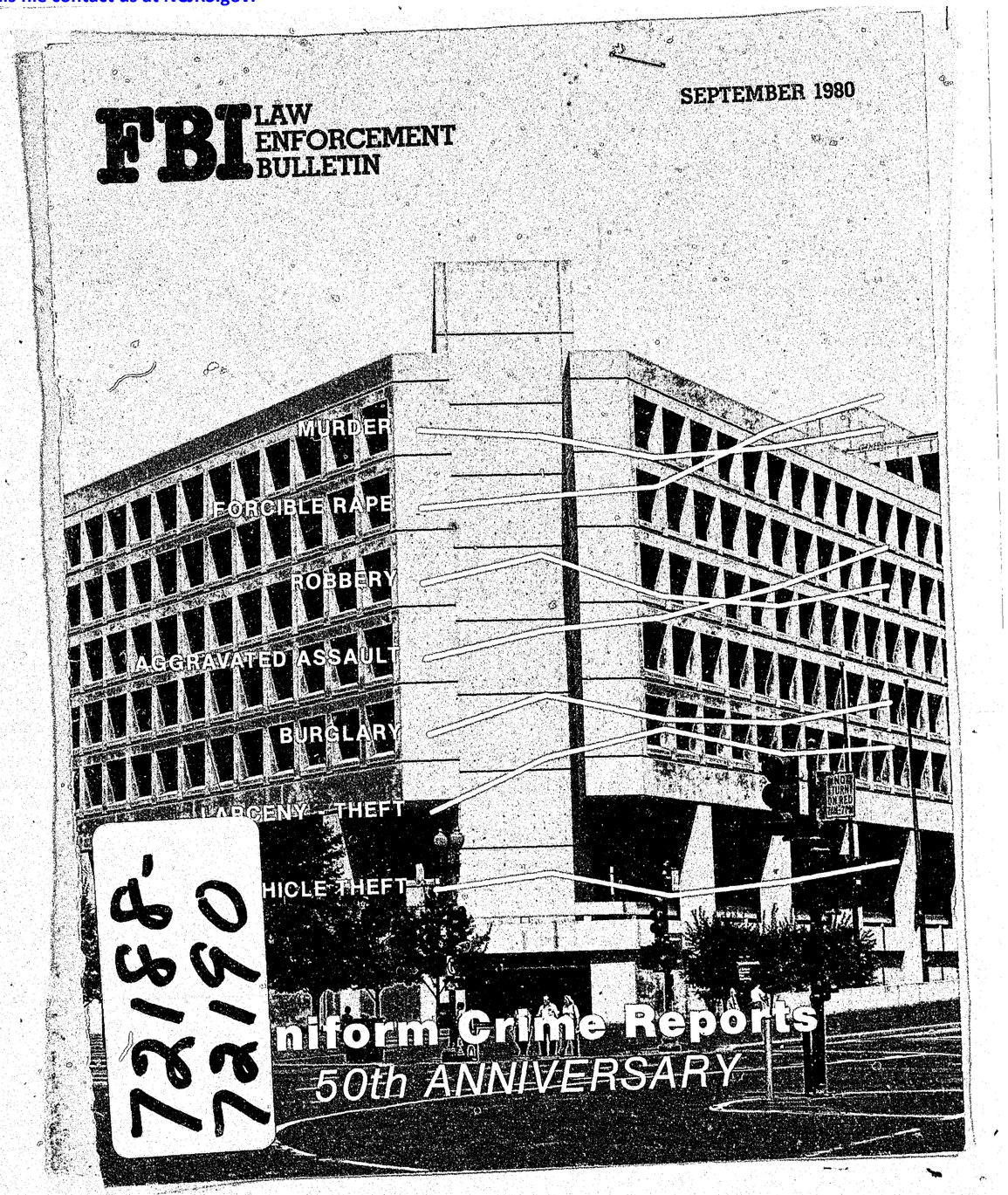

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THE COVER: This month, the FBI's Uniform Crime Reporting Program completes 50 years of service to the law enforcement community. See story p. 2.

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William H. Webster, Director

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AGE VS. FAT

Effect on Physical Performance of Police Officers

By PAUL O. DAVIS, Ph. D.
and ALBERT R. STARCK, M.A.
Institute of Human Performance
Fairfax, Va.

Law enforcement administrators have traditionally and typically advocated that police officers should have a youthful physical profile. The prevailing attitude is that older individuals are not able to perform the required physical duties of the job. There appears universal acceptance of the requirement that recruits possess a high level of physical fitness. Maximum hiring ages have been implemented, apparently with the feeling that youth is a prerequisite for excellence in health and fitness. However, there are a number of older individuals who have maintained their physical abilities and possess equal, and in some cases superior, physical profiles to much younger persons. It is believed that individuals who exceed maximum hiring ages should be allowed to demonstrate their level of fitness rather than being judged unfit based on an arbitrary age cutoff.

To establish age as a bonafide occupational qualification and use age cutoffs to exclude older applicants, the following criteria must be met:

1) It must be demonstrated that virtually all individuals who exceed the cutoff age are incapable of performing the physical job requirements;

2) Tests do not exist to distinguish effectively between individuals who can and cannot perform the job; or

3) The cost of developing such tests are prohibitively expensive.

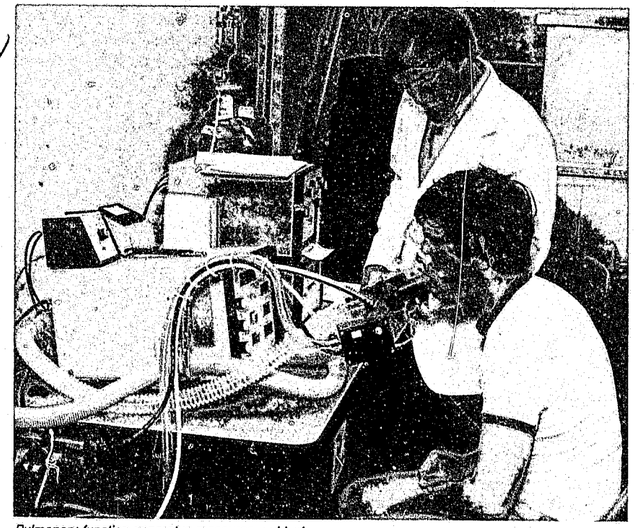
In light of our research findings, none of these conditions exists. Inexpensive tests are available which are quite effective in establishing an individual's ability to perform various physical tasks. The question that is more difficult to answer is whether the aging process automatically results in declining physical fitness.

Dr. Davis

Mr. Starck

In an effort to answer this question, we evaluated the current fitness levels of 671 male and female police officers in the Washington, D.C., metropolitan area. Each officer underwent a laboratory evaluation designed to determine such fitness attributes as aerobic capacity, muscular strength and endurance, flexibility, and percentage of body fat. Simple tests such as pushups, standing broad jump, and a measure of flexibility (figure 1) were employed, along with more elaborate tests requiring laboratory equipment. Aerobic capacity, or one's ability to endure rigorous activity, was measured on a treadmill. The longer one remained on the treadmill, the greater his aerobic capacity. This test was also used to detect heart and blood pressure abnormalities. Body composition (percent body fat) was determined by measuring each subject's buoyancy when totally submerged in a tank of water. The more tendency he had to float, the higher the percentage of fat. An added feature of this test was that each subject received a recommended optimal body weight. Muscular strength was determined by measuring both grip strength and shoulder strength with force measuring devices. These measures have proved to be quite reliable in predicting overall body strength.

Table 1 lists the average test values for the police officers studied. The 19.8-percent body fat figure is the typical average value at which we previously arrived when studying other public safety workers. It is approximately the same value as normal sedentary Americans of similar ages. However, the normal sedentary person is not expected to perform dangerous law enforcement tasks that place their lives and the lives of others in jeopardy. Police officers should possess an average percentage of body fat closer to 16 percent.



Pulmonary function apparatus measures residual volume and forced expiratory volume in one second.

Handgrip (dynamometer) measures grip strength.

Table 1
Descriptive and Normative Data

Variable	Mean
Age (years)	33.3
Weight (lbs)	185.5
Fat weight (lbs)	37.6
Percent fat (%)	19.8
Height (in.)	70.8
Pushups	29.3
Situps	40.6
Hip Flexibility (inches)	12.54
Long Jump (inches)	80.75
Total strength score (kg)	224.2
Treadmill time (min.)	10.6

Table 2

Correlation Coefficients: Age and Percent Fat vs. Selected Test Items

Variable	Age	Fat
Pushups	−.360	−.499
Situps	−.460	−.487
Hip flexibility	−.137	−.200
Strength	.008	−.087
Jump	−.404	−.461
Treadmill	−.430	−.526

The mean result of the hip flexibility test of 12.54 inches indicates that the average officer was able to reach 1/2 inch beyond the toes. A score of 12.0 would indicate the ability to touch the toes, and each inch greater than 12 means reaching an additional inch beyond the toes. Our results show that about one-half of the officers could not touch their toes. Poor flexibility in this area of the body has been linked to a high incidence of low back problems. Disability and injury claims of any municipality will show that back injuries among police officers rank extremely high in terms of total medical payments. All other test result averages may be considered typical for police officers in general.

"The requirement for possessing and maintaining good health and fitness should not only be levied on recruits but on every officer involved in police work."

The data were next analyzed to see if any relationships could be found between age and any of the test results. We found that similar relationships existed between age and certain tests (variables) and also between percent fat and the same variables. These relationships, listed in table 2, are expressed as correlation coefficients. A relationship between two variables can be expressed mathematically as a value from −1.0 to +1.0. A value of 0.0 means that there is no relationship between the variables. Values progressing from zero to +1.0 indicate increasingly stronger relationships between two variables. One can better predict that as one variable increases, the other variable *increases* more or less equally. Values from zero and progressing to −1.0 indicate increasingly stronger relationships, so that as one variable increases, the other *decreases* more or less equally. For example, the relationship between rainfall and grass height would lie somewhere between zero and +1.0—the more rain, the higher the grass. The relationship between cloudiness and sunshine would lie between zero and −1.0—as clouds increase, sunshine decreases.

Table 2 indicates two sets of relationships. First, as age increases, performance decreases on all tests except strength. This is indicated by the negative numbers. Second, as percent fat increases, performance decreases. Notice that the numbers in both columns are very similar, which shows that there may be a strong relationship between the effects that both age and fat have on performance. In fact, it may be possible to show that what may be considered an aging effect may actually be an effect due to increased body fat.

In table 3, we have listed a number of test items and have divided the police officer population into six age groups. Notice that as age increases among the groups, the performance and body weight/fat data become poorer, certainly not an unexpected finding. The gradual increase in weight may be explained by increased amounts of body fat. The lean weight (total weight minus fat weight) remains relatively constant across the age group. It is the fat weight component that increases, which is the reason for the increasingly higher percent fat figures. Insurance height/weight charts allow an individual to carry more body fat with increased age, but from a physiological viewpoint, it is unnecessary and creates an unhealthy situation.

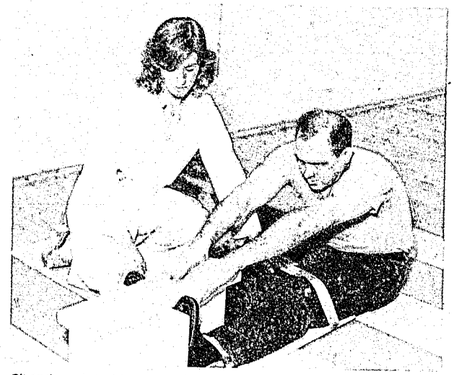
In adults, the waist girth is sensitive to changes in body fat. Table 3 shows a waist girth increase of nearly 5 inches over the six age groups. This is attributable to gains in fat weight. Our laboratory findings have clearly shown the inadvisability of using height/weight charts for determining appropriate body weight. A more sensible approach would be the application of available body weight and waist girth charts.

The decrease in performance of the other fitness items listed in table 3 corresponds with the increased amounts of body fat as the groups advance in age. This was mathematically demonstrated in table 2 with the negative correlation coefficients, i.e., as age and fat increase, performance decreases.

To answer the initial question of whether aging automatically results in decreased performance, and to investigate the degree of interaction between age and body fat on declining performance, we used a statistical technique called analysis of covariance. This technique allowed us to look at the effect one variable had on another without the confounding effect of a third variable. For instance, it is known that muscular endurance will have an impact on one's ability to perform activities such as situps. It is also known that excessive body fat has a harmful

An officer undergoes the treadmill test.

Body composition is determined by measuring an officer's buoyancy when he is totally submerged in a tank of water.



Sit and reach test for measuring hip flexibility.

Table 3

Unadjusted Means for Selected Test Items

Variables	<24	25 to 29	30 to 34	35 to 39	40 to 45	>45
Weight (lbs)	171.38	181.22	186.40	187.43	191.69	191.92
Lean weight (lbs)	146.55	147.92	148.38	147.68	147.35	145.34
Fat weight (lbs)	24.77	33.25	37.97	39.70	44.26	46.58
Waist girth (in.)	33.01	34.56	35.87	36.38	37.51	37.91
Percent fat	14.19	17.95	20.04	20.72	22.727	23.94
Pushups	36.25	34.96	29.89	25.8	21.87	19.97
Situps	49.13	47.61	42.26	35.81	29.86	24.27
Hip flex (in.)	13.42	12.77	12.70	12.62	11.64	10.72
Long jump (in.)	89.58	83.16	82.38	77.96	74.74	72.03
Strength (kgs)	215.779	223.21	225.96	224.295	223.219	217.69
Time on treadmill	11.96	11.26	10.78	9.926	9.643	8.95

Table 4

Adjusted Means for Selected Test Items

Variable	<24	25 to 29	30 to 44	35 to 39	40 to 45	>45
Weight (lbs)	171.38	172.7	173.2	172.5	172.4	169.9
Waist girth (in.)	33.01	33.04	33.50	33.71	34.12	34.00
Pushups	36.25	38.62	35.58	32.20	30.17	29.40
Situps	49.13	50.43	48.20	42.49	38.53	34.17
Treadmill time (min.)	11.96	11.67	11.46	11.54	10.63	10.1

effect on the performance of situps and that older individuals usually perform poorly on this test. Our review of these statistical correlations indicates that body fat may be acting simultaneously with aging in reducing performance of situps, as well as other physical performance tests. Using analysis of covariance allowed us to consider what the age group scores would be if we could assume all groups had the same body fat (no increases with age). Table 4 contains the age group means for several important test items previously listed in table 3. These averages, called "adjusted means," have been statistically adjusted based on all age groups maintaining a constant 14.19-percent body fat equal to the youngest age group. Notice that for weight and waist girth, the scores for all age groups remained virtually identical. The performance of pushups, situps, and treadmill time show much less decline than on table 3. Not all of the decrease in performance is accounted for by body fat—some is still attributed to other aging effects. The largest measure of loss, however, is due to excessive amounts of body fat.

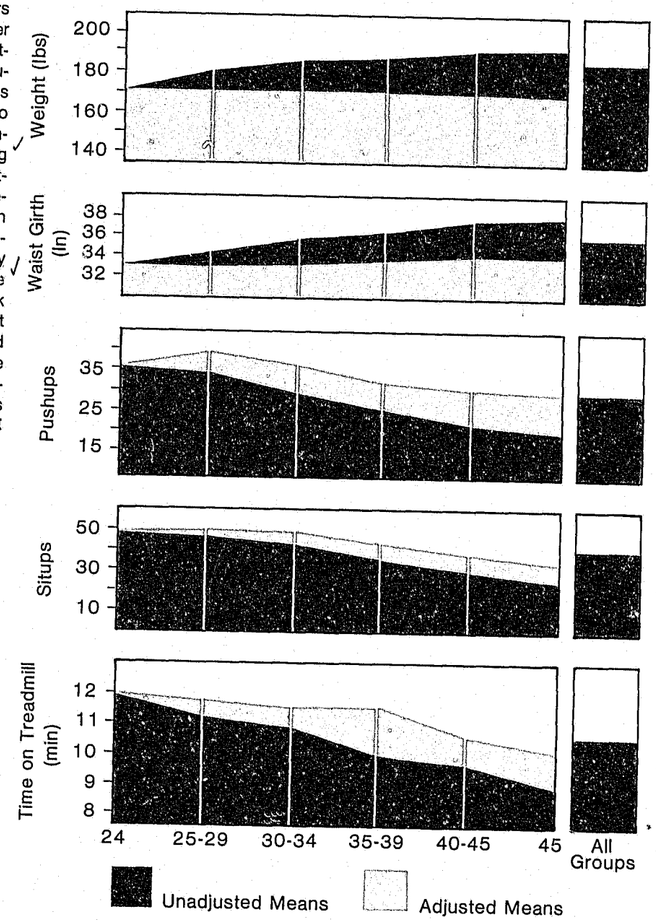
Figure 1 is a graph of the numbers from tables 3 and 4. The dark areas are the "unadjusted" or actual results, while the light areas represent the "adjusted" mean results. The figure graphically illustrates the improvement in test performance that may be attained by maintaining a lower percentage of body fat. Older individuals who retain youthful levels of body fat, usually less than 16 percent, can generally be expected to perform physically demanding tasks at levels equivalent to much younger persons. This is especially true of tasks requiring movement of the body itself—pushups, situps, jumping, climbing, and running. Strength tests involving little or no body movement usually show no relation to amounts of body fat. Table 2 shows virtually no relationship between strength and age (.008) or percent fat (.087).

Age cutoff standards, when used as a job selection criterion, may be discriminatory and unreliable. In fact, many of the physically fit, older officers we tested demonstrated much better health and fitness profiles than the out-of-shape younger officers. The only judicious method of determining who is physically qualified for police work is to test physically applicants and incumbents. The requirement for possessing and maintaining good health and fitness should not only be levied on recruits but on every officer involved in police work. Those officers who possess high aerobic capacity, low body fat, and good muscular fitness have reduced heart disease and low back injury risk factors. All law enforcement personnel, regardless of age, should be physically fit. The benefits accrue immediately, not just in on-the-job performance but in other aspects of life as well.

FBI

Figure 1

Age Group Comparison of Adjusted and Unadjusted Mean Scores



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