, and imaginative steps toward the void remains to be clearly identified. Many are extending their feet, but the lack of a concerted effort in unison may well prevent the optimum goal—preventive dental practice enjoyed by all.

Many dental services, such as preventive measures, are considered luxuries rather than necessities and this attitude may well persist for the next decade. It has been estimated that expenditures for dentist-directed services will almost double between the 1965 and 1975 levels (2).

Will preventive faculty growth also double?

REFERENCES

1. U.S. Dept. of Health, Education, and Welfare. PHS Pub. 1000-Series 11, No. 12. Periodontal disease.
2. Report of the National Advisory Commission on Health Manpower. Vol. 1, Nov. 1967, p. 35.
3. Young, Wesley O. and E. R. Sanders. Developing performance objectives. Paper presented at Workshop on Community Dentistry, Apr. 10-13, 1967, Lexington, Ky. 17 pp. processed.

4. 1966 Directory of Dental Educators in the United States and Canada. American Association of Dental Schools, Chicago.

5. Holmes, C. B. The School of Public Health, its role in improving practice through continuing professional education. *J. Pub. Health Dent.* 24:113-19, Summer 1964.

6. Rogers, J. F. Colleges and universities look at their need for professional staff. In "Current issues in higher education," G. K. Smith, ed. Washington, D.C., N.E.A. 1966, pp. 207-208.

7. ———. Staffing American colleges and universities. Dept. of Health, Education, and Welfare, Washington, D.C. 1967.

8. Dunning, J. M. et al. Dental manpower and education in 1966. *J. Pub. Health Dent.* 27:174-192, No. 4, 1967.

9. Lee, P. R. The government's role in dental health programs. 18th National Dental Health Conference, American Dental Association, April 17-18, 1967, Chicago.

10. Calisti, L. J. P. Personal and community dental health services, a symbiosis. Paper presented at Workshop on Community Dentistry, April 10-13, 1967, Lexington, Ky. 10 pp. processed.



Dental Students: Social Class And Academic Performance

MARCEL A. FREDERICKS, Ph.D. and PAUL MUNDY, Ph.D.

R ESEARCHERS have investigated the possibility of a relationship between social class and dental school performance (1) and have examined social class in relation to stress-anxiety responses and professional attitudes (2). In addition, there have been many studies on the reliability of the dental aptitude test as a predictor of performance in dental school (3-8).

However, apparently there has been no previous attempt to explore the interrelationships of social class, average academic grade in college (AGC), average science grade in college (AGS) of the AGC, dental aptitude test (DAT) scores, and academic achievement (AA) in the preclinical years of dental school. It is hoped that the present study, which is an examination of these factors as they relate to a group of students during their first and second years at one dental school, will provide further insights of how persons from different socioeconomic classes respond to professional dental training; what possible relation social class has to preclinical dental school achievement; and, in addition, what relationship, if any, the latter intellectual indicator has to AGC, AGS of the AGC, and the DAT scores.

In the present study, therefore, an attempt is made to examine two empirical questions relevant to dental students in terms of social class, AGC, AGS, DAT scores, and academic achievement in the preclinical years of dental training:

1. Do dental students from families of upper-class background have higher academic records in the preclinical years of a dental school than students of lower-class origin?

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Dr. Mundy is Professor and Chairman, Department of Sociology, Loyola University, Chicago.

This is the fourth study about dental students by Drs. Fredericks and Mundy to appear in the JOURNAL; see July 1967, October 1967, and July 1968.

2. What are some of the relationships (if any) among social class, AGC, AGS, DAT scores, and academic achievement for a class of preclinical dental students?

It is hypothesized that preclinical dental students from families of upper-class background have higher academic records than preclinical dental students from families of middle and lower-class backgrounds. Stated in the null (negative) form the above hypothesis reads: Social class does not relate significantly to an individual's academic achievement in the preclinical years of dental school. It is assumed that a P (probability) of 0.05 was accepted as significant.

METHODOLOGY

The study sample, which was described in detail in previous articles (1, 2), consisted of a class of 81 male preclinical dental students attending a Midwestern school of dentistry during the academic years 1965-1967.

Most students in the sample came from rather small, fairly well-educated families living in urban communities at a reasonably high socioeconomic level. Twenty-three per cent of the respondents had German ancestry and 18 per cent were of Italian descent; in both cases the progenitors were primarily from the lower-middle and upper-lower classes.

The articles also described the manner in which the study subjects were grouped into social classes. This entailed an initial 5-class grouping using Hollingshead's (9) 2-factor index of class position,* based on their fathers' education and occupation. Since the number of cases in Class II and Class V were too small to allow for statistical analyses, the subjects were regrouped into 3 classes, with 20 students (24 per cent) in Class 1, 32 (39 per cent) in Class 2, and 29 (36 per cent) in Class 3. Subsequent to the regrouping, the classes were identified simply as 1 (formerly I), 2 (formerly II and III), and 3 (formerly IV and V).

The data for this study were gathered mainly through self-administered questionnaires and attitude inventories given the first week

* These social class positions are: I—upper; II—upper middle; III—lower middle; IV—upper-lower; and V—lower-lower.

The concept of social class as used throughout this study refers to the kinds of psychological and social characteristics found differentially distributed among dental students classified by the weighted index of the father's occupation and education.

of class at the beginning of the first and second years of dental school. More data were obtained from interviews with the study subjects, and also from extensive participant-observations of the students in their school situations and in their living quarters. One of the authors of this paper lived in a dental fraternity throughout the school year 1965-66. All these data were subjected to both a qualitative and quantitative analysis.

FINDINGS

Social Class and Academic Achievement. In this study no relationship has been found between social class and academic achievement in the first year of dental school (1). The hypothesis that academic achievement in the second year of dental school is significantly related to social class is not supported by the data reported in Figure 1. It will be observed that, in the second year of training, dental students in Classes 2 and 3 fall in slightly similar academic levels in contrast to Class 1 students, whose academic level is greater.

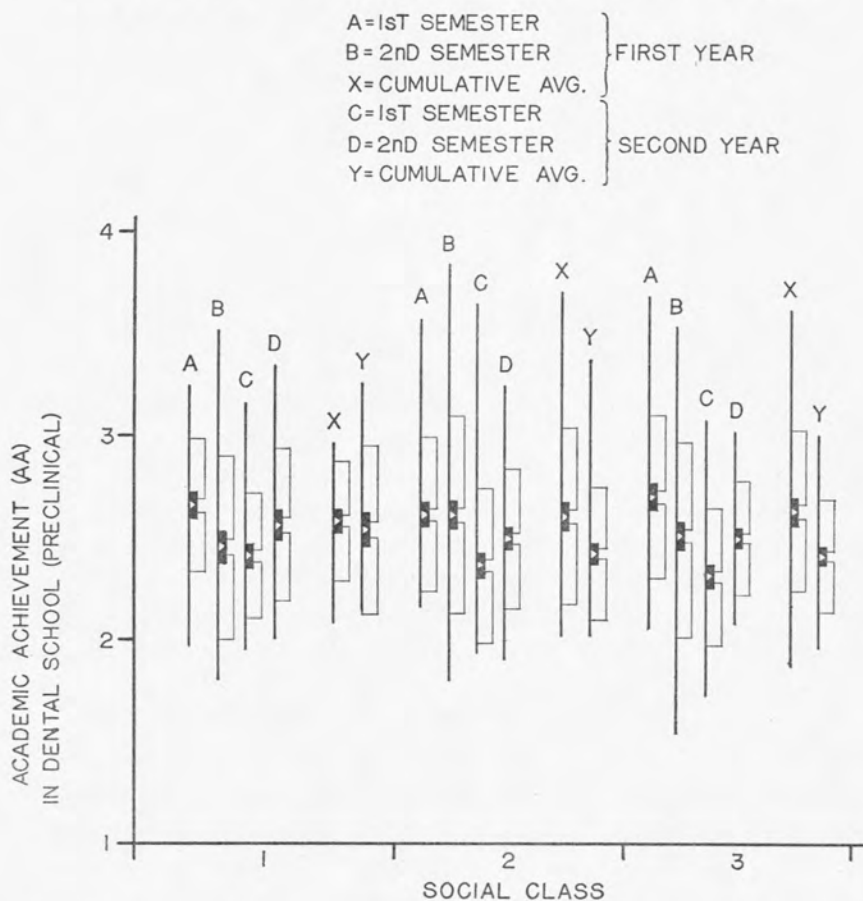
An analysis of the cumulative averages of the study subjects in the first and second years indicates that Class 1 students maintained a relatively constant academic performance in contrast to Classes 2 and 3 students, whose academic achievement are strikingly lower in the second year. However, although there are achievement differences between Classes 1, 2, and 3 during their preclinical years of dental training, *t*-test results indicate that these differences do not approach significance at the .05 level.

While the data illustrated by Figure 1 do not provide evidence of a positive relationship between social class and dental achievement, neither do the data alone confirm the null hypothesis that social class does not relate significantly to an individual's academic achievement in the preclinical years of dental school.

To test the hypothesis further by determining whether social class is related to either of the three other achievement variables—DAT scores, AGC, and AGS—and whether these, in turn, are related to academic achievement, the relation among all of these five factors was studied.

Social Class, AGC, AGS, and DAT Scores. In this study no significant differences ($p > .05$) were found between social class and either the AGC or the AGS of the respondents in the sample (1).

FIGURE 1
RELATIONSHIP OF SOCIAL CLASS (SC) and ACADEMIC ACHIEVEMENT (AA)
OF STUDENTS IN THEIR PRECLINICAL YEARS OF DENTAL SCHOOL



The vertical lines indicate the range of variation in AA for a given SC; the mean is represented by a small triangle; the blackened part of each bar comprises twice the standard of the mean on either side of the mean; one-half of each black bar plus the white bar at either end outlines one standard deviation on either side of the mean. Differences are not significant at .05 level.

As noted previously, there have been several articles on the reliability, validity, and predictive qualities of the DAT. In the current longitudinal study, each sub-test of the DAT was analyzed, but specific focus was given to the analysis and investigation of the two

composite or average scores, namely, Academic Average (AC) and the Manual Average (MA). There is no relationship between social class and either the AC or the MA scores of the DAT of the study subjects (1).

DAT Scores (AC and MA), Academic Achievement, AGC, and AGS. In the first year of the preclinical training of the study subjects, the data revealed that there was no relationship between the respondent's DAT scores and his academic achievement in the second semester (of the freshman year) within any of the three social classes (1). No significant differences were found between academic achievement and MA in the first semester ($p > .05$). However, in the first semester (of the freshman year) there is a significant difference ($p < .05$) between the upper third of the class in academic standing, and with the middle and lower third when comparing the academic average of the DAT of these groups (1).

In the second year of the preclinical training (Table 1), the data indicate that there is no relationship between the subject's DAT scores and his academic achievement. It would seem, therefore, that many students with high dental aptitude, as measured by the AC and MA of the DAT, were relatively low in academic achievement at the conclusion of the preclinical years of dental school. Conversely, many students with lower scores on the AC and MA of the DAT exhibited relatively high academic achievement.

The data in Table 1 also indicate that academic achievement was related in part to the AGS in the second semester, but not to the first semester of the second year. The AGC is also related in part to academic achievement in the second year of dental training. However, the AGC was not related to the AA in the first year of dental school training of the study subjects (1).

In this study, the AGC of the respondents is related in part to the AC (but *not* to the MA) of the DAT (1). Further, no significant differences were found between AGS on the one hand, and the AC and MA of the DAT on the other (1).

DISCUSSION

The data from this study indicate that dental students, irrespective of social class background, performed at similar levels in each year of the preclinical period of their dental training. These findings fur-

TABLE 1
 RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT IN THE
 SECOND YEAR OF DENTAL SCHOOL AND AVERAGE ACADEMIC
 GRADE IN COLLEGE, ACADEMIC SCIENCE GRADE IN COLLEGE,
 AND ACADEMIC AND MANUAL AVERAGES OF DENTAL
 APTITUDE TEST

Achievement Variables	Academic Standing in the Second-Year Class*					
	1 and 2		2 and 3		1 and 3	
	t	Sig.†	t	Sig.	t	Sig.
	<i>First Semester</i>					
Average Academic Grade in College (AGC)	-0.207	NS	2.097	S	1.119	NS
Average Science Grade in College (AGS)	-0.007	NS	1.520	NS	0.880	NS
Academic Average of Aptitude Test (AC)	1.432	NS	0.064	NS	1.689	NS
Manual Average of Aptitude Test (MA)	0.374	NS	-0.091	NS	0.475	NS
	<i>Second Semester</i>					
Average Academic Grade in College (AGC)	-0.213	NS	3.121	S	2.359	S
Average Science Grade in College (AGS)	-0.491	NS	3.308	S	1.853	NS
Academic Average of Aptitude Test (AC)	1.204	NS	0.501	NS	1.544	NS
Manual Average of Aptitude Test (MC)	1.537	NS	-0.897	NS	0.909	NS

* Academic standing was divided into thirds on a 4 point system: 1 = Upper third (2.79-3.69); 2 = Middle third (2.46-2.78); 3 = Lower third (1.97-2.45). First semester of the second year: Upper N = 5; Middle N = 21; Lower N = 55. In the second semester of the second year: Upper N = 9; Middle N = 40; Lower N = 32.

† Sig. = significance; S = Significance at .05 level; NS = no significance; t = test used for finding S or NS.

ther document the fact that, at least for this dental school, social class is not a determinant of academic performance.

Additionally, a student's AGC, AGS, and his AC and MA scores of the DAT appear to have very little relationship to his academic performance in the preclinical years of dental school.

Indeed, applicants do require intensive evaluation to discover whether or not they can cope with dental studies, the intensity of such studies, and the range of material which is presented in the four year period of dental training. However, an admissions' committee could not be justified in disqualifying a potential candidate to the dental profession because he has a lower social class and/or a lower AGC; and/or a lower DAT score. (There may be subtle differences in the *colleges* from which the students come, of course, and this will require investigation.)

What is clear in this research is that social class position and parameters such as average grade in college, and the manual average of the dental aptitude test are *not* predictors of dental school achievement, as reflected in the preclinical academic performance of the study subjects. It appears, therefore, that a critical re-evaluation ought to be given to "the untapped pool of possible dental school applicants" with lower social class backgrounds and/or lower AGC's; and/or lower DAT scores.

Of further import, the findings of this study suggest in part that parameters, such as average grade in college, utilized by an admissions' committee to yield a quantitative estimate of success in dental school performance require thorough analysis. Probably, in the selection procedures of admitting students to dental schools, additional emphases ought to be given to the type and content of courses taken by the student in pre-dental years of study.

Additionally, the type and content of pre-dental courses ought to be evaluated in relation to other variables such as the teacher, the quality and objectives of the pre-dental program of the applicant's college (s), and the grades earned in the various subjects. It might be possible that an applicant who received a "C" in a graduate school organic chemistry course learned more in substance and attitude than the person who obtained an "A" in a chemistry course for non-science majors.

Since the representatives of the three social classes covered in the study group came from a predominantly white, Catholic, urban environment, additional research is required to explore the possibilities of whether or not these findings can be extrapolated for all regions, subcultures, and religions.

SUMMARY

Social class and academic achievement in the preclinical program of a dental school were studied in relation to average college grades, average college grades in science, and dental aptitude test scores. The data for the first year of the preclinical period have been reported upon previously (1). The data for the second year (of the preclinical period) indicate these findings:

1. Academic performance of the study subjects in the second year of the preclinical period at the dental school at which the research was conducted was not related to social class position.

2. There was no relation between the subjects' DAT scores and their academic achievement in the second year of the preclinical period, irrespective of social class.

3. Academic achievement was related in part to the AGS in the second semester, but not to the first semester of the second year. Further, the AGC is related in part to academic achievement in the second year of dental training.

REFERENCES

1. Fredericks, Marcel, and Paul Mundy. Relations between social class, average grade in college, dental aptitude test scores, and academic achievement of dental students. *J. D. Educ.* 32:26-36, March 1968.
2. Fredericks, Marcel, and Paul Mundy. Dental students: relationship between social class, stress, achievement, and attitudes. *J. Am. Col. Den.* 34:218-228, Oct. 1967.
3. Gruber, Emanuel C., and Edward C. Gruber. *Dental aptitude test*. New York: Arco Publishing Co. 1963.
4. Manhold, John H., Paul W. Vinton, and Beverly Manhold. Preliminary study of the efficacy of the dental aptitude test in predicting four-year performance in dental school. *J. D. Educ.* 27:84-87, 1963.
5. Hood, Albert B. Predicting achievement in dental school. *J. D. Educ.* 27:148-155, 1963.
6. Reilly, Robert R., Robert I. Yufit, and Dale E. Mattson. The dental student at the University of Illinois. *J. D. Educ.* 29:162-174, 1965.
7. Peterson, Shailer. Validation of the dental aptitude batteries. *JADA* 37:259, 1948.
8. De Revere, Robert E. Comparison of dental aptitude tests with achievement in operative dentistry. *J. D. Educ.* 25:50-56, 1961.
9. Hollingshead, A. B. *Two factor index of social position*. New Haven: Yale University Press, 1956.

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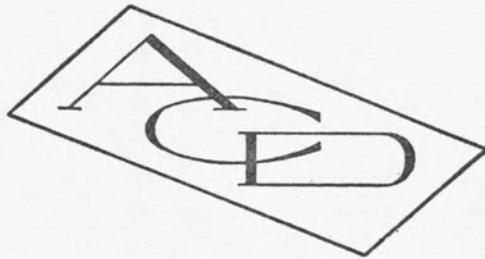
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The Objectives of the American College of Dentists

The American College of Dentists, in order to promote the highest ideals in dental care, advance the standards and efficiency of dentistry, develop good human relations and understanding, and extend the benefits of dental health to the greatest number, declares and adopts the following principles and ideals as ways and means for the attainment of these goals:

(a) To urge the development and use of measures for the control and prevention of oral disorders;

(b) To urge broad preparation for such a career at all educational levels;

(c) To encourage graduate studies and continuing educational efforts by dentists;

(d) To encourage, stimulate, and promote research;

(e) To encourage qualified persons to consider a career in dentistry so that the public may be assured of the availability of dental health services now and in the future;

(f) To improve the public understanding and appreciation of oral health service and its importance to the optimum health of the patient through sound public dental health education;

(g) To encourage the free exchange of ideas and experiences in the interest of better service to the patient;

(h) To cooperate with other groups for the advancement of inter-professional relationships in the interest of the public; and

(i) To urge upon the professional man the recognition of his responsibilities in the community as a citizen as well as a contributor in the field of health service;

(j) In order to give encouragement to individuals to further these objectives, and to recognize meritorious achievements and potentials for contributions in dental science, art, education, literature, human relations and other areas that contribute to the human welfare and the promotion of these objectives—by conferring Fellowship in the College on such persons properly selected to receive such honor.

This is from the Preamble to the Constitution and Bylaws of the American College of Dentists.

