Large-Scale Diabetes Screening Program for Federal Employees

GLEN W. McDONALD, M.D., JOHN B. HOZIER, M.D., GAIL F. FISHER, and ARVO B. EDERMA, M.D.

SCREENING TESTS for diabetes are being offered on a continuing basis to Federal employees through the joint efforts of the Federal Employee Health Program and the Diabetes and Arthritis Branch of the Public Health Service. The tests are offered on a voluntary basis, at scheduled intervals of time, by the employees' health units.

This project is an example of cooperative activities between a clinical, service-oriented department and one interested in the development, application, and evaluation of new techniques. Both areas of interest have been successfully served. Primarily, this project aims to provide a service to employees who wish to be tested for diabetes. Although essentially a screening project, it has several unique features which provide important information on screening techniques and yield of new cases in a large population. These features relate to the magnitude of the number of persons screened; preparation of the screenee for the test; level of glucose regarded as positive; an automated method, using the Technicon AutoAnalyzer, for quantitative determinations of blood glucose levels; and the type of retesting and referral program.

Since the project began, on July 1, 1960, more than 25,000 persons have been screened in Washington, D.C., Dallas, Tex., Denver, Colo., Boston, Mass., Kansas City, Mo., New York, N.Y., Greenbelt, Md., Alexandria, Va., and Belle Mead, N.J.

This report presents data on the first year of screening activities in Washington, D.C., and Dallas, Tex., where 15,535 employees, representing 31 Federal departments or agencies, volunteered for the test.

The authors are with the Public Health Service. Dr. McDonald is chief and Mrs. Fisher is chief statistician, Diabetes and Arthritis Branch, Division of Chronic Diseases. Dr. Hozier is chief and Dr. Ederma is deputy chief, Federal Employee Health Program, Division of Hospitals.

Procedures

Screenees are instructed to eat their usual breakfast and fast for 2 hours after reporting for work. At that time, each person eats two 2¼-ounce bars of fudge which have a combined content of 78.8 gm. carbohydrate (sucrose, dextrose, levulose, maltose, and higher sugars), 16.0 gm. fat, and 2.0 gm. protein (*1*). The candy is eaten within 15 minutes. No additional food is allowed before the test except water, plain tea, or black, sugarless coffee. Venous blood specimens are drawn between 1 hour and 45 minutes and 2 hours and 15 minutes after the carbohydrate is eaten.

For this study, the screening level considered positive is relatively low: 130 mg. per 100 ml. Tests are made on plasma, which provides higher determinations than those obtained from whole blood. Although estimates of the difference vary, most experiments result in a difference of 15 to 20 mg. per 100 ml. (Data available to the Diabetes and Arthritis Branch indicate that plasma values are always higher than whole blood values. The absolute difference between whole blood and plasma in-

creases as the glucose concentration of the blood increases. The correlation between plasma and whole blood values is quite high, and one can be predicted accurately from the other. Conclusions based on plasma, with appropriate adjustment of critical levels, are as accurate as those based on whole blood.)

If whole blood is regarded as a standard, the level for positive readings in this project is between 110 and 115. Although this level results in the identification of more positive cases, it imposes a greater burden on the screening program in retesting persons with positive specimens in order to avoid unnecessary referrals.

This is one of the first large-scale programs to use the AutoAnalyzer to obtain quantitative determinations for the screening test. Blood is draw into vacutainer tubes containing 30 mg. sodium fluoride as a preservative. Plasma is prepared, and glucose determinations are made.

Direct referral is made to private physicians for diagnosis when the screening plasma value is 300 or more (180 or more before May 1, 1961, when it was changed to decrease the number of referrals). When the screening level is between 130 and 299, glucose tolerance tests are administered by the health unit physicians. They refer to the private physician those persons who, in their judgment, require diagnostic examination.

Interpretation of the glucose tolerance tests and decision for referral are the responsibility of the individual health unit physician. The physicians are aware of but not required to use the Public Health Service criterion for inter-

Table 1. Number of Federal employees screened for diabetes, percent positive, and diagnosis rate, by age group, race, and sex, July 1, 1960–June 30, 1961

Age group (years)	Number screened	Percent positive	New diabetes [1]
Total	[2] 15,535	10.4	13.5
Under 20	283	.7	0
20–29	1,825	1.1	1.1
30–39	3,482	4.1	2.9
40–49	4,747	9.6	9.5
50–59	3,482	17.6	24.1
60–69	1,277	26.7	47.8
70–79	23	43.5	130.4
Age not stated	416	9.1	12.0
White males	6,797	10.0	14.4
Under 20	16	[3]	[3]
20–29	594	.7	1.7
30–39	1,651	3.7	3.6
40–49	2,286	9.1	7.4
50–59	1,513	15.9	25.8
60–69	579	26.1	53.5
70–79	12	[3]	[3]
Age not stated	146	8.9	13.7
White females	5,499	12.6	14.7
Under 20	226	.9	0
20–29	692	1.3	1.4
30–39	827	4.6	1.2
40–49	1,548	11.2	12.9
50–59	1,500	19.5	22.0
60–69	584	27.6	41.1
70–79	10	[3]	[3]
Age not stated	112	12.5	17.9
Nonwhite males	1,257	7.6	11.1
Under 20	4	[3]	[3]
20–29	181	.6	0
30–39	393	4.1	0
40–49	353	8.8	14.2
50–59	216	13.4	23.1
60–69	57	26.3	70.2
70–79	0	-------	-------
Age not stated	53	7.5	0
Nonwhite females	1,772	7.7	8.5
Under 20	36	0	0
20–29	332	1.8	0
30–39	567	4.6	5.3
40–49	510	8.2	5.9
50–59	228	19.7	21.9
60–69	50	24.0	40.0
70–79	1	[3]	[3]
Age not stated	48	10.4	20.8

[1] Rate per 1,000 screened. [2] Race or sex, or both, were unknown for 210 persons: 6.7 percent were positive and the rate of new diabetes per 1,000 was 9.5.
[3] Percent or rate not computed if number screened is less than 20.

Table 2. Number of Federal employees screened for diabetes, percent positive, and diagnosis rate, by weight status, July 1, 1960–June 30, 1961

Weight status	Number screened	Percent positive	New diabetes rate per 1,000
Total	15,535	10.4	13.5
Percent overweight:			
50 or more	405	14.1	51.9
40–49	546	18.7	31.1
30–39	1,095	16.5	34.7
20–29	2,245	12.2	18.7
10–19	4,201	10.7	11.7
Normal weight	6,365	7.9	6.1
Percent underweight:			
10–19	446	7.0	2.2
20 or more	29	10.3	0
Unknown	203	10.8	14.8

Table 3. Number of Federal employees screened for diabetes, percent positive, and diagnosis rate, by job classification, July 1, 1960–June 30, 1961

Job classification	Number screened	Percent positive	New diabetes rate per 1,000
Total	15, 535	10. 4	13. 5
GS grade:			
1–3	1, 411	8. 6	15. 6
4	1, 545	10. 0	11. 7
5–6	2, 841	10. 4	12. 3
7–8	1, 393	10. 6	10. 1
9–10	1, 205	10. 0	10. 8
11–12	2, 379	9. 4	11. 3
13–14	2, 219	12. 1	15. 8
15–18	734	14. 4	17. 7
Wage Board	1, 336	10. 6	20. 2
Commissioned corps or Foreign Service	47	10. 6	0
Other	78	5. 1	12. 8
Not stated	347	9. 5	14. 4

pretation of the glucose tolerance test based on "true glucose" venous whole blood samples (*2*).

Yield of new cases of diabetes, as used in the data presentation, is based on screenees referred to private physicians and subsequently diagnosed. Referral was made because of an elevated plasma screening level, and, whenever appropriate as described above, a glucose tolerance test interpreted as positive by the health unit physician. Procedures for diagnostic examination are not prescribed. They are based on the judgment of the private physician. A diagnostic determination is requested from him.

Many of the procedures used in this program would be applicable to screening employees in industry or business. Preparation of the screenee for the test, as followed in this project, is not difficult in such a setting, and it facilitates followup of positive cases. These techniques have been evaluated in this project.

Population Screened

Information is obtained on the screened population regarding age, race, sex, height, weight, history of diabetes in the family, and job classification. Distributions of these characteristics are seen in the various tables presented for those screened from July 1, 1960, to June 30, 1961. In general, the population represented an adult group between 20 and 69 years of age, with approximately an equal number of males and females. Eighty percent were white and the majority were overweight. More than 15 percent were aware of diabetes in the family. Those tested represented a full range of civil service job classifications, a sampling of Wage Board categories, and a few from the commissioned corps or Foreign Service.

Weight status was interpreted as normal or by percent underweight or overweight. Estimates were based on tables prepared by the Metropolitan Life Insurance Company (*3*). Establishment of desirable weight was based on the lowest mortality experience of males and females by height-weight measurement, not on average weights by sex.

Screening Results

Selection of the lower level of 130 mg. per 100 ml. on plasma samples as the criterion for a positive reading resulted in a high proportion of positive screenees. Of the total population, 10.4 percent (1,622) were positive. Table 1 shows the percent positive and the yield of new cases by age, race, and sex. The percent positive and the rate of diagnosed cases increased dramatically with age for all groups. More whites than nonwhites and more females than males screened positive. The differences were

Table 4. Number of Federal employees screened for diabetes, percent positive, and diagnosis rate, by family history of diabetes, July 1, 1960–June 30, 1961

Family history of diabetes	Number screened	Percent positive	New diabetes rate per 1,000
Total	15, 535	10. 4	13. 5
Not stated	172	6. 4	5. 8
No diabetes in family	12, 945	10. 0	12. 0
Diabetes in family	[1] 2, 418	13. 0	22. 3
Grandparent	741	8. 9	14. 8
Parent	1, 378	12. 8	23. 2
Brother or sister	466	18. 9	38. 6
Child	30	20. 0	0
Grandchild	6	([2])	0
Other relatives	21	38. 1	47. 6

[1] Sum of relatives with diabetes does not equal number of screenees because some screenees had more than one relative with diabetes.

[2] Percent not computed if number screened is less than 20.

not great, particularly by age group. The rate of diagnosis of new cases was higher among the total white population, but such differences were not as evident in comparisons of each age group by sex. The yield of new cases tended to be higher among males when examined by age group.

The percent positive and the yield of new cases of diabetes by weight status are shown in table 2. The percent positive tended to increase with added weight. The lowest percent positive was seen in those 10 to 19 percent underweight. This percentage increased slightly in those 20 percent or more underweight. It is not known if this increase is meaningful, since the number of cases is small and the increase is not great. (The age range of the 29 persons in this group was less than 20 to over 60 years.) The yield of new cases per 1,000 persons screened increased dramatically with increase in the percent overweight. Again, the lowest yield was seen in those who were 10 to 19 percent underweight: 2.2 per 1,000 persons. Among normal-weight persons the rate was 6.1 per 1,000. Among those who were overweight, the rate increased from 11.7 per 1,000 persons for those 10 to 19 percent overweight, to 51.9 per 1,000 persons for those 50 percent or more overweight.

Meaningful differences were not seen in the percent positive or rate of new cases by job classification (table 3). Age-adjusted rates, however, revealed somewhat higher rates among those in GS grades 1 to 4 and Wage Board classifications.

A slightly higher proportion of those who indicated that there was diabetes in the family screened positive (table 4). The diagnosis rate was considerably higher for those who knew of diabetes in the family: 22.3 compared with 12.0 per 1,000 for those who knew of no diabetes among family members. The highest rate was among those with diabetic siblings: 38.6 per 1,000.

Completeness of Followup

Disposition of the 1,622 positive cases was as follows: Of the 309 positive screenees who did not have a glucose tolerance test, 264 were referred directly to their private physicians, and subsequent reports were obtained (table 5). Of the 45 in this classification who were not referred successfully, 28 had a screening level of 130 to 139, 8 had 140 to 149, and 3 had 150 to 159. Only 2 of these 45 persons had a screening level above 180 mg. per 100 ml. Glucose tolerance tests were administered to 1,313 positive screenees, of whom all but one had a screening level between 130 and 299. A total of 389 of these 1,313 persons were referred to their private physicians by the health unit physicians. The health unit physicians successfully referred all but one person whose glucose tolerance tests were interpreted as positive and 70 percent of those whose tests were interpreted as borderline.

Table 5. Disposition of 1,622 Federal employees positive for diabetes and results of referral to private physicians

Interpretation of glucose tolerance test [1]	Total positive screenees		Not referred		Results of referral									
					No diabetes		Diabetes undetermined		New diabetes		Known diabetes		No information received	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1,622	100.0	969	59.7	186	11.5	123	7.6	210	12.9	30	1.8	104	6.4
Negative	877	100.0	851	97.0	20	2.3	4	.5	0	------	0	-----	2	.2
Positive	196	100.0	1	.5	34	17.3	37	18.9	98	50.0	4	2.0	22	11.2
Borderline	240	100.0	72	30.0	53	22.1	43	17.9	22	9.2	3	1.2	47	19.6
Not done	309	100.0	45	14.6	79	25.6	39	12.6	90	29.1	23	7.4	33	10.7

[1] By health unit physician.

Referral to private physicians of highly suspect screenees, therefore, was quite successful. In a few cases, however, it was impossible to obtain glucose tolerance tests when appropriate, or to refer directly those screenees with highly elevated screening blood sugars.

Reporting by the private physicians to whom screenees were referred was relatively successful. For 104 (15.9 percent) of the 653 referrals, reports had not been obtained by the time this summary was prepared. Only 23 of these 104 referrals had screening levels of 180 or more.

Because of the quality of retesting, referral, and physician reporting, diagnoses rates are presented on the total population rather than excluding the few screenees for whom there were inadequacies in these areas.

Referral and Diagnosis

A total of 653 persons were referred to their physicians. Of these, 210 were diagnosed as having diabetes. New cases of diabetes were discovered at a rate of 13.5 per 1,000 population. The rates were low in the younger age groups and increased with age. Almost three-fourths of the persons identified as new cases were 50 years of age or older.

Several points are of interest regarding diagnosis as it relates to the screening levels. New cases were diagnosed among those screening positive at all levels, 130 mg. per 100 ml. or more. Thirty-two cases were diagnosed among those who screened at 130 to 139, and 23 cases among those who screened at 140 to 149. Presumably, most of these cases would have been missed had the criterion for a positive reading been 130 mg. per 100 ml., as determined on whole blood samples.

New cases of diabetes were diagnosed in 25.8 percent of those who screened positive at 130 to 149 and were referred. This percentage increased as the screening level became higher. Of those who screened positive at 190 or more and were referred, almost 50 percent were diagnosed. Referral of these persons required, in most instances, confirmation of the elevated screening level with glucose tolerance tests interpreted as positive or borderline by health unit physicians (table 6).

Among the positive screenees who were referred to their private physicians, 30 were classified as having known cases of diabetes. Some of these persons stated that they were not aware of this condition at the time of their screening test.

Evaluation of Methods

In this population, application of estimated rates of unknown cases of diabetes by age (based on previous community studies (*4*, *5*) and unpublished data of the Diabetes and Arthritis Branch) resulted in an expected number of 183 unknown cases (table 7). This figure is less than the 210 cases diagnosed, indicating a high degree of sensitivity of methods and procedures used in this study, or a higher prevalence of unknown diabetes in this group, or a combination of both of these. Possible differences in the incidence and prevalence of the disease, degree of obesity, pattern of medical

Table 6. Results of referral to private physicians of screenees positive for diabetes, according to blood sugar screening levels

Screening level	Total referred	Percent	New diabetes		No diabetes		Diagnosis undetermined		No information received	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	[1] 623	100.0	210	33.7	186	29.9	123	19.7	104	16.7
130–149	213	100.0	55	25.8	61	28.6	50	23.5	47	22.1
150–169	139	100.0	42	30.2	47	33.8	26	18.7	24	17.3
170–189	102	100.0	32	31.4	29	28.4	24	23.5	17	16.7
190 or more	169	100.0	81	47.9	49	29.0	23	13.6	16	9.5

[1] Excluding 30 persons with previously known diabetes.

care, basis for diagnosis by physicians, and other variables relating to the number of unknown cases in a given population could not be determined in preparing the estimate of expected cases.

Interestingly, fewer cases were diagnosed than expected in the younger age groups, and more were diagnosed than expected in the older groups. Almost twice the expected number of cases were found among those 60 to 69 years of age. These differences could be attributed to the estimates of unknown diabetes used in this analysis. (The estimated rates were obtained from several community and other studies, and they are regarded as conservative.)

Measurement of the sensitivity and specificity of the exact procedures used in this project is not available. Also, they cannot be determined from this project, since no diagnostic information is available for screenees with negative results. The procedures were developed and selected, however, on the basis of available information regarding the sensitivity and specificity of particular tests and procedures (*6*). It was anticipated that selection of a venous blood sample drawn 2 hours after carbohydrate loading and following a period of fasting would provide a highly sensitive, highly specific screening test. Modifications of procedures from more classic tests were required to suit the particular situation.

Since the yield exceeds the number of expected cases, it appears that the procedures were well selected. (All unknown cases will not be identified in any one screening program because of the limitations of the screening test.)

Retesting with glucose tolerance tests avoided unnecessary referral of many persons to private physicians, and apparently it was successful in identifying those persons for whom referral was necessary. Almost one of every three persons referred was diagnosed for the first time as having diabetes.

Further application and evaluation are required for complete assessment and quantitation of the efficiency of these tests and procedures.

Discussion

Recommendations for appropriate diabetes screening techniques are difficult to formulate. Factors that must be considered in any decision regarding screening tests, equipment, population to be tested, and preparation for the test by the screenee are related to available facilities and staff and source of the population to be tested. In planning a screening program, a primary objective is the use of the most efficient testing procedure available for that particular situation. The efficiency of the test is expressed in terms of sensitivity and specificity. (Sensitivity is the power of the test to identify "true positives," persons with the disease; and specificity is the power of the test to reject "true negatives," persons without the disease.) Re-

Table 7. Observed and expected rates of previously unknown diabetes among Federal employees, by age group, July 1, 1960–June 30, 1961

Age group (years)	Total population	Observed diabetes		Expected diabetes		Ratio of observed cases to expected cases
		Number	Rate per 1,000	Number	Rate per 1,000 [1]	
Total	15,535	210	[2] 13.5	182.9	[3] 11.8	1.15
Under 20	283	0	0	.2	.7	0
20–29	1,825	2	1.1	3.5	1.9	.57
30–39	3,482	10	2.9	18.1	5.2	.55
40–49	4,747	45	9.5	56.0	11.8	.80
50–59	3,482	84	24.1	72.4	20.8	1.16
60–69	1,277	61	47.8	32.1	25.1	1.90
70–79	23	3	130.4	.6	25.6	5.00
Age not stated	415	5	12.0	----------	----------	----------

[1] From reference 4 and unpublished material. [2] Includes five persons for whom age group was unknown.
[3] Based on age-specific rates.

sults of experimental work with screening tests have indicated that it is wise to consider blood testing rather than urine testing and postprandial testing rather than fasting to obtain greater sensitivity and specificity.

Screening tests can be made more efficient in terms of cost per new case by effective selection of the population to be tested. Groups which often produce a high yield include older populations, relatives of persons with diabetes, and the obese.

Selection of laboratory procedures is also very important to the success of the project. "True glucose" methods such as the Somogyi-Nelson and Wilkerson-Heftmann are regarded as preferable techniques for glucose determinations. Individual determinations by a technician, however, are not always practical for large screening programs. As a result, automated techniques for glucose determinations have been used increasingly for large screening programs. The clinitron, as a modification of the Wilkerson-Heftmann technique, identifies those positive at a specified level, usually 130 or 160 mg. per 100 ml. It is relatively inexpensive and handles 120 samples per hour. The AutoAnalyzer can be used for screening in some situations. It has the advantage of presenting the quantitative result of each blood sample. However, the AutoAnalyzer is relatively expensive and it handles only 40 to 60 (in contrast to 120) blood samples per hour. Selection of such equipment for screening must be based on many factors in the particular situation.

This project has attempted to select and adapt tests, equipment, and procedures that would provide a highly efficient screening program with a minimum of inconvenience to the screenee and an acceptable number of referrals to private physicians. Selection was directed toward those procedures adaptable to the screening of large groups of employees where health unit facilities are available.

Although the project was not designed to quantitate the precise sensitivity and specificity of the tests, it appears that the combination of a low screening level with a 2-hour post-carbohydrate test and adequate retesting prior to referral results in the efficient diagnosis of a large percentage of "true positives."

Application of estimated rates of unknown cases of diabetes to screened populations has its hazards as a technique for evaluating the success of various screening programs. Some of these hazards were mentioned in the section on evaluation of methods. Such estimates provide only a crude idea of the relative success of the project. Also, it must be noted that the population in this project is unique in several ways. Selection factors in employment and other variables have contributed to this uniqueness.

Summary

A continuing diabetes screening program is being conducted among a large group of Federal employees by the Federal Employee Health Program and the Diabetes and Arthritis Branch of the Public Health Service.

The project has several unique features. Screenees are prepared for the test by a short period of fasting followed by carbohydrate loading. Two hours later, a venous blood sample is drawn. The screening level selected as a criterion for positive readings is low in contrast to those usually used in screening projects. Retesting of positives is done with glucose tolerance tests. The use of quantitative readings as obtained on an AutoAnalyzer permits direct referral without the need to retest persons with highly elevated screening blood sugars.

Of 15,535 persons screened from July 1, 1960, to June 30, 1961, 1,622 screened positive (10.4 percent of the total). Of these, 1,313 received a glucose tolerance test. Referrals were made to private physicians for 653 screenees (30 had previously known diabetes). Two hundred and ten cases of diabetes were diagnosed, a rate of 13.5 per 1,000 population. Positive results and new cases diagnosed were more frequent among the older groups, the more obese, and those with a history of diabetes in the family. Large differences in rates of diagnosis were not apparent between sexes, by race, or by job classification.

Based on estimated rates for unknown diabetes by age, 183 unknown cases were expected in this population. But, in this project, 210 were diagnosed by physicians following refer-

ral. This suggests that the methods used in the project are sensitive and efficient, but further application and evaluation are required to measure their efficiency in precise terms. These methods would be applicable in any organization where control of the preparation of the individual for the test and followup are possible.

REFERENCES

(*1*) Allan, F. N., and Georgeson, L. W.: A candy tolerance test in the detection of early diabetes. Med Clin N Amer 44: 2 (1960).

(*2*) U.S. Public Health Service: Diabetes program guide. PHS Publication No. 506. U.S. Government Printing Office, Washington, D.C., 1960, p. 30.

(*3*) Statistical Bulletin, Metropolitan Life Insurance Company, vol 40. November–December 1959.

(*4*) U.S. Public Health Service: Diabetes fact book. PHS Publication No. 890. U.S. Government Printing Office, Washington, D.C., 1961.

(*5*) Remein, Q. R.: A current estimate of the prevalence of diabetes mellitus in the United States. Ann New York Acad Sci 82: 229–235, September 25, 1959.

(*6*) Remein, Q. R., and Wilkerson, H. L. C.: The efficiency of screening tests for diabetes. J Chronic Dis 13: 6–21, January 1961.

Normal Aging

Many manifestations of aging which were previously thought to result from the aging process itself may be attributable to social, personality, and health variables, according to studies by the National Institute of Mental Health, Public Health Service. The senior investigators were Dr. Robert N. Butler, Dr. Seymour Perlin, Dr. James E. Birren, Dr. Samuel W. Greenhouse, Dr. Louis Sokoloff, and Dr. Marian Yarrow.

The subjects were 47 medically healthy men, aged 65 to 92 with a mean age of 71. The group was in contrast to those of earlier studies, which focused on sick or institutionalized subjects.

No significant difference in measurements of cerebral blood flow and oxygen consumption was found between the study group and a group of healthy young controls with a mean age of 21. Those subjects who did have decreased measurements had evidence of arteriosclerosis, suggesting that decreases in cerebral circulation and oxygen consumption in older people result not from the aging process itself but from arteriosclerosis.

In general the study group was alert, mentally flexible, constructive, resourceful, and optimistic and did not display the mental and emotional rigidity commonly believed to accompany old age. Their verbal ability was rated superior to that of the young normal controls. In other tests however, evidence of diminishing function was observed, particularly in psychomotor speed.

The average chronological age of those with symtoms of a mild, early stage of mental decline did not differ from the average age of those without such symptoms. The investigators were thus led to question the common view that chronological age is an overriding factor in the development of psychiatric disorders in the aged.

Social factors were closely related to deterioration in behavior and attitudes. Deterioration was more likely in persons suffering loss of family members or loss of income. The studies indicated that whether or not enforced retirement has unfortunate consequences for the individual depends to some degree on whether retirement was accompanied by conflicting internal and external pressures.

The findings of the studies were reported by Dr. Butler in the March 1963 issue of the *American Journal of Psychiatry*.