

Basic Data on Spirometry in Adults 25-74 Years of Age

United States, 1971-75

This report presents basic data on forced respiratory function by age, sex, race, and smoking status, as evidenced on the Forced Expiratory Spirogram test from the findings of the first National Health and Nutrition Examination Survey.

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In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

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PREFACE

The National Center for Health Statistics has as its mission the collection, analysis, and dissemination of data on the health of the population of the United States. One of the major programs is the Health Examination Survey, in which are conducted extensive examinations of a sample of the U.S. population. Data from this survey have been published periodically in Series 11 reports of *Vital and Health Statistics*.

Historically the published documents in Series 11 present only a small fraction of the available data. In order to make additional data available for users, the Center has for many years had a policy of preparing public-use tapes for purchase by persons interested in more detailed analysis or analysis of additional variables not published in Series 11 reports. These data, however, are only easily accessible to persons with computers and support staff who can read, interpret, and analyze the data. In order to make these data more generally accessible to many users and, in particular, to persons not able to directly use data tapes, the Division of Health Examination Statistics, in the autumn of 1977, initiated a program to release, along with the data tapes, basic descriptive summary tables of data contained in those tapes. These tabular summaries have been termed "basic data publications," of which this report is one.

These basic data publications present findings of the Health and Nutrition Examination Survey of 1971-75. For each of the data sets, these publications include information on the methods used to collect the data, a descriptive summary of the tables included, an index to the tables, and the tables themselves. An appendix describes the basic format of the associated data tape. More detailed information on use of the data for additional analysis is available on request from the staff of the Division of Health Examination Statistics.

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SYMBOLS

Data not available-----	---
Category not applicable-----	...
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Quantity more than 0 but less than 0.05----	0.0
Figure does not meet standards of reliability or precision-----	*

BASIC DATA ON SPIROMETRY IN ADULTS 25-74 YEARS OF AGE

Richard J. O'Brien, M.D.^a and Terence A. Drizd, M.S.P.H.^b

INTRODUCTION

This report summarizes some respiratory function test findings from the first National Health and Nutrition Examination Survey, conducted in 1971-75 among U.S. adults. The findings are based on Forced Expiratory Spirogram test results, which were obtained from standardized detailed examinations administered to a national probability sample of adults 25-74 years of age. The sample was selected to represent the adult civilian noninstitutionalized population of the coterminous United States. Data collection started in April 1971 and, for the 25-74-year age group given the detailed examination, continued through October 1975. A total of 6,913 persons received the detailed examination.

This detailed examination focused primarily on cardiovascular disease, arthritis and rheumatic conditions, respiratory conditions, hearing deficiencies, and determination of current and unmet health care needs of adults. Along with spirometry, the detailed examinees received: supplementary medical history, health care needs, and general well-being questionnaires; a pulmonary diffusion test; chest, hip, knee, hand, and wrist X-rays; audiometric, electrocardiographic, goniometric, and additional laboratory determinations; as well as all questionnaires, procedures, and measurements administered to ex-

aminees who received only the more limited nutrition examination and related components.

Pulmonary function tests—a Forced Expiratory Spirogram and a test of single breath carbon monoxide diffusion capacity—were administered to all examinees not disqualified by the physician for medical reasons. Other data collected relating to the respiratory system included posterior-anterior and lateral chest X-rays and responses to two questionnaires: the General Medical History and the Medical History Supplement. Those individuals who indicated that they had ever had certain respiratory symptoms or illnesses also completed a Supplementary Respiratory Questionnaire. The forms used to collect these data and a description of the plan and operation of the survey are presented elsewhere.^{1, 2}

These data are recorded on microdata tapes, which are available for purchase. Additional variables not included in this report are also available on the tapes for persons interested in more detailed analyses.

This report describes the pulmonary function tests and presents tabular results for selected spirometric variables for this population. Also included is a discussion of the nonresponse bias introduced because not all examinees were suitable for pulmonary function testing, and of those tested not all performed satisfactorily.

For completeness, the findings for examinees whose test results were deemed unreliable are included separately in the detailed tables. National estimates from most of these unreliable test data will also be unreliable because of the small number of persons involved. That is, they

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will have confidence limits too great to meet the standards of reliability or precision set for National Center for Health Statistics publications (standard errors of no more than one-fourth the size of the statistic). These estimates are included solely to show the extent to which and among which groups reliable tests could not be obtained.

Appendix I contains the age, sex, and race distribution of the civilian noninstitutionalized U.S. population at the midpoint of the survey, the distribution of the probability sample drawn from it, and a brief description of the statistical design of the survey. Appendix II gives definitions of demographic terms used in this report. Appendix III provides a glossary of spirometric terms. Data reduction procedures and computer algorithms used to generate spirometric values are described briefly in appendix IV. A discussion of the spirometric training and retraining received by the technicians, as well as a description of relevant quality control procedures, can be found in appendix V. A summary of the spirometry microdata tape can be found in appendix VI.

SOURCES AND LIMITATIONS OF DATA

Spirometry was performed with an Ohio Medical Instruments Model 800 electronic spirometer. The output from the spirometer consisted of a volume signal which was recorded (along with a derived flow signal) on a nine-track magnetic tape recorder after being converted to a digital format. The instrument was calibrated according to a standardized procedure prior to testing each subject.

Each participant suitable for spirometric testing performed the Forced Expiratory Spirogram (FES), a procedure involving one or two practice forced vital capacity (FVC, the total amount of gas expired) trials, followed by five regular FVC trials. An FVC trial consists of a maximal inspiration followed by maximal forced expiration through a mouthpiece into the spirometer. If two reproducible, procedurally correct trials were not found among the five trials, the examinee rested for a few minutes and then performed another five trials. If reproduci-

bility and acceptability were still not demonstrated for any pair of trials, the examinee rested for at least 15 minutes and then performed a final set of 5 trials.

A set of 55 spirometric measurements (see appendix VI for listing) was generated for each acceptable trial, after all volume and flow data were corrected to BTPS (body temperature and pressure, saturated with water vapor). A thorough description of the computerized data reduction and parameter generation has been published.³

With the exception of the calculation of zero time (the point on the volume-time tracing that defines the beginning of the examinee effort) and the length of time data were recorded, the spirometric equipment and measurement generation methodology met all criteria for standardization of spirometry established by the American Thoracic Society (ATS) in 1979.⁴

In the first National Health and Nutrition Examination Survey (NHANES I) program, zero time was based on a flow threshold of 1 liter per second. Further analysis indicated that values of FEV_{1.0} (the amount of gas expired in the first second) based on the flow threshold method were similar to those obtained by the triangular method and manual calculations, while those obtained by the extrapolation method and by the volume threshold method yielded higher values for FEV_{1.0}. A discussion of these analyses and the rationale for using the flow threshold method for calculation of zero time appear elsewhere.³

The NHANES I spirometry equipment limited data collection for each trial to 9.18 seconds and, since the examinee effort was begun after the recording equipment had been turned on, most trials had an effective limit of about 8 seconds. The ATS recommends that data be recorded for a minimum of 10 seconds. Limiting FVC_t (the time required to reach the maximum expired volume) to 9.18 seconds would not affect the results obtained from healthy subjects, but would result in the rejection of a number of trials from subjects with airways obstruction, thereby favoring the retention of trials with lower FVC_t's and correspondingly lower FVC's, higher FEV_{1.0}/FVC ratios, and higher flow rates at most lung volumes in such subjects.

Of the 6,913 subjects selected for the detailed examination, spirometric data were obtained for 5,544 (80 percent). Sixteen percent of the latter, 862 subjects, did not have reproducible best trials. Thus, totally satisfactory data were obtained for 4,682 examinees (68 percent of total). This nonresponse bias, comprising those with no data or with no reproducible best trials, includes a disproportionate number of black persons and older individuals (appendix table II). Thus the representativeness of the test data for certain subgroups (e.g., 65-74-year-old black women) may be suspect. There is no way to determine the quantitative impact of this bias (or if such an impact even exists), but it does appear that the causes of nonreproducibility are not related directly to health status. The conclusion remains that these data are the most representative estimates of reproducible spirometric function available for the U.S. adult population.

HIGHLIGHTS

The results of spirometric testing, in which measurements of vital or lung capacity and functioning are obtained, are a function of respiratory system mechanics and of understanding and cooperation on the part of the subject. Thus results that deviate from those expected may be due to pulmonary disease, submaximal subject effort, or a combination of the two.

Population estimates for U.S. adults based on NHANES I findings are presented for nine

parameters, either measured or derived from time-volume tracings (see figure 1). They are as follows:

- FVC — Forced vital capacity, the volume of gas expired during the FES.
- FEV_{1.0} — Forced expiratory volume at 1 second, the amount of gas expired by the end of the first second of the expiration.
- FEV_{1.0}/FVC — Ratio of FEV_{1.0} to FVC, expressed as a percentage.
- Peak Flow — Peak instantaneous flow rate.
- FEF_{200-1,200} — Average forced expiratory flow rate between the first 200 and 1,200 milliliters (ml) of the FVC.
- FEF_{25-75%} — Average forced expiratory flow rate between 25 percent and 75 percent of FVC.
- FEF_{25%} — Instantaneous expiratory flow rate at 25 percent of FVC.
- FEF_{50%} — Instantaneous expiratory flow rate at 50 percent of FVC.
- FEF_{75%} — Instantaneous expiratory flow rate at 75% percent of FVC.

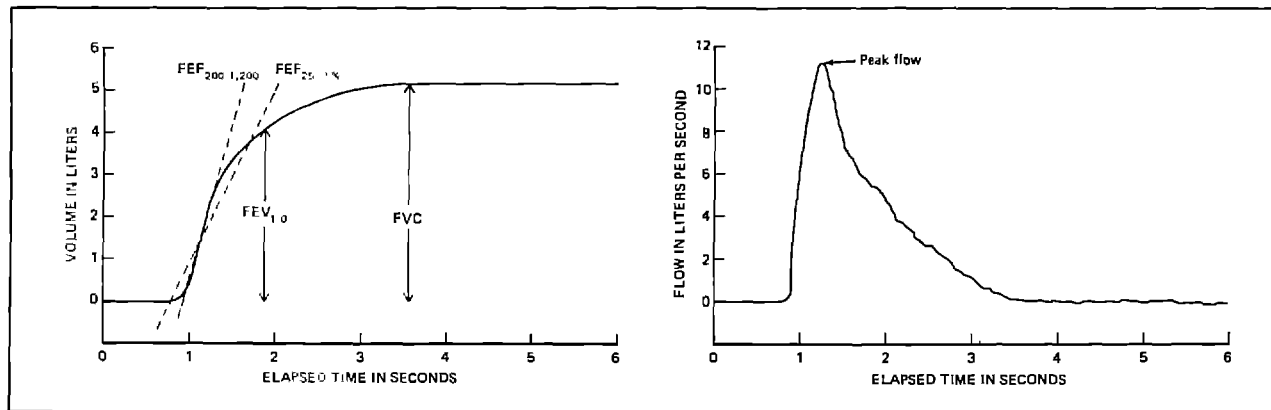


Figure 1. Sample time-volume and time-flow tracings

These measurements are commonly used in routine spirometric testing and in clinical and epidemiological studies.

Although not purported to be nationally representative, "normal" values for these spirometric variables, determined by testing groups of healthy, nonsmoking subjects, have been published.^{5,6} Predicted values are based on testing such subjects under laboratory conditions. In the present analysis those subjects with respiratory symptoms, a past or current history of respiratory illnesses, or abnormal chest X-rays have not been separated out. Thus it is expected that, for subgroups containing sizable numbers of "abnormal" individuals, the mean values would fall below predicted values for the various parameters.

Of the factors found to influence spirometric test results in normal individuals, age, sex, and height are most important.^{7,8} Cigarette smoking and race also affect the results.⁹ Other factors, such as socioeconomic status, health status, and exposure to atmospheric pollutants may also play a role. A complete analysis of these and other variables is beyond the scope of this report.

Table 1 presents population estimates of U.S. adults' FVC values by age, sex, race, and smoking status, based on tests of those subjects with reproducible best trials. For the majority of the subgroups the results are as expected and, for the nonsmokers, usually fall within ± 10 percent of the previously referenced normal values. FVC decreases with age, is lower in women and black persons, and is inversely related to smoking. These patterns (which are significant at the 5-percent or less level) are most clearly shown for the subgroups with the largest numbers of subjects, that is, white males and white females. For example, white males' FVC decreases from 5,277 ml for the age group 25-34 years to 3,563 ml for the age group 65-74 years. With the exception of the 35-44-year age group, white males categorized by smoking status show a decrease in FVC with smoking, and current smokers have lower values than ex-smokers. (Smoking status has been variously defined in published studies. See appendix III for a definition of the categorization used in this report.) These differences persist even after the groups

are subdivided by age. Observed results that deviate from the expected (for example, black male nonsmokers generally have lower FVC values than current smokers and ex-smokers in comparable age groups) are in part due to differences in mean height and age, but are most likely explained by the large sampling errors associated with small counts in the subgroups. For example, there are only 41 black male nonsmokers and 96 black female nonsmokers.

Table 1 also presents FVC values for those subjects who performed spirometry but did not have two reproducible best trials. The mean values for the individual subgroups are in general lower than comparable values for those with reproducible best trials. Although this may be a result of differences in age, height, health status, and sampling error, it is more likely that the lower values are a consequence of these subjects' inability to reproduce a maximal effort during testing. Data for subjects with nonreproducible best trials will not be considered in this and subsequent analyses.

Table 2 gives results for the $FEV_{1.0}$. Although the results depend greatly on subject effort, the $FEV_{1.0}$ is inversely related to the amount of obstruction in larger airways. As this "obstruction" may result from narrowed airways (for example, asthma) or from loss of supporting structure around airways (for example, emphysema), $FEV_{1.0}$ decreases with both increasing age and with smoking, and it decreases to a relatively greater degree than does the FVC. A better measure of obstruction is the ratio of the $FEV_{1.0}$ to the FVC (usually expressed as a percent), and this is shown in table 3. The greatest relative decrease in $FEV_{1.0}$ is in older smokers.

Table 4 gives the peak flow which is the maximal expiratory flow derived from the time-volume tracing. A comparable measure from the volume-time tracing, the average flow between the first 200 and 1,200 ml of expired volume ($FEF_{200-1,200}$) (see figure 1), is given in table 5. Both variables depend greatly on subject effort, and the values are decreased in the presence of obstruction in larger airways. As with the other variables presented, the results for peak flow and $FEF_{200-1,200}$ agree closely with published normal values for the nonsmokers in the

survey. Table 6 shows the forced expiratory flow at the point when 25 percent of FVC is expired ($FEF_{25\%}$). This variable is closely related to peak flow and $FEF_{200-1,200}$; it occurs in the early part of the forced expiration, is greatly effort dependent, and is affected by large airways obstruction.

Table 7, forced expiratory flow at 50 percent of the FVC ($FEF_{50\%}$) and table 8, mid-expiratory flow rate (the average flow between 25 and 75 percent of the FVC, $FEF_{25-75\%}$), present similar data: Both variables are measured from the time-volume tracing and both are estimates of flow during the middle part of the expiration (see figure 1). Reduction of flow rates in the midportion of the FVC may be attributable to decreased subject effort and to obstruction in both large and small airways. Again, the same variables noted earlier (age, sex, and smoking) for the other spirometric parameters also affect the $FEF_{25-75\%}$ and the $FEF_{50\%}$. As mentioned before, results from this survey

usually fall within ± 10 percent of published normal values.

The final spirometric variable presented in this report, forced expiratory flow after 75 percent of the FVC is expired ($FEF_{75\%}$), is shown in table 9. This measurement is made in what is referred to as the "effort independent" portion of the flow-volume tracing. Reductions in flow rates at this lower lung volume are believed to be caused primarily by resistance to airflow in the smaller airways. As with other spirometric variables, $FEF_{75\%}$ is primarily affected by age, sex, and smoking, and the results presented are as expected. At present there are no totally satisfactory normal values for comparison. Values of $FEF_{75\%}$ for the NHANES I survey are substantially lower than Knudson's values for a representative sample of white residents of Tucson, Arizona.¹⁰ Reasons for this discrepancy are not totally clear, but similar differences have been found in other unpublished data.¹¹



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Table 1. Forced vital capacity (FVC) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age:
United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
		Milliliters				Milliliters		
25-34 years.....	10,372	5,277	789	55	157	4,824	836	632
35-44 years.....	7,942	4,838	778	76	237	3,649	748	606
45-54 years.....	7,620	4,423	753	56	666	3,546	1,038	324
55-64 years.....	5,729	4,060	812	83	738	2,967	1,038	255
65-74 years.....	2,877	3,563	764	86	719	3,024	973	158
White females								
25-34 years.....	9,679	3,717	507	40	1,386	3,546	835	203
35-44 years.....	7,699	3,604	524	46	757	3,244	812	213
45-54 years.....	7,585	3,282	532	39	1,352	2,695	657	110
55-64 years.....	5,175	2,884	517	41	2,185	2,748	976	240
65-74 years.....	3,312	2,605	547	61	1,811	2,299	622	76
Black males								
25-34 years.....	880	4,584	706	169	96	*4,361	295	1,392
35-44 years.....	673	3,986	649	203	137	*3,500	810	1,686
45-54 years.....	749	4,005	685	185	66	*3,218	1,095	938
55-64 years.....	399	3,756	720	257	100	*3,837	519	1,042
65-74 years.....	227	3,392	555	166	84	2,651	561	264
Black females								
25-34 years.....	926	3,200	481	109	348	3,204	717	304
35-44 years.....	852	3,137	372	64	286	2,673	544	227
45-54 years.....	520	2,831	512	136	407	2,565	838	350
55-64 years.....	264	2,464	472	210	355	2,215	759	253
65-74 years.....	164	2,425	525	200	211	1,929	569	214
NONSMOKERS								
White males								
25-34 years.....	2,633	5,480	769	138	24	*4,407	1,148	2,599
35-44 years.....	1,669	4,761	759	139	42	*4,307	-	3,517
45-54 years.....	1,206	4,506	795	138	96	*3,372	1,050	1,087
55-64 years.....	885	4,263	756	175	111	*3,936	1,088	1,415
65-74 years.....	481	3,867	774	202	113	3,015	968	425
White females								
25-34 years.....	4,128	3,712	464	47	812	3,477	922	351
35-44 years.....	3,609	3,607	530	73	455	3,118	771	238
45-54 years.....	3,736	3,340	522	55	683	2,761	595	149
55-64 years.....	2,781	2,932	526	54	1,170	2,640	705	124
65-74 years.....	2,413	2,602	481	61	1,307	2,339	646	101
Black males								
25-34 years.....	158	4,494	674	366	56	*4,237	265	2,834
35-44 years.....	111	*4,382	403	1,972	9	*2,947	-	2,406
45-54 years.....	123	3,381	809	841	20	*3,016	391	2,035
55-64 years.....	114	3,942	982	758	13	*3,598	653	2,453
65-74 years.....	52	3,144	736	625	7	*2,163	583	1,571
Black females								
25-34 years.....	295	3,247	397	182	146	3,307	1,009	576
35-44 years.....	297	3,195	435	151	64	*2,763	512	1,099
45-54 years.....	254	2,880	556	201	167	2,722	1,032	463
55-64 years.....	165	2,436	420	516	283	2,157	778	303
65-74 years.....	129	2,289	417	198	158	2,032	602	238

See note at end of table.

Table 1. Forced vital capacity (FVC) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
		Milliliters				Milliliters		
25-34 years.....	1,547	5,285	759	167	67	*4,711	478	2,605
35-44 years.....	1,977	5,046	773	126	-	-	-	-
45-54 years.....	2,394	4,502	785	99	208	3,830	1,362	933
55-64 years.....	1,970	4,252	778	120	217	3,031	1,252	573
65-74 years.....	1,344	3,577	791	132	208	2,901	791	310
White females								
25-34 years.....	1,452	3,760	533	107	123	4,038	865	476
35-44 years.....	1,269	3,631	449	73	114	*3,245	601	1,079
45-54 years.....	978	3,291	543	118	139	2,826	793	559
55-64 years.....	843	3,044	489	108	320	*3,652	1,744	1,192
65-74 years.....	499	2,675	568	150	253	2,380	523	217
Black males								
25-34 years.....	51	*4,897	303	1,905	-	-	-	-
35-44 years.....	45	*3,939	237	1,865	82	*4,149	-	3,388
45-54 years.....	187	3,972	580	542	-	-	-	-
55-64 years.....	71	3,679	705	777	-	-	-	-
65-74 years.....	60	3,649	494	506	29	*2,693	332	859
Black females								
25-34 years.....	32	*3,043	193	2,033	-	-	-	-
35-44 years.....	100	*3,139	285	880	18	*2,677	71	1,786
45-54 years.....	46	*3,310	183	2,214	-	-	-	-
55-64 years.....	20	*2,862	171	1,913	5	*2,144	-	1,751
65-74 years.....	31	*2,959	608	1,432	2	*2,282	-	1,863
SMOKERS								
White males								
25-34 years.....	6,192	5,189	789	74	66	*5,085	899	1,760
35-44 years.....	4,296	4,773	770	102	194	3,506	752	804
45-54 years.....	4,020	4,352	712	80	361	3,428	746	330
55-64 years.....	2,874	3,866	805	109	410	2,671	669	273
65-74 years.....	1,052	3,406	674	105	397	3,091	1,052	280
White females								
25-34 years.....	4,100	3,707	538	66	450	3,535	578	224
35-44 years.....	2,822	3,588	546	76	187	3,550	931	571
45-54 years.....	2,871	3,204	532	61	530	2,576	675	181
55-64 years.....	1,551	2,712	467	86	695	2,513	553	144
65-74 years.....	400	2,533	815	305	250	2,011	497	147
Black males								
25-34 years.....	672	4,581	728	199	40	*4,536	242	2,147
35-44 years.....	517	3,904	685	253	47	*2,469	261	1,660
45-54 years.....	439	4,194	572	145	46	*3,304	1,273	1,146
55-64 years.....	214	3,682	509	208	87	*3,874	485	1,213
65-74 years.....	115	3,370	416	197	48	*2,700	627	838
Black females								
25-34 years.....	599	3,185	525	151	202	3,129	367	408
35-44 years.....	455	3,098	338	93	205	2,645	573	406
45-54 years.....	220	2,673	424	145	240	*2,456	644	635
55-64 years.....	79	*2,418	570	1,022	66	2,471	645	590
65-74 years.....	4	*2,689	-	2,196	51	*1,594	256	519

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 2. Forced expiratory volume at 1 second (FEV_{1.0}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
<u>White males</u>								
		Milliliters				Milliliters		
25-34 years.....	10,372	4,200	629	42	157	3,743	713	522
35-44 years.....	7,942	3,722	654	60	237	2,740	676	503
45-54 years.....	7,620	3,324	643	46	666	2,672	888	267
55-64 years.....	5,729	2,950	674	60	738	2,032	715	196
65-74 years.....	2,877	2,527	649	72	719	2,012	805	124
<u>White females</u>								
25-34 years.....	9,679	3,062	412	30	1,386	2,837	557	137
35-44 years.....	7,699	2,869	411	33	757	2,593	746	207
45-54 years.....	7,585	2,536	434	31	1,352	1,994	550	84
55-64 years.....	5,175	2,226	424	37	2,185	2,096	833	214
65-74 years.....	3,312	1,991	465	50	1,811	1,714	454	56
<u>Black males</u>								
25-34 years.....	880	3,669	623	153	96	*3,440	687	1,204
35-44 years.....	673	3,205	573	175	137	*2,524	454	1,175
45-54 years.....	749	3,041	569	142	66	*2,376	451	602
55-64 years.....	399	2,747	445	145	100	*2,379	349	635
65-74 years.....	227	2,477	445	141	84	1,781	527	268
<u>Black females</u>								
25-34 years.....	926	2,614	462	107	348	2,332	399	148
35-44 years.....	852	2,503	307	62	286	2,092	286	139
45-54 years.....	520	2,205	410	106	407	1,869	461	182
55-64 years.....	264	1,938	363	153	355	1,563	498	135
65-74 years.....	164	1,852	296	125	211	1,451	479	182
NONSMOKERS								
<u>White males</u>								
25-34 years.....	2,633	4,404	584	100	24	*3,620	787	2,092
35-44 years.....	1,669	3,742	591	107	42	*3,391	-	2,769
45-54 years.....	1,206	3,487	626	103	96	*2,714	987	939
55-64 years.....	885	3,214	529	114	111	*2,627	871	1,002
65-74 years.....	481	2,856	627	151	113	2,178	643	292
<u>White females</u>								
25-34 years.....	4,128	3,096	372	38	812	2,816	654	253
35-44 years.....	3,609	2,907	397	54	455	2,440	605	183
45-54 years.....	3,736	2,631	401	41	683	2,114	514	123
55-64 years.....	2,781	2,289	401	42	1,170	2,009	492	79
65-74 years.....	2,413	2,005	400	52	1,307	1,763	462	73
<u>Black males</u>								
25-34 years.....	158	3,580	627	320	56	*3,862	264	2,585
35-44 years.....	111	*3,566	407	1,617	9	*2,257	-	1,843
45-54 years.....	123	*2,515	640	650	20	*2,402	173	1,608
55-64 years.....	114	2,986	464	376	13	*2,607	613	1,803
65-74 years.....	52	2,514	637	519	7	*1,712	356	1,204
<u>Black females</u>								
25-34 years.....	295	2,707	435	212	146	2,465	491	330
35-44 years.....	297	2,595	302	102	64	*2,041	86	721
45-54 years.....	254	2,225	451	165	167	1,898	519	252
55-64 years.....	165	1,969	354	423	283	1,586	535	184
65-74 years.....	129	1,818	297	140	158	1,528	501	208

See note at end of table.

Table 2. Forced expiratory volume at 1 second (FEV_{1,0}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
		Milliliters				Milliliters		
25-34 years.....	1,547	4,242	590	113	67	*3,593	609	2,061
35-44 years.....	1,977	3,978	660	106	-	-	-	-
45-54 years.....	2,394	3,418	675	90	208	2,906	1,041	696
55-64 years.....	1,970	3,117	643	80	217	1,918	656	277
65-74 years.....	1,344	2,533	681	108	208	2,076	707	249
White females								
25-34 years.....	1,452	3,091	441	82	123	3,178	314	165
35-44 years.....	1,269	2,916	360	68	114	*2,581	541	859
45-54 years.....	978	2,535	454	96	139	2,001	554	356
55-64 years.....	843	2,320	456	120	320	*3,003	1,570	1,070
65-74 years.....	499	2,020	487	128	253	1,756	354	145
Black males								
25-34 years.....	51	*4,097	529	1,640	-	-	-	-
35-44 years.....	45	*3,359	243	1,595	82	*2,862	-	2,337
45-54 years.....	187	3,121	452	428	-	-	-	-
55-64 years.....	71	2,783	521	579	-	-	-	-
65-74 years.....	60	2,662	378	401	29	*1,896	386	665
Black females								
25-34 years.....	32	*2,634	116	1,758	-	-	-	-
35-44 years.....	100	*2,573	264	726	18	*2,093	210	1,403
45-54 years.....	46	*2,635	122	1,761	-	-	-	-
55-64 years.....	20	*2,312	34	1,542	5	*1,674	-	1,367
65-74 years.....	31	*1,974	272	908	2	*1,577	-	1,283
SMOKERS								
White males								
25-34 years.....	6,192	4,103	635	57	66	3,938	735	1,363
35-44 years.....	4,296	3,596	639	84	194	2,598	667	623
45-54 years.....	4,020	3,219	609	66	361	2,527	717	307
55-64 years.....	2,874	2,755	677	75	410	1,932	611	251
65-74 years.....	1,052	2,369	552	82	397	1,932	881	222
White females								
25-34 years.....	4,100	3,017	434	55	450	2,782	348	124
35-44 years.....	2,822	2,800	439	59	187	2,973	991	614
45-54 years.....	2,871	2,413	437	49	530	1,836	555	154
55-64 years.....	1,551	2,064	400	75	695	1,826	419	98
65-74 years.....	400	1,868	714	257	250	1,415	384	113
Black males								
25-34 years.....	672	3,657	616	166	40	*2,845	657	1,424
35-44 years.....	517	3,114	591	212	47	*1,983	318	1,349
45-54 years.....	439	3,153	508	127	46	*2,366	526	729
55-64 years.....	214	2,607	337	100	87	*2,344	271	719
65-74 years.....	115	2,364	319	182	48	*1,722	604	580
Black females								
25-34 years.....	599	2,568	479	122	202	2,235	278	295
35-44 years.....	455	2,428	299	89	205	2,108	327	298
45-54 years.....	220	2,091	326	85	240	1,848	415	450
55-64 years.....	79	*1,776	339	735	66	1,454	294	286
65-74 years.....	4	*2,016	-	1,646	51	*1,207	299	414

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 3. Percent ratio of forced expiratory volume at 1 second to forced vital capacity (FEV_{1,0}/FVC) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
<u>White males</u>								
		Percent				Percent		
25-34 years.....	10,372	79.8	6.4	0.5	157	77.9	8.8	5.5
35-44 years.....	7,942	77.0	7.1	0.6	237	74.3	9.7	10.0
45-54 years.....	7,620	75.2	7.1	0.5	666	75.0	12.9	4.0
55-64 years.....	5,729	72.5	8.3	0.8	738	69.4	13.7	3.7
65-74 years.....	2,877	70.6	9.3	1.2	719	65.9	14.4	2.8
<u>White females</u>								
25-34 years.....	9,679	82.6	6.4	0.5	1,386	81.3	10.1	2.2
35-44 years.....	7,699	79.9	6.0	0.5	757	80.1	11.8	2.6
45-54 years.....	7,585	77.4	6.1	0.4	1,352	73.8	12.0	2.2
55-64 years.....	5,175	77.2	5.8	0.5	2,185	76.3	9.0	1.3
65-74 years.....	3,312	76.4	6.6	0.8	1,811	75.1	9.7	1.1
<u>Black males</u>								
25-34 years.....	880	80.1	6.7	1.8	96	*79.7	17.9	28.7
35-44 years.....	673	80.3	5.2	1.5	137	*73.2	5.7	33.0
45-54 years.....	749	76.0	6.3	1.1	66	77.6	14.1	18.7
55-64 years.....	399	73.9	8.0	2.3	100	*62.4	7.7	16.5
65-74 years.....	227	73.2	6.6	1.9	84	67.0	14.7	7.1
<u>Black females</u>								
25-34 years.....	926	81.6	7.2	1.7	348	74.2	11.7	5.2
35-44 years.....	852	80.0	5.8	1.7	286	79.5	7.9	2.9
45-54 years.....	520	78.1	5.8	1.7	407	75.7	14.3	6.4
55-64 years.....	264	79.0	5.3	2.3	355	72.7	13.7	4.8
65-74 years.....	164	77.6	8.3	3.0	211	74.7	9.8	4.1
NONSMOKERS								
<u>White males</u>								
25-34 years.....	2,633	80.7	5.9	1.0	24	*83.5	6.5	45.7
35-44 years.....	1,669	78.8	5.2	0.9	42	*78.7	-	64.3
45-54 years.....	1,206	77.5	6.0	1.1	96	*77.1	11.8	21.9
55-64 years.....	885	75.8	5.1	1.3	111	*67.3	14.1	24.3
65-74 years.....	481	73.5	7.6	1.6	113	72.8	10.2	4.9
<u>White females</u>								
25-34 years.....	4,128	83.7	5.9	0.6	812	82.2	9.4	3.1
35-44 years.....	3,609	80.9	5.7	0.7	455	79.5	13.5	4.3
45-54 years.....	3,736	79.0	5.8	0.6	683	76.9	10.7	3.3
55-64 years.....	2,781	78.2	4.9	0.6	1,170	77.0	9.1	1.5
65-74 years.....	2,413	77.1	6.0	0.8	1,307	76.2	10.0	1.4
<u>Black males</u>								
25-34 years.....	158	79.5	5.6	3.2	56	*91.1	0.5	60.7
35-44 years.....	111	*81.2	2.8	36.2	9	*76.6	-	62.5
45-54 years.....	123	74.2	4.9	14.6	20	*80.2	4.1	53.6
55-64 years.....	114	77.4	7.7	5.5	13	*71.6	4.8	47.9
65-74 years.....	52	79.6	4.5	9.4	7	*80.1	3.4	53.5
<u>Black females</u>								
25-34 years.....	295	83.2	7.4	3.8	146	77.2	13.5	8.4
35-44 years.....	297	81.5	4.1	1.4	64	*75.6	9.7	28.2
45-54 years.....	254	77.4	6.2	2.7	167	72.7	10.2	4.0
55-64 years.....	165	80.8	3.6	15.6	283	75.4	12.7	4.9
65-74 years.....	129	79.9	6.1	2.5	158	74.7	9.5	4.5

See note at end of table.

Table 3. Percent ratio of forced expiratory volume at 1 second to forced vital capacity (FEV_{1,0}/FVC) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
<u>White males</u>								
		Percent				Percent		
25-34 years.....	1,547	80.6	6.5	1.4	67	*76.2	11.9	42.9
35-44 years.....	1,977	78.9	6.9	1.2	-	-	-	-
45-54 years.....	2,394	75.9	7.1	0.9	208	77.2	7.7	9.8
55-64 years.....	1,970	73.2	7.9	1.1	217	65.4	14.4	6.2
65-74 years.....	1,344	70.3	9.7	1.7	208	70.6	14.8	4.8
<u>White females</u>								
25-34 years.....	1,452	82.4	5.8	1.2	123	81.6	14.8	7.9
35-44 years.....	1,269	80.5	5.3	1.1	114	*79.4	9.3	25.4
45-54 years.....	978	77.0	5.0	1.0	139	71.2	16.1	11.6
55-64 years.....	843	76.0	6.6	2.2	320	80.9	6.5	3.2
65-74 years.....	499	75.3	6.6	1.6	253	74.3	8.9	3.0
<u>Black males</u>								
25-34 years.....	51	*83.4	6.3	32.5	-	-	-	-
35-44 years.....	45	*85.3	3.2	40.3	82	*69.0	-	56.3
45-54 years.....	187	79.0	7.0	9.5	-	-	-	-
55-64 years.....	71	76.4	9.5	13.8	-	-	-	-
65-74 years.....	60	73.3	7.0	8.7	29	*70.7	14.6	24.6
<u>Black females</u>								
25-34 years.....	32	*86.7	1.6	57.8	-	-	-	-
35-44 years.....	100	*81.9	2.5	22.4	18	*78.0	5.9	52.1
45-54 years.....	46	*79.7	0.8	53.1	-	-	-	-
55-64 years.....	20	*81.0	3.4	54.1	5	*78.1	-	63.8
65-74 years.....	31	*68.4	9.9	32.0	2	*68.8	-	56.2
SMOKERS								
<u>White males</u>								
25-34 years.....	6,192	79.3	6.5	0.7	66	*77.5	3.4	24.5
35-44 years.....	4,296	75.5	7.4	0.9	194	73.3	10.5	15.2
45-54 years.....	4,020	74.0	7.2	0.8	361	73.2	15.2	6.9
55-64 years.....	2,874	71.0	9.1	1.1	410	72.0	12.7	4.6
65-74 years.....	1,052	69.6	9.2	1.7	397	61.4	13.7	3.9
<u>White females</u>								
25-34 years.....	4,100	81.7	6.8	0.9	450	79.6	9.3	3.6
35-44 years.....	2,822	78.2	6.2	0.7	187	82.2	8.2	4.6
45-54 years.....	2,871	75.4	6.3	0.7	530	70.5	11.4	3.3
55-64 years.....	1,551	76.0	6.6	1.1	695	73.0	8.5	2.6
65-74 years.....	400	73.6	8.7	2.9	250	70.3	6.8	2.0
<u>Black males</u>								
25-34 years.....	672	80.0	6.8	2.5	40	*63.6	18.1	32.7
35-44 years.....	517	79.7	5.5	1.9	47	*80.0	4.0	53.4
45-54 years.....	439	75.2	6.0	1.2	46	*76.5	16.5	22.6
55-64 years.....	214	71.2	6.4	3.6	87	*61.0	7.1	19.1
65-74 years.....	115	70.2	4.9	2.5	48	*62.8	14.1	18.9
<u>Black females</u>								
25-34 years.....	599	80.6	7.0	1.8	202	72.1	9.5	9.8
35-44 years.....	455	78.6	6.9	2.9	205	80.8	6.9	9.5
45-54 years.....	220	78.5	5.8	2.4	240	*77.8	16.3	19.6
55-64 years.....	79	*74.5	5.9	29.0	66	60.9	11.8	12.4
65-74 years.....	4	*75.0	-	61.2	51	*75.0	10.8	23.3

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 4. Peak flow rate of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
Milliliters per minute								
25-34 years.....	10,372	10,348	1,734	148	157	8,359	2,092	1,431
35-44 years.....	7,942	9,915	1,676	152	237	7,415	2,469	1,768
45-54 years.....	7,620	8,943	1,858	131	620	7,777	2,061	688
55-64 years.....	5,729	8,076	1,840	181	738	6,246	2,032	640
65-74 years.....	2,877	7,318	1,691	189	719	5,848	2,043	395
White females								
25-34 years.....	9,679	7,123	1,136	94	1,386	6,402	1,619	390
35-44 years.....	7,699	6,942	1,103	99	743	6,057	1,280	314
45-54 years.....	7,585	6,432	1,095	91	1,352	5,482	1,365	253
55-64 years.....	5,175	6,257	1,150	125	2,160	5,774	1,652	364
65-74 years.....	3,306	5,586	1,150	122	1,773	5,108	1,042	155
Black males								
25-34 years.....	880	9,522	1,654	389	96	*8,910	2,117	3,243
35-44 years.....	673	9,159	2,009	686	137	*8,256	1,863	4,088
45-54 years.....	749	8,267	2,147	615	66	6,502	862	1,545
55-64 years.....	399	7,281	1,847	536	100	*4,929	1,027	1,430
65-74 years.....	227	7,169	1,293	434	84	5,359	1,901	1,050
Black females								
25-34 years.....	926	6,742	1,586	434	348	5,832	1,449	478
35-44 years.....	852	6,781	1,032	201	286	5,412	678	234
45-54 years.....	520	6,302	1,100	256	407	5,165	1,199	425
55-64 years.....	264	6,034	1,275	503	355	4,936	1,195	380
65-74 years.....	164	5,170	1,044	382	209	4,423	1,144	414
NONSMOKERS								
White males								
25-34 years.....	2,633	10,292	1,666	269	24	*8,909	2,275	5,153
35-44 years.....	1,669	10,166	1,515	272	42	*11,815	-	9,647
45-54 years.....	1,206	9,447	1,856	333	96	*7,196	1,762	2,288
55-64 years.....	885	8,482	1,513	298	111	*6,176	1,929	2,165
65-74 years.....	481	7,937	1,878	468	113	5,754	1,579	713
White females								
25-34 years.....	4,128	7,153	1,091	146	812	6,544	1,873	750
35-44 years.....	3,609	7,067	1,068	142	442	5,990	1,340	422
45-54 years.....	3,736	6,529	1,048	116	683	5,789	1,407	377
55-64 years.....	2,781	6,363	1,074	139	1,144	5,673	1,359	254
65-74 years.....	2,407	5,686	1,166	142	1,284	5,028	1,026	181
Black males								
25-34 years.....	158	9,269	2,152	1,110	56	*10,010	1,042	6,735
35-44 years.....	111	*10,925	1,432	4,983	9	*4,490	-	3,666
45-54 years.....	123	*6,731	2,069	1,996	20	*7,261	565	4,862
55-64 years.....	114	8,254	1,244	913	13	*6,518	1,387	4,480
65-74 years.....	52	7,545	1,424	1,235	7	*3,994	669	2,757
Black females								
25-34 years.....	295	7,423	1,882	990	146	6,529	1,584	546
35-44 years.....	297	7,189	1,013	346	64	*5,313	606	1,942
45-54 years.....	254	6,442	1,200	436	167	5,233	1,566	710
55-64 years.....	165	5,870	1,257	1,287	283	4,906	1,245	465
65-74 years.....	129	5,343	1,046	440	156	4,682	1,188	482

See note at end of table.

Table 4. Peak flow rate of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute								
25-34 years.....	1,547	10,853	1,588	292	67	*7,934	1,879	4,560
35-44 years.....	1,977	10,560	1,769	309	-	-	-	-
45-54 years.....	2,394	9,167	1,713	244	185	*8,743	2,596	2,290
55-64 years.....	1,970	8,395	1,676	237	217	6,169	2,345	1,065
65-74 years.....	1,344	7,422	1,743	305	208	6,577	2,282	849
White females								
25-34 years.....	1,452	7,096	1,188	247	123	7,237	1,005	614
35-44 years.....	1,269	6,970	1,076	257	114	*6,823	1,097	2,220
45-54 years.....	978	6,627	1,093	207	139	5,340	1,088	840
55-64 years.....	843	6,372	1,127	267	320	*7,144	2,684	1,794
65-74 years.....	499	5,469	924	206	249	5,518	993	421
Black males								
25-34 years.....	51	*11,404	1,158	4,472	-	-	-	-
35-44 years.....	45	*9,216	903	4,397	82	*9,745	-	7,957
45-54 years.....	187	8,197	1,892	1,451	-	-	-	-
55-64 years.....	71	8,053	1,483	1,684	-	-	-	-
65-74 years.....	60	7,393	1,399	1,209	29	*6,830	2,055	2,695
Black females								
25-34 years.....	32	*5,986	371	4,000	-	-	-	-
35-44 years.....	100	*7,021	978	2,068	18	*4,890	766	3,305
45-54 years.....	46	*7,195	121	4,798	-	-	-	-
55-64 years.....	20	*7,041	1,396	4,836	5	*5,130	-	4,189
65-74 years.....	31	*4,298	433	1,954	2	*4,264	-	3,482
SMOKERS								
White males								
25-34 years.....	6,192	10,245	1,775	185	66	*8,626	2,149	3,170
35-44 years.....	4,296	9,521	1,579	214	194	6,461	1,520	1,537
45-54 years.....	4,020	8,658	1,891	200	339	7,415	1,574	720
55-64 years.....	2,874	7,732	1,969	256	410	6,306	1,873	824
65-74 years.....	1,052	6,904	1,403	195	397	5,491	1,924	614
White females								
25-34 years.....	4,100	7,102	1,161	126	450	5,918	1,000	376
35-44 years.....	2,822	6,771	1,136	121	187	5,752	1,037	492
45-54 years.....	2,871	6,240	1,127	152	530	5,125	1,281	396
55-64 years.....	1,551	6,005	1,252	227	695	5,308	1,010	254
65-74 years.....	400	5,132	1,185	423	241	5,116	1,075	350
Black males								
25-34 years.....	672	9,439	1,452	399	40	*7,362	2,272	3,880
35-44 years.....	517	8,774	1,982	765	47	*6,367	241	4,249
45-54 years.....	439	8,728	2,065	639	46	*6,177	757	1,754
55-64 years.....	214	6,504	1,872	896	87	*4,685	690	1,535
65-74 years.....	115	6,881	1,091	724	48	*4,689	1,308	1,519
Black females								
25-34 years.....	599	6,447	1,340	346	202	5,328	1,094	934
35-44 years.....	455	6,462	945	284	205	5,488	668	660
45-54 years.....	220	5,953	940	310	240	5,118	852	1,241
55-64 years.....	79	*6,116	1,144	2,517	66	5,051	998	993
65-74 years.....	4	*6,219	-	5,078	51	*3,631	460	1,115

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 5. Maximal expiratory flow rate (FEF_{200-1,200}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
<u>White males</u>								
		Milliliters per minute				Milliliters per minute		
25-34 years.....	10,372	8,819	1,762	145	157	6,924	2,336	1,643
35-44 years.....	7,942	8,250	1,880	173	237	*5,417	2,192	1,514
45-54 years.....	7,620	7,278	1,965	138	631	5,790	2,325	771
55-64 years.....	5,691	6,313	2,020	185	724	3,881	2,287	725
65-74 years.....	2,868	5,415	2,112	232	709	3,731	2,301	394
<u>White females</u>								
25-34 years.....	9,679	5,968	1,150	85	1,386	5,080	1,610	367
35-44 years.....	7,699	5,767	1,140	88	757	4,561	1,494	336
45-54 years.....	7,585	5,080	1,289	97	1,347	3,655	1,641	285
55-64 years.....	5,175	4,596	1,351	129	2,152	3,828	1,758	330
65-74 years.....	3,312	3,768	1,431	148	1,763	3,023	1,405	185
<u>Black males</u>								
25-34 years.....	880	7,776	1,551	385	96	*6,779	2,564	2,927
35-44 years.....	673	7,567	1,722	566	137	*6,150	1,579	3,072
45-54 years.....	749	6,450	2,066	595	66	*5,039	997	1,309
55-64 years.....	399	6,003	1,722	435	100	*3,904	949	1,156
65-74 years.....	227	5,486	1,700	611	84	*2,872	1,592	898
<u>Black females</u>								
25-34 years.....	926	5,386	1,509	417	348	4,298	1,381	446
35-44 years.....	852	5,409	1,160	213	286	3,577	1,213	529
45-54 years.....	520	4,583	1,355	348	401	3,162	1,450	595
55-64 years.....	264	4,008	1,656	695	352	2,515	1,469	419
65-74 years.....	164	3,594	1,018	437	194	2,291	1,453	567
NONSMOKERS								
<u>White males</u>								
25-34 years.....	2,633	8,834	1,561	252	24	*7,251	2,632	4,509
35-44 years.....	1,669	8,519	1,710	317	42	*9,193	-	7,506
45-54 years.....	1,206	7,805	2,106	393	85	*6,430	1,306	2,135
55-64 years.....	885	6,727	1,524	324	111	*4,553	1,461	1,748
65-74 years.....	472	6,526	1,863	469	113	4,012	1,804	864
<u>White females</u>								
25-34 years.....	4,128	5,993	1,078	136	812	5,277	1,762	677
35-44 years.....	3,609	5,923	1,058	138	455	4,549	1,536	472
45-54 years.....	3,736	5,268	1,185	129	677	4,020	1,551	428
55-64 years.....	2,781	4,824	1,264	139	1,137	3,828	1,422	219
65-74 years.....	2,413	3,880	1,391	171	1,267	3,181	1,325	233
<u>Black males</u>								
25-34 years.....	158	7,680	1,974	1,059	56	*8,000	1,511	5,495
35-44 years.....	111	*8,773	856	3,958	9	*3,471	-	2,834
45-54 years.....	123	*4,761	1,877	1,641	20	*5,703	188	3,805
55-64 years.....	114	7,046	1,092	826	13	*5,341	1,805	3,832
65-74 years.....	52	*5,572	2,113	1,479	7	*2,831	795	2,070
<u>Black females</u>								
25-34 years.....	295	5,979	1,840	948	146	4,966	1,563	978
35-44 years.....	297	5,787	1,077	358	64	*2,372	908	1,203
45-54 years.....	254	4,606	1,500	582	161	3,398	1,592	807
55-64 years.....	165	*4,053	1,573	1,149	280	2,530	1,490	524
65-74 years.....	129	3,730	1,063	488	145	*2,574	1,512	680

See note at end of table.

Table 5. Maximal expiratory flow rate (FEF_{200-1,200}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute					Milliliters per minute			
25-34 years.....	1,547	9,123	1,891	373	67	*6,316	2,285	4,001
35-44 years.....	1,977	8,804	1,990	338	-	-	-	-
45-54 years.....	2,394	7,435	1,856	284	185	*6,724	2,251	1,875
55-64 years.....	1,970	6,607	1,988	286	203	3,927	2,046	961
65-74 years.....	1,344	5,459	2,240	370	199	4,668	2,576	1,004
White females								
25-34 years.....	1,452	5,964	1,153	239	123	5,679	911	535
35-44 years.....	1,269	5,771	1,022	227	114	*5,164	1,474	1,785
45-54 years.....	978	5,146	1,398	272	139	*3,503	1,663	965
55-64 years.....	843	4,671	1,297	314	320	*5,054	2,528	1,642
65-74 years.....	499	3,868	1,463	328	253	3,265	1,367	586
Black males								
25-34 years.....	51	*9,591	542	3,731	-	-	-	-
35-44 years.....	45	*7,555	471	3,578	82	*7,389	-	6,033
45-54 years.....	187	6,180	1,629	1,146	-	-	-	-
55-64 years.....	71	6,828	1,659	1,620	-	-	-	-
65-74 years.....	60	6,031	1,787	1,318	29	*3,330	1,308	1,457
Black females								
25-34 years.....	32	*5,194	470	3,480	-	-	-	-
35-44 years.....	100	*5,976	423	1,690	18	*3,085	842	2,142
45-54 years.....	46	*5,986	330	4,004	-	-	-	-
55-64 years.....	20	*6,178	1,314	4,262	5	*3,628	-	2,962
65-74 years.....	31	*3,111	645	1,475	2	*2,679	-	2,187
SMOKERS								
White males								
25-34 years.....	6,192	8,737	1,799	171	66	*7,420	2,123	2,844
35-44 years.....	4,296	7,890	1,811	257	194	*4,598	1,443	1,213
45-54 years.....	4,020	7,027	1,943	200	361	5,160	2,348	1,080
55-64 years.....	2,836	5,981	2,120	255	410	*3,677	2,533	1,167
65-74 years.....	1,052	4,862	1,824	265	397	3,181	2,106	532
White females								
25-34 years.....	4,100	5,944	1,218	137	450	4,562	1,310	545
35-44 years.....	2,822	5,566	1,256	133	187	4,221	1,273	578
45-54 years.....	2,871	4,812	1,333	158	530	3,228	1,637	444
55-64 years.....	1,551	4,148	1,421	265	695	3,263	1,520	381
65-74 years.....	400	2,969	1,373	454	243	1,943	1,369	444
Black males								
25-34 years.....	672	7,662	1,398	431	40	*5,061	2,751	3,216
35-44 years.....	517	7,309	1,818	693	47	*4,491	728	3,056
45-54 years.....	439	7,039	1,997	580	46	*4,754	1,066	1,492
55-64 years.....	214	5,171	1,576	601	87	*3,684	418	1,155
65-74 years.....	115	5,163	1,323	924	48	*2,605	1,766	1,434
Black females								
25-34 years.....	599	5,104	1,261	331	202	3,815	982	728
35-44 years.....	455	5,038	1,193	386	205	3,994	1,046	692
45-54 years.....	220	4,262	1,096	269	240	*3,003	1,322	952
55-64 years.....	79	*3,352	1,383	1,713	66	*2,363	1,391	911
65-74 years.....	4	*2,943	-	2,403	47	*1,392	769	747

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 6. Forced expiratory flow rate at 25 percent of forced vital capacity (FEF_{25%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
		Milliliters per minute				Milliliters per minute		
25-34 years.....	10,372	7,762	1,672	122	157	6,552	1,774	1,189
35-44 years.....	7,942	7,323	1,866	171	237	*5,431	2,048	1,386
45-54 years.....	7,620	6,620	1,893	130	666	5,356	2,387	744
55-64 years.....	5,729	5,991	1,959	187	738	3,935	2,189	726
65-74 years.....	2,877	5,173	2,005	230	719	3,809	2,105	380
White females								
25-34 years.....	9,679	5,793	1,073	72	1,386	4,969	1,384	319
35-44 years.....	7,699	5,619	1,065	73	757	4,813	1,368	302
45-54 years.....	7,585	5,075	1,196	84	1,352	3,964	1,635	283
55-64 years.....	5,175	4,848	1,189	113	2,185	4,224	1,863	387
65-74 years.....	3,312	4,227	1,316	141	1,811	3,631	1,340	180
Black males								
25-34 years.....	880	7,167	1,607	364	96	*7,005	3,168	3,322
35-44 years.....	673	7,278	1,475	448	137	*5,636	417	2,558
45-54 years.....	749	6,096	2,047	531	66	*5,138	1,520	1,442
55-64 years.....	399	5,720	1,689	388	100	*4,349	760	1,175
65-74 years.....	227	5,703	1,495	488	84	*3,208	1,543	866
Black females								
25-34 years.....	926	5,430	1,661	438	348	4,342	1,315	504
35-44 years.....	852	5,526	1,212	290	286	3,742	1,340	590
45-54 years.....	520	5,022	1,379	368	407	3,370	1,342	488
55-64 years.....	264	4,885	1,532	623	355	3,458	1,295	373
65-74 years.....	164	4,123	1,191	474	211	2,936	1,364	476
NONSMOKERS								
White males								
25-34 years.....	2,633	7,871	1,513	239	24	*7,240	1,762	4,238
35-44 years.....	1,669	7,715	1,545	295	42	*8,084	-	6,601
45-54 years.....	1,206	7,262	1,796	303	96	*6,434	2,557	2,389
55-64 years.....	885	6,545	1,588	372	111	*4,528	1,541	1,863
65-74 years.....	481	6,097	1,951	483	113	4,191	1,374	610
White females								
25-34 years.....	4,128	5,852	1,040	124	812	4,980	1,458	522
35-44 years.....	3,609	5,758	952	100	455	4,765	1,356	413
45-54 years.....	3,736	5,252	1,141	101	683	4,420	1,603	435
55-64 years.....	2,781	4,996	1,091	122	1,170	4,112	1,390	228
65-74 years.....	2,413	4,329	1,304	160	1,307	3,740	1,269	221
Black males								
25-34 years.....	158	6,834	1,735	1,048	56	*8,713	140	5,810
35-44 years.....	111	*7,542	1,195	3,467	9	*4,082	-	3,333
45-54 years.....	123	*4,743	1,595	1,482	20	*5,985	807	4,043
55-64 years.....	114	6,904	1,058	832	13	*5,212	1,491	3,667
65-74 years.....	52	6,068	1,848	1,353	7	*3,004	749	2,157
Black females								
25-34 years.....	295	5,721	2,089	1,048	146	5,053	1,323	551
35-44 years.....	297	5,946	1,096	407	64	*2,232	815	1,084
45-54 years.....	254	5,074	1,361	523	167	3,630	1,576	733
55-64 years.....	165	*4,831	1,547	1,244	283	3,483	1,260	438
65-74 years.....	129	4,419	992	447	158	3,263	1,358	517

See note at end of table.

Table 5. Maximal expiratory flow rate (FEF_{200-1,200}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute					Milliliters per minute			
25-34 years.....	1,547	9,123	1,891	373	67	*6,316	2,285	4,001
35-44 years.....	1,977	8,804	1,990	338	-	-	-	-
45-54 years.....	2,394	7,435	1,856	284	185	*6,724	2,251	1,875
55-64 years.....	1,970	6,607	1,988	286	203	3,927	2,046	961
65-74 years.....	1,344	5,459	2,240	370	199	4,668	2,576	1,004
White females								
25-34 years.....	1,452	5,964	1,153	239	123	5,679	911	535
35-44 years.....	1,269	5,771	1,022	227	114	*5,164	1,474	1,785
45-54 years.....	978	5,146	1,398	272	139	*3,503	1,663	965
55-64 years.....	843	4,671	1,297	314	320	*5,054	2,528	1,642
65-74 years.....	499	3,868	1,463	328	253	3,265	1,367	586
Black males								
25-34 years.....	51	*9,591	542	3,731	-	-	-	-
35-44 years.....	45	*7,555	471	3,578	82	*7,389	-	6,033
45-54 years.....	187	6,180	1,629	1,146	-	-	-	-
55-64 years.....	71	6,828	1,659	1,620	-	-	-	-
65-74 years.....	60	6,031	1,787	1,318	29	*3,330	1,308	1,457
Black females								
25-34 years.....	32	*5,194	470	3,480	-	-	-	-
35-44 years.....	100	*5,976	423	1,690	18	*3,085	842	2,142
45-54 years.....	46	*5,986	330	4,004	-	-	-	-
55-64 years.....	20	*6,178	1,314	4,262	5	*3,628	-	2,962
65-74 years.....	31	*3,111	645	1,475	2	*2,679	-	2,187
SMOKERS								
White males								
25-34 years.....	6,192	8,737	1,799	171	66	*7,420	2,123	2,844
35-44 years.....	4,296	7,890	1,811	257	194	*4,598	1,443	1,213
45-54 years.....	4,020	7,027	1,943	200	361	5,160	2,348	1,080
55-64 years.....	2,836	5,981	2,120	255	410	*3,677	2,533	1,167
65-74 years.....	1,052	4,862	1,824	265	397	3,181	2,106	532
White females								
25-34 years.....	4,100	5,944	1,218	137	450	4,562	1,310	545
35-44 years.....	2,822	5,566	1,256	133	187	4,221	1,273	578
45-54 years.....	2,871	4,812	1,333	158	530	3,228	1,637	444
55-64 years.....	1,551	4,148	1,421	265	695	3,263	1,520	381
65-74 years.....	400	2,969	1,373	454	243	1,943	1,369	444
Black males								
25-34 years.....	672	7,662	1,398	431	40	*5,061	2,751	3,216
35-44 years.....	517	7,309	1,818	693	47	*4,491	728	3,056
45-54 years.....	439	7,039	1,997	580	46	*4,754	1,066	1,492
55-64 years.....	214	5,171	1,576	601	87	*3,684	418	1,155
65-74 years.....	115	5,163	1,323	924	48	*2,605	1,766	1,434
Black females								
25-34 years.....	599	5,104	1,261	331	202	3,815	982	728
35-44 years.....	455	5,038	1,193	386	205	3,994	1,046	692
45-54 years.....	220	4,262	1,096	269	240	*3,003	1,322	952
55-64 years.....	79	*3,352	1,383	1,713	66	*2,363	1,391	911
65-74 years.....	4	*2,943	-	2,403	47	*1,392	769	747

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 6. Forced expiratory flow rate at 25 percent of forced vital capacity (FEF_{25%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
Milliliters per minute								
25-34 years.....	10,372	7,762	1,672	122	157	6,552	1,774	1,189
35-44 years.....	7,942	7,323	1,866	171	237	*5,431	2,048	1,386
45-54 years.....	7,620	6,620	1,893	130	666	5,356	2,387	744
55-64 years.....	5,729	5,991	1,959	187	738	3,935	2,189	726
65-74 years.....	2,877	5,173	2,005	230	719	3,809	2,105	380
White females								
25-34 years.....	9,679	5,793	1,073	72	1,386	4,969	1,384	319
35-44 years.....	7,699	5,619	1,065	73	757	4,813	1,368	302
45-54 years.....	7,585	5,075	1,196	84	1,352	3,964	1,635	283
55-64 years.....	5,175	4,848	1,189	113	2,185	4,224	1,863	387
65-74 years.....	3,312	4,227	1,316	141	1,811	3,631	1,340	180
Black males								
25-34 years.....	880	7,167	1,607	364	96	*7,005	3,168	3,322
35-44 years.....	673	7,278	1,475	448	137	*5,636	417	2,558
45-54 years.....	749	6,096	2,047	531	66	*5,138	1,520	1,442
55-64 years.....	399	5,720	1,689	388	100	*4,349	760	1,175
65-74 years.....	227	5,703	1,495	488	84	*3,208	1,543	866
Black females								
25-34 years.....	926	5,430	1,661	438	348	4,342	1,315	504
35-44 years.....	852	5,526	1,212	290	286	3,742	1,340	590
45-54 years.....	520	5,022	1,379	368	407	3,370	1,342	488
55-64 years.....	264	4,885	1,532	623	355	3,458	1,295	373
65-74 years.....	164	4,123	1,191	474	211	2,936	1,364	476
NONSMOKERS								
White males								
25-34 years.....	2,633	7,871	1,513	239	24	*7,240	1,762	4,238
35-44 years.....	1,669	7,715	1,545	295	42	*8,084	-	6,601
45-54 years.....	1,206	7,262	1,796	303	96	*6,434	2,557	2,389
55-64 years.....	885	6,545	1,588	372	111	*4,528	1,541	1,863
65-74 years.....	481	6,097	1,951	483	113	4,191	1,374	610
White females								
25-34 years.....	4,128	5,852	1,040	124	812	4,980	1,458	522
35-44 years.....	3,609	5,758	952	100	455	4,765	1,356	413
45-54 years.....	3,736	5,252	1,141	101	683	4,420	1,603	435
55-64 years.....	2,781	4,996	1,091	122	1,170	4,112	1,390	228
65-74 years.....	2,413	4,329	1,304	160	1,307	3,740	1,269	221
Black males								
25-34 years.....	158	6,834	1,735	1,048	56	*8,713	140	5,810
35-44 years.....	111	*7,542	1,195	3,467	9	*4,082	-	3,333
45-54 years.....	123	*4,743	1,595	1,482	20	*5,985	807	4,043
55-64 years.....	114	6,904	1,058	832	13	*5,212	1,491	3,667
65-74 years.....	52	6,068	1,848	1,353	7	*3,004	749	2,157
Black females								
25-34 years.....	295	5,721	2,089	1,048	146	5,053	1,323	551
35-44 years.....	297	5,946	1,096	407	64	*2,232	815	1,084
45-54 years.....	254	5,074	1,361	523	167	3,630	1,576	733
55-64 years.....	165	*4,831	1,547	1,244	283	3,483	1,260	438
65-74 years.....	129	4,419	992	447	158	3,263	1,358	517

See note at end of table.

Table 6. Forced expiratory flow rate at 25 percent of forced vital capacity (FEF_{25%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute								
25-34 years.....	1,547	7,959	1,795	369	67	*5,948	1,573	3,623
35-44 years.....	1,977	7,941	2,051	325	-	-	-	-
45-54 years.....	2,394	6,739	1,907	255	208	*5,568	2,357	1,607
55-64 years.....	1,970	6,337	1,831	224	217	*3,833	2,561	1,170
65-74 years.....	1,344	5,229	2,073	347	208	4,619	2,612	941
White females								
25-34 years.....	1,452	5,705	1,126	234	123	5,715	1,028	554
35-44 years.....	1,269	5,675	977	208	114	*5,303	1,496	1,826
45-54 years.....	978	5,084	1,176	213	139	*3,572	1,729	996
55-64 years.....	843	4,749	1,058	254	320	*5,937	2,896	1,890
65-74 years.....	499	4,213	1,278	294	253	3,869	1,302	528
Black males								
25-34 years.....	51	*8,301	611	3,245	-	-	-	-
35-44 years.....	45	*9,056	744	4,307	82	*5,685	-	4,642
45-54 years.....	187	6,216	1,819	1,205	-	-	-	-
55-64 years.....	71	*6,495	1,775	1,637	-	-	-	-
65-74 years.....	60	6,250	1,363	1,214	29	*3,472	1,181	1,419
Black females								
25-34 years.....	32	*5,558	672	3,738	-	-	-	-
35-44 years.....	100	*6,395	557	1,844	18	*3,717	970	2,572
45-54 years.....	46	*6,949	621	4,673	-	-	-	-
55-64 years.....	20	*6,464	1,666	4,528	5	*4,924	-	4,020
65-74 years.....	31	*2,708	919	1,410	2	*3,451	-	2,818
SMOKERS								
White males								
25-34 years.....	6,192	7,666	1,698	146	66	*6,917	1,782	2,580
35-44 years.....	4,296	6,887	1,774	226	194	*4,856	1,802	1,377
45-54 years.....	4,020	6,356	1,860	213	361	*4,946	2,247	1,030
55-64 years.....	2,874	5,583	2,058	249	410	*3,828	2,097	964
65-74 years.....	1,052	4,679	1,768	273	397	3,275	1,797	458
White females								
25-34 years.....	4,100	5,765	1,083	112	450	4,745	1,254	517
35-44 years.....	2,822	5,415	1,200	145	187	4,630	1,243	604
45-54 years.....	2,871	4,843	1,233	153	530	3,481	1,475	437
55-64 years.....	1,551	4,636	1,372	248	695	3,624	1,438	426
65-74 years.....	400	3,628	1,274	450	250	2,821	1,444	481
Black males								
25-34 years.....	672	7,160	1,589	441	40	*4,602	3,776	3,492
35-44 years.....	517	7,066	1,463	526	47	*5,845	62	3,897
45-54 years.....	439	6,425	2,098	534	46	*4,775	1,607	1,584
55-64 years.....	214	4,828	1,392	666	87	*4,217	440	1,288
65-74 years.....	115	5,252	1,213	739	48	*3,082	1,782	1,539
Black females								
25-34 years.....	599	5,280	1,424	320	202	3,828	1,041	745
35-44 years.....	455	5,061	1,183	428	205	4,213	1,137	752
45-54 years.....	220	4,558	1,128	300	240	*3,189	1,116	887
55-64 years.....	79	*4,590	1,181	1,956	66	*3,230	1,402	1,005
65-74 years.....	4	*5,390	-	4,401	51	*1,898	753	761

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 7. Forced expiratory flow rate at 50 percent of forced vital capacity (FEF_{50%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
Milliliters per minute					Milliliters per minute			
25-34 years.....	10,372	4,767	1,284	93	157	4,290	1,215	858
35-44 years.....	7,942	4,147	1,404	120	237	3,279	1,228	793
45-54 years.....	7,620	3,593	1,330	89	666	2,905	1,381	431
55-64 years.....	5,729	3,102	1,405	113	738	1,960	1,348	384
65-74 years.....	2,877	2,555	1,346	142	719	1,959	1,529	279
White females								
25-34 years.....	9,679	3,791	1,008	74	1,386	3,517	1,163	284
35-44 years.....	7,699	3,550	1,067	89	757	3,291	1,449	339
45-54 years.....	7,585	2,911	1,117	78	1,352	2,340	1,412	247
55-64 years.....	5,175	2,700	1,102	100	2,185	2,493	1,531	342
65-74 years.....	3,312	2,352	1,056	113	1,811	2,092	1,089	149
Black males								
25-34 years.....	880	4,320	1,178	300	96	*4,682	2,078	2,270
35-44 years.....	673	4,135	1,301	395	137	*2,099	479	1,086
45-54 years.....	749	3,446	1,289	231	66	*3,358	1,331	1,154
55-64 years.....	399	2,811	916	260	100	*1,797	1,124	864
65-74 years.....	227	2,677	1,270	452	84	*1,747	1,476	594
Black females								
25-34 years.....	926	3,289	1,257	271	348	2,378	1,347	485
35-44 years.....	852	3,344	1,189	297	286	2,581	994	411
45-54 years.....	520	2,832	1,014	235	407	2,281	1,223	532
55-64 years.....	264	2,665	990	414	355	1,626	936	255
65-74 years.....	164	2,418	1,154	500	211	1,749	1,080	434
NONSMOKERS								
White males								
25-34 years.....	2,633	4,998	1,255	179	24	*4,262	1,169	2,534
35-44 years.....	1,669	4,315	1,221	223	42	*4,353	-	3,554
45-54 years.....	1,206	3,972	1,287	205	96	*3,009	1,427	1,256
55-64 years.....	885	3,735	1,216	260	111	*2,566	1,492	1,385
65-74 years.....	481	3,157	1,060	238	113	2,026	995	460
White females								
25-34 years.....	4,128	3,988	965	112	812	3,547	1,303	469
35-44 years.....	3,609	3,713	989	139	455	3,245	1,390	488
45-54 years.....	3,736	3,170	1,119	129	683	2,716	1,561	424
55-64 years.....	2,781	2,886	955	101	1,170	2,308	1,111	202
65-74 years.....	2,413	2,409	992	121	1,307	2,243	1,096	182
Black males								
25-34 years.....	158	4,302	1,265	699	56	*5,625	788	3,813
35-44 years.....	111	*3,944	896	1,855	9	*3,062	-	2,500
45-54 years.....	123	*2,543	1,076	892	20	*2,853	125	1,905
55-64 years.....	114	2,938	300	212	13	*2,626	1,032	1,928
65-74 years.....	52	*3,474	1,705	1,196	7	*2,901	65	1,935
Black females								
25-34 years.....	295	3,594	1,312	655	146	*3,006	1,480	858
35-44 years.....	297	3,586	1,132	352	64	*2,041	422	840
45-54 years.....	254	2,808	929	219	167	2,165	1,015	486
55-64 years.....	165	2,617	701	632	283	1,773	843	256
65-74 years.....	129	2,729	1,046	481	158	*1,976	1,083	504

See note at end of table.

Table 7. Forced expiratory flow rate at 50 percent of forced vital capacity (FEF_{50%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
<u>White males</u>								
		Milliliters per minute				Milliliters per minute		
25-34 years.....	1,547	4,931	1,277	243	67	*4,367	1,328	2,710
35-44 years.....	1,977	4,688	1,439	241	-	-	-	-
45-54 years.....	2,394	3,749	1,418	206	208	3,368	1,292	818
55-64 years.....	1,970	3,354	1,329	190	217	*1,355	967	490
65-74 years.....	1,344	2,586	1,373	200	208	*2,814	1,952	722
<u>White females</u>								
25-34 years.....	1,452	3,674	949	169	123	3,649	1,253	668
35-44 years.....	1,269	3,588	1,033	256	114	*3,124	1,301	1,168
45-54 years.....	978	2,816	1,091	211	139	*2,037	1,141	664
55-64 years.....	843	2,711	1,432	426	320	*4,163	2,411	1,582
65-74 years.....	499	2,384	1,092	261	253	2,050	986	427
<u>Black males</u>								
25-34 years.....	51	*4,793	1,158	2,057	-	-	-	-
35-44 years.....	45	*4,627	1,174	2,364	82	*1,827	-	1,492
45-54 years.....	187	3,842	1,292	811	-	-	-	-
55-64 years.....	71	*3,672	1,153	1,026	-	-	-	-
65-74 years.....	60	*2,918	1,094	785	29	*2,421	1,726	1,669
<u>Black females</u>								
25-34 years.....	32	*3,693	82	2,463	-	-	-	-
35-44 years.....	100	*3,659	920	1,206	18	*1,681	189	1,129
45-54 years.....	46	*4,205	722	2,892	-	-	-	-
55-64 years.....	20	*3,504	380	2,358	5	*2,667	-	2,178
65-74 years.....	31	*1,073	535	666	2	*1,218	-	994
SMOKERS								
<u>White males</u>								
25-34 years.....	6,192	4,628	1,279	120	66	*4,222	1,102	1,544
35-44 years.....	4,296	3,832	1,366	165	194	*3,047	1,237	916
45-54 years.....	4,020	3,386	1,249	133	361	2,611	1,341	612
55-64 years.....	2,874	2,734	1,403	140	410	*2,117	1,362	550
65-74 years.....	1,052	2,241	1,330	245	397	1,491	1,158	319
<u>White females</u>								
25-34 years.....	4,100	3,632	1,037	130	450	3,426	811	295
35-44 years.....	2,822	3,325	1,137	140	187	*3,505	1,639	927
45-54 years.....	2,871	2,605	1,039	138	530	1,935	1,109	314
55-64 years.....	1,551	2,361	1,062	197	695	2,038	1,031	278
65-74 years.....	400	1,965	1,279	417	250	1,342	799	204
<u>Black males</u>								
25-34 years.....	672	4,288	1,151	383	40	*3,353	2,551	2,496
35-44 years.....	517	4,133	1,371	494	47	*2,391	532	1,655
45-54 years.....	439	3,531	1,224	245	46	*3,574	1,538	1,489
55-64 years.....	214	2,457	834	390	87	*1,671	1,082	1,034
65-74 years.....	115	2,190	830	583	48	*1,171	1,106	702
<u>Black females</u>								
25-34 years.....	599	3,117	1,229	270	202	*1,924	1,025	618
35-44 years.....	455	3,116	1,231	474	205	2,826	1,050	619
45-54 years.....	220	2,572	927	276	240	*2,362	1,342	912
55-64 years.....	79	*2,547	1,424	1,472	66	*913	981	671
65-74 years.....	4	*2,695	-	2,200	51	*1,062	740	590

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 8. Maximal mid-expiratory flow rate (FEF_{25-75%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males								
		Milliliters per minute				Milliliters per minute		
25-34 years.....	10,372	4,092	1,089	78	157	3,612	1,091	743
35-44 years.....	7,942	3,380	1,130	95	237	*2,511	1,043	690
45-54 years.....	7,620	2,852	1,097	78	666	2,287	1,102	326
55-64 years.....	5,729	2,350	987	72	738	1,515	886	250
65-74 years.....	2,877	1,883	891	96	719	1,479	1,151	195
White females								
25-34 years.....	9,679	3,233	849	62	1,386	2,938	1,127	260
35-44 years.....	7,699	2,852	775	61	757	2,716	1,223	310
45-54 years.....	7,585	2,341	745	53	1,352	1,773	937	163
55-64 years.....	5,175	2,033	713	64	2,185	1,893	1,165	279
65-74 years.....	3,312	1,762	690	77	1,811	1,519	801	105
Black males								
25-34 years.....	880	3,642	1,053	280	96	*4,161	2,110	2,220
35-44 years.....	673	3,234	1,005	304	137	*1,709	377	869
45-54 years.....	749	2,724	1,050	202	66	*2,277	1,033	747
55-64 years.....	399	2,164	786	232	100	*1,359	700	555
65-74 years.....	227	1,965	899	301	84	*1,357	856	388
Black females								
25-34 years.....	926	2,831	1,025	235	348	1,957	947	410
35-44 years.....	852	2,552	709	188	286	2,223	601	235
45-54 years.....	520	2,104	722	188	407	1,631	822	375
55-64 years.....	264	1,884	602	244	355	1,282	808	233
65-74 years.....	164	1,803	590	235	211	1,346	757	288
NONSMOKERS								
White males								
25-34 years.....	2,633	4,357	1,008	146	24	*3,692	846	2,135
35-44 years.....	1,669	3,501	911	163	42	*3,165	-	2,584
45-54 years.....	1,206	3,198	1,021	167	96	*2,779	1,293	1,158
55-64 years.....	885	2,730	763	163	111	*2,125	1,117	1,112
65-74 years.....	481	2,314	827	175	113	*1,758	1,081	464
White females								
25-34 years.....	4,128	3,362	822	84	812	2,975	1,140	408
35-44 years.....	3,609	2,973	727	93	455	2,590	1,162	386
45-54 years.....	3,736	2,572	703	66	683	2,059	1,044	292
55-64 years.....	2,781	2,164	663	74	1,170	1,788	765	122
65-74 years.....	2,413	1,805	610	80	1,307	1,640	824	127
Black males								
25-34 years.....	158	3,490	996	562	56	*5,494	521	3,691
35-44 years.....	111	*3,375	775	1,619	9	*2,073	-	1,693
45-54 years.....	123	*2,061	903	737	20	*2,192	156	1,466
55-64 years.....	114	2,556	509	364	13	*1,811	832	1,373
65-74 years.....	52	*2,624	1,220	876	7	*1,801	24	1,201
Black females								
25-34 years.....	295	3,076	1,042	527	146	*2,278	971	630
35-44 years.....	297	2,727	592	187	64	*2,202	525	947
45-54 years.....	254	2,032	741	276	167	1,386	488	234
55-64 years.....	165	2,057	569	498	283	1,423	779	252
65-74 years.....	129	1,917	592	253	158	1,438	797	348

See note at end of table.

Table 8. Maximal mid-expiratory flow rate (FEF_{25-75%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute								
25-34 years.....	1,547	4,246	1,067	217	67	3,635	1,311	2,331
35-44 years.....	1,977	3,860	1,260	202	-	-	-	-
45-54 years.....	2,394	3,038	1,179	158	208	*2,488	1,090	641
55-64 years.....	1,970	2,526	947	121	217	1,212	704	312
65-74 years.....	1,344	1,882	916	136	208	1,877	1,308	469
White females								
25-34 years.....	1,452	3,222	809	153	123	*3,108	1,541	794
35-44 years.....	1,269	2,945	762	169	114	*2,604	1,031	951
45-54 years.....	978	2,270	714	149	139	*1,575	776	489
55-64 years.....	843	2,006	857	260	320	*3,232	1,966	1,312
65-74 years.....	499	1,728	723	182	253	1,430	693	271
Black males								
25-34 years.....	51	*4,040	1,154	1,813	-	-	-	-
35-44 years.....	45	*4,155	714	2,040	82	*1,512	-	1,235
45-54 years.....	187	3,108	1,133	677	-	-	-	-
55-64 years.....	71	*2,619	827	722	-	-	-	-
65-74 years.....	60	*2,184	867	606	29	*1,496	735	759
Black females								
25-34 years.....	32	*3,292	34	2,195	-	-	-	-
35-44 years.....	100	*2,863	572	901	18	*1,880	284	1,269
45-54 years.....	46	*2,693	158	1,802	-	-	-	-
55-64 years.....	20	*2,487	324	1,680	5	*1,494	-	1,220
65-74 years.....	31	*1,365	353	702	2	*894	-	730
SMOKERS								
White males								
25-34 years.....	6,192	3,940	1,100	105	66	*3,559	906	1,302
35-44 years.....	4,296	3,112	1,061	133	194	*2,370	1,100	800
45-54 years.....	4,020	2,637	1,019	117	361	2,040	979	411
55-64 years.....	2,874	2,111	1,014	102	410	1,511	815	315
65-74 years.....	1,052	1,687	815	145	397	1,191	990	247
White females								
25-34 years.....	4,100	3,107	872	111	450	2,824	942	334
35-44 years.....	2,822	2,654	800	89	187	3,090	1,387	837
45-54 years.....	2,871	2,066	708	88	530	1,457	679	194
55-64 years.....	1,551	1,813	654	115	695	1,452	680	199
65-74 years.....	400	1,545	995	340	250	970	471	135
Black males								
25-34 years.....	672	3,648	1,050	349	40	*2,284	2,077	1,955
35-44 years.....	517	3,124	1,026	366	47	*1,986	498	1,388
45-54 years.....	439	2,747	958	214	46	*2,314	1,228	944
55-64 years.....	214	1,803	713	352	87	*1,290	650	638
65-74 years.....	115	1,552	367	220	48	*1,208	945	639
Black females								
25-34 years.....	599	2,686	1,013	252	202	*1,725	857	549
35-44 years.....	455	2,368	752	298	205	2,260	633	397
45-54 years.....	220	2,062	715	252	240	*1,802	954	670
55-64 years.....	79	*1,363	284	572	66	*664	658	442
65-74 years.....	4	*1,508	-	1,231	51	*1,076	541	490

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

Table 9. Forced expiratory flow rate at 75 percent of forced vital capacity (FEF_{75%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
ALL SMOKING STATUSES								
White males				White females				
		Milliliters per minute				Milliliters per minute		
25-34 years.....	10,372	1,839	680	54	157	*1,546	626	408
35-44 years.....	7,942	1,343	710	60	237	*859	838	569
45-54 years.....	7,620	1,030	639	51	666	*977	818	253
55-64 years.....	5,729	788	539	41	738	*724	767	186
65-74 years.....	2,877	567	493	53	719	702	721	162
Black males								
25-34 years.....	880	1,650	616	170	96	*2,084	845	938
35-44 years.....	673	1,186	751	222	137	*537	284	371
45-54 years.....	749	1,024	750	117	66	*1,098	1,098	690
55-64 years.....	399	695	473	166	100	*1,326	552	590
65-74 years.....	227	560	423	141	84	*458	512	221
Black females								
25-34 years.....	926	1,149	666	165	348	958	764	223
35-44 years.....	852	926	365	82	286	1,030	508	151
45-54 years.....	520	583	419	109	407	*749	868	225
55-64 years.....	264	*600	434	203	355	*732	674	238
65-74 years.....	164	*470	316	119	211	*578	553	263
NONSMOKERS								
White males				White females				
25-34 years.....	2,633	2,065	649	99	24	*1,361	100	744
35-44 years.....	1,669	1,478	843	191	42	*622	-	508
45-54 years.....	1,206	1,184	664	103	96	*1,164	746	695
55-64 years.....	885	976	611	108	111	*961	587	533
65-74 years.....	481	795	408	95	113	*931	649	326
Black males								
25-34 years.....	158	1,490	698	333	56	*2,682	440	1,829
35-44 years.....	111	*1,564	621	856	9	*204	-	167
45-54 years.....	123	*630	417	308	20	*982	103	660
55-64 years.....	114	885	165	132	13	*723	473	608
65-74 years.....	52	*873	588	401	7	*478	150	357
Black females								
25-34 years.....	295	1,290	595	284	146	*1,328	789	377
35-44 years.....	297	936	344	142	64	*1,344	716	779
45-54 years.....	254	*528	401	157	167	*551	1,058	447
55-64 years.....	165	*630	310	198	283	*638	450	174
65-74 years.....	129	*485	317	132	158	*667	555	303

See note at end of table.

Table 9. Forced expiratory flow rate at 75 percent of forced vital capacity (FEF_{75%}) of white and black adults ages 25-74 years, by best trial status, smoking status, sex, and age: United States, 1971-75—Con.

Smoking status, race, sex, and age	Reproducible best trial				Nonreproducible best trial			
	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean	Estimated population in thousands	Mean	Standard deviation	Standard error of the mean
EX-SMOKERS								
White males								
Milliliters per minute								
25-34 years.....	1,547	1,889	680	154	67	*1,797	852	1,253
35-44 years.....	1,977	1,582	708	126	-	-	-	-
45-54 years.....	2,394	1,145	669	80	208	*1,292	1,109	612
55-64 years.....	1,970	804	444	52	217	*387	355	148
65-74 years.....	1,344	594	517	65	208	*767	717	253
White females								
25-34 years.....	1,452	1,480	616	103	123	1,945	939	482
35-44 years.....	1,269	1,225	536	98	114	*581	691	374
45-54 years.....	978	734	378	77	139	*560	586	332
55-64 years.....	843	*638	694	211	320	*1,268	1,170	775
65-74 years.....	499	578	481	141	253	*661	765	333
Black males								
25-34 years.....	51	*2,020	963	1,077	-	-	-	-
35-44 years.....	45	*1,605	549	852	82	*609	-	497
45-54 years.....	187	*1,194	629	321	-	-	-	-
55-64 years.....	71	*738	323	283	-	-	-	-
65-74 years.....	60	*449	436	310	29	*475	478	406
Black females								
25-34 years.....	32	*982	204	672	-	-	-	-
35-44 years.....	100	*910	290	326	18	*1,350	92	902
45-54 years.....	46	*791	78	533	-	-	-	-
55-64 years.....	20	*718	185	503	5	0	-	0
65-74 years.....	31	*470	280	316	2	0	-	0
SMOKERS								
White males								
25-34 years.....	6,192	1,730	668	73	66	*1,359	281	491
35-44 years.....	4,296	1,180	604	69	194	*910	916	601
45-54 years.....	4,020	915	588	70	361	*746	506	222
55-64 years.....	2,874	719	560	60	410	*838	899	330
65-74 years.....	1,052	428	452	87	397	*602	723	259
White females								
25-34 years.....	4,100	1,373	692	96	450	1,476	719	262
35-44 years.....	2,822	985	486	51	187	*1,889	1,253	789
45-54 years.....	2,871	693	477	60	530	*430	672	178
55-64 years.....	1,551	541	468	82	695	468	425	103
65-74 years.....	400	*588	901	280	250	*364	578	181
Black males								
25-34 years.....	672	1,659	544	196	40	*1,243	487	690
35-44 years.....	517	*1,068	752	272	47	*476	450	493
45-54 years.....	439	1,062	828	193	46	*1,148	1,307	869
55-64 years.....	214	*579	579	297	87	*1,419	503	649
65-74 years.....	115	476	199	119	48	*446	564	319
Black females								
25-34 years.....	599	1,089	702	223	202	*690	621	383
35-44 years.....	455	923	393	128	205	905	381	213
45-54 years.....	220	*602	465	181	240	*887	671	439
55-64 years.....	79	*507	640	477	66	*1,190	1,130	767
65-74 years.....	4	0	-	0	51	*321	458	329

NOTE: Estimates preceded by an asterisk do not meet National Center for Health Statistics standards of reliability (that is, the standard error is greater than 25 percent of the estimate).

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APPENDIX I

STATISTICAL NOTES

Survey Design

The sample design for the first National Health and Nutrition Examination Survey (NHANES I) in April 1971-June 1974 was basically a three-stage, stratified, probability sample of loose clusters of persons living in land-based segments. The sample was designed to represent the civilian noninstitutionalized population, ages 1-74 years, living within the coterminous United States, with the exception that all persons residing upon reservation lands set aside for the use of American Indians would be excluded. The subsample of adults ages 25-74 years who received the detailed medical examination in addition to the more general nutrition examination was chosen systematically after a random start. This group constituted one-fifth of the total sample of adults ages 25-74 years in the first 65 NHANES I locations. The detailed examination part of the program was extended from July 1974 to October 1975 as the NHANES I Augmentation Survey to provide a larger sample and hence more reliable national estimates for this part of the program.

At the first stage of the design 100 primary sampling units (PSU's) were selected with probability proportional to size from the approximately 1,900 PSU's into which the United States has been divided by the U.S. Bureau of the Census. (Ten PSU's were selected into the sample twice, so that in fact there were only 90 distinct PSU's selected.) A PSU consists of a county, a small group of contiguous counties, or a standard metropolitan statistical area. Before selecting the 100 PSU's for inclusion in NHANES I, the approximately 1,900 PSU's were first grouped into 40 strata of which 15 contained only 1 PSU, comprising a single large metropolitan area

with a population of more than 2 million. All 15 of the largest PSU's and 3 PSU's from each of the other 25 were selected.

At the second stage of the design a sample of segments, consisting of approximately six households each, was systematically selected within each selected PSU. Although 1970 census data were used as the frame for sampling within PSU's when they became available, the calendar of operations required that 1960 census data be used for the first 44 selected PSU's. Generally, the following three types of segments were used:

1. Segments from the census listing books that were created in taking the population census.
2. Area segments that are defined geographically.
3. Permit segments, using updated lists of building permits issued in sample PSU's since January 1970.

At the third stage of sampling a list of all eligible persons was made within each selected segment. From this list, persons were systematically selected for inclusion in NHANES I.

The selection of PSU's for the Augmentation Survey was done by the same process used earlier at the beginning of NHANES I, which has been described earlier. The final stages of sampling for the NHANES I Augmentation Survey involved the random selection of one of every two adults ages 25-74 years who were eligible for the sample.

A more complete description of the survey design is available elsewhere.^{1,2}

NOTE: A list of references follows the text.

Because the design of NHANES I is a multi-stage probability sample, it is necessary to use complex procedures in the derivation of estimates. Three basic operations are involved:

Inflation by the reciprocal of the probability of selection.—The probability of selection is the product of the probabilities of selection from each step of selection in the design (PSU, segment, and sample person).

Nonresponse adjustment.—The estimates are inflated by a multiplication factor calculated within each PSU for each of five selected income groups. The numerator of these factors consists of the sum of weights for *sample* persons resulting from the reciprocal of the probability of selection, and the denominator consists of the weights for *examined* persons resulting from the reciprocal of the probability of selection.

Poststratification by age-sex-race.—The estimates are ratio adjusted within each of 60 age-sex-race cells to an independent estimate, provided by the U.S. Bureau of the Census, of the population of each cell as of the midpoint of the survey. The effect of the ratio-estimating process is to make the sample more closely representative of the civilian noninstitutionalized population by age, sex, and race, which thereby reduces sampling variance.

The U.S. population estimates at the midpoint of the survey period and the size of the examined sample are presented in table I. The number and percent of acceptable Forced Expiratory Spirograms by race, sex, and age are included in table II.

Reliability of Estimates

Because the statistics presented in the text and detailed tables of this report are national estimates based on a sample, they will differ somewhat from the figures that would have been obtained if the survey had been conducted on the complete population. In other words, the statistics are subject to sampling variability.

The standard error is primarily a measure of sampling variability, but may also include part of the variation that arises in the measurement process. The standard errors presented in tables 1-9 have been calculated by a balanced repeated replication technique.¹² The need for this specialized technique for estimating standard errors arises because of the complexity of the NHANES I sample design. It must be noted that estimates of standard errors are themselves subject to errors that may be large if the number of cases on which the estimates are based is small.

Table I. Number of examined persons in the NHANES I detailed 100-location design and estimated number of persons in the U.S. population as of February 1974, by sex, race, and age: NHANES I, 1971-75

Age	Total	Sex		Race		Total	Sex		Race	
		Male	Female	White	Black		Male	Female	White	Black
	Number of examined persons					Estimated number of persons in U.S. population				
Total.....	6,913	3,171	3,742	5,968	873	106,639,033	50,586,997	56,052,036	94,885,892	10,656,186
25-34 years.....	1,563	672	891	1,362	175	28,296,796	13,663,092	14,633,704	24,835,350	3,039,000
35-44 years.....	1,216	528	688	1,048	149	22,302,278	10,761,322	11,540,956	19,582,183	2,415,030
45-54 years.....	1,613	746	867	1,396	206	23,548,824	11,288,375	12,260,449	21,053,345	2,357,701
50-54 years.....	811	375	436	707	98	11,812,931	5,733,376	6,079,555	10,717,541	1,042,219
55-64 years.....	1,288	626	662	1,118	161	19,345,852	9,191,996	10,153,856	17,500,480	1,674,111
65-74 years.....	1,233	599	634	1,044	182	13,145,283	5,682,212	7,463,071	11,914,534	1,170,344

NOTE: The numbers in this table constitute estimates and closely approximate the U.S. population as estimated by the U.S. Bureau of the Census as of February 1, 1974.

Table 11. Number of white and black adults ages 25-74 years in sample, and number and percent of Forced Expiratory Spirograms, by race, sex, and age: NHANES I, 1971-75

Race, sex, and age	Number in sample	Reproducible and nonreproducible best trials		Reproducible best trials		Nonreproducible best trials	
		Number	Percent	Number	Percent	Number	Percent
<u>White males</u>							
25-34 years	587	527	89.8	516	87.9	11	1.9
35-44 years	469	410	87.4	400	85.3	10	2.1
45-54 years	642	525	81.8	486	75.7	39	6.1
55-64 years	544	422	77.6	380	69.9	42	7.7
65-74 years	502	345	68.7	271	54.0	74	14.7
<u>White females</u>							
25-34 years	775	682	88.0	609	78.6	73	9.4
35-44 years	579	500	86.4	450	77.7	50	8.6
45-54 years	754	626	83.0	531	70.4	95	12.6
55-64 years	574	456	79.4	327	57.0	129	22.5
65-74 years	542	404	74.5	258	47.6	146	26.9
<u>Black males</u>							
25-34 years	72	52	72.2	47	65.3	5	6.9
35-44 years	52	39	75.0	35	67.3	4	7.7
45-54 years	99	65	65.7	55	55.6	10	10.1
55-64 years	76	44	57.9	35	46.1	9	11.8
65-74 years	91	48	52.7	30	33.0	18	19.8
<u>Black females</u>							
25-34 years	103	79	76.7	55	53.4	24	23.3
35-44 years	97	79	81.4	58	59.8	21	21.6
45-54 years	107	76	71.0	47	43.9	29	27.1
55-64 years	85	54	63.5	21	24.7	33	38.8
65-74 years	91	52	57.1	24	26.4	28	30.8

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APPENDIX II

DEFINITION OF DEMOGRAPHIC TERMS

Age.—Two ages were recorded for each examinee: Age at last birthday at the time of the examination and age at the time of the census interview. The age criterion for inclusion in the survey sample was defined as age at time of census interview. The adjustment and weighting procedures used to produce national estimates were based on the age at interview. Data in the detailed tables and text of the report are shown by age at the time of the examination, except that those few who became 75 years by the time of the examination are included in the 65-74-year age group.

Race.—Race was recorded as “white,” “black,” or “other.” “Other” includes Japanese, Chinese, American Indian, Korean, Eskimo, and all races other than white and black. Mexicans were included with “white” unless definitely known to be American Indian or of another race. Blacks and persons of mixed black and other parentage were recorded as “black.” When a person was uncertain about his or her race, the race of the father was recorded.



APPENDIX III

DEFINITION OF SPIROMETRIC TERMS

Acceptability.—A trial is judged acceptable if it is free of procedural errors, that is, errors caused by incorrect execution of the FES maneuver (see table III). A subject is determined to have performed an acceptable test if at least two trials are reproducible and free of procedural errors.

Best trial.—An examinee's best trial is that one of all reproducible acceptable trials that demonstrates the highest summed FVC and FEV_{1.0}. If reproducibility is not established, the acceptable trial with the highest summed FVC and FEV_{1.0} is chosen, and the trial is described as "nonreproducible best."

Zero time.—The point on the time axis of the time-volume tracing that defines the beginning of the FES.

EOT.—End of trial, the point at which expiration ceased.

BTPS.—Body temperature and pressure, saturated with water vapor. A factor used to convert observed volumes to standard conditions.

FEF_{25%}, FEF_{50%}, FEF_{75%}.—The instantaneous forced expiratory flow rate at the indicated percent of FVC.

FES.—Forced Expiratory Spirogram.

FEV_{1.0}.—Forced expiratory volume at 1 second, the amount of gas expired by the end of the first second of expiration.

FEV_{1.0}/FVC.—The proportion of FVC that is expired in the first second of effort, expressed as a percent.

Table III. Procedural error codes and their definitions

Code	Definition
0.....	No violations.
1.....	Onset of volume curve occurred less than 0.15 second after the beginning of the record (short baseline).
2.....	End of trial (EOT) not identified in the 9.18-second record (premature termination by recorder).
3.....	A volume increment of less than 4 percent between 0.5 and 1 second after the onset of the curve, or an increment of less than 4 percent between 1 and 2 seconds (midtrial premature termination by subject).
4.....	Occurrence of a negative flow followed by a post-EOT positive flow in excess of 50 milliliters per second over any 0.50-second interval following EOT (inhalation artifact).
5.....	Peak flow greater than 3 standard deviation units above subject's predicted peak flow (Venturi artifact).
6.....	Computed FVC less than 0.2 liter (invalid trial).
7.....	Post-peak flow but pre-EOT signal that shows a marked decrease (25 percent of peak flow) in flow for a time interval of 0.10 second or more and followed by a marked increase (25 percent of peak flow) in flow (hesitation artifact).
8.....	The 0.50 second of a trial after EOT has a slope in excess of 50 milliliters per second (premature termination at end of trial by subject).

FVC.—Forced vital capacity, the total expired volume.

MMEF.—Maximal mid-expiratory flow rate, the averaged rate of expiration between 25 and 75 percent of FVC.

MEFR.—Maximal expiratory flow rate, the averaged rate of expiration between 200 and 1,200 milliliters of volume expired.

Peak flow.—Peak instantaneous flow rate.

Reproducibility.—Trials are termed repro-

ducible if (1) the FVC's are within 5 percent for FVC's over 3 liters (l) or within 10 percent for FVC's under 3 l, and (2) if the flow-volume curves, as shown on the oscilloscope, demonstrate similar morphologies.

Smoking status.—(1) Smoker: one who currently smokes cigarettes, cigars, or pipes, (2) nonsmoker: one who has never smoked more than 100 cigarettes, 50 cigars, or 3 pouches of tobacco, and (3) ex-smoker: one who has smoked in the past but does not smoke now.



APPENDIX IV

DATA REDUCTION AND PARAMETER GENERATION

A unique but generalizable series of computer programs was written to assist in the generation of spirometric parameters from the digitized signal collected for each Forced Expiratory Spirogram (FES) trial. The programs were designed to be run on the IBM 370/158 computer used by the National Center for Health Statistics and are specific to the data formats and lengths used by the Division of Health Examination Statistics data collection equipment and media. Only a few relatively simple modifications are required to adapt the programs to other systems. An indepth description of the processes and programs can be found elsewhere.⁴

The data reduction was a multistep operation that involved a number of programs and processes. At each step, intermediate results were checked to verify the particular process being implemented. The steps included: (1) altering the bit structure of the collected data words to conform to the IBM 16-bit format; (2) evaluating and altering each trial to delete records of incorrect length and to eliminate spurious electronic "noise"; (3) correcting erro-

neous trial identification information; (4) adjusting the data in each trial to compensate for electronic variability between spirometers; (5) adjusting the data in each trial from atmospheric temperature and pressure, saturated with water vapor (ATPS) to body temperature and pressure, saturated with water vapor (BTPS); and (6) performing 5-point averaging of the incoming signal to arrive at a trial of 918 data points, which represented a sampling rate of 100 per second. This processing resulted in 30,564 trials representing 5,544 subjects.

The 55 parameters (listed in appendix VI) were generated for each of the trials if they were free of procedural errors (see table III). Zero time, the time expiratory effort is said to have begun, is determined by a triangular back-extrapolation from the time of peak flow; end-of-trial time is defined as the maximum volume preceding the first negative flow after the first 0.1-second plateau of volume data. Once these two points are established, the other parameters are calculated. All flows after 75 percent of volume is expired are set to an "unknown" code (to indicate the unreliability of these measures), as are any parameters occurring after the end of trial (for example, flow at 6 liters for a trial of less than 6 liters).

NOTE: A list of references follows the text.



APPENDIX V

TECHNICIAN TRAINING AND QUALITY CONTROL

Quality control and technician training and retraining were intrinsic parts of the spirometric testing conducted during the first National Health and Nutrition Examination Survey (NHANES I). Several formal and informal procedures were adopted to ensure the highest possible data quality and technician performance levels. In general, these efforts were initiated and controlled by the Medical Advisor of the Division of Health Examination Statistics.

Technician Training

Before the survey began, all the Health Technicians participated in intensive 2- or 3-day seminars designed to familiarize them with the NHANES I electronic data collection and recording systems, which were markedly different from those employed in the previous survey, and to educate them in the psychology, physiology, and physics of spirometric performance. Although many of the Health Technicians were qualified X-ray technologists, few had extensive spirometric testing experience. The seminars combined classroom instruction and practical training, using both experienced and inexperienced subjects. In most cases a physician knowledgeable in pulmonary function conducted the training. In other instances the training was conducted by an epidemiologist with extensive spirometric testing experience.

Quality Control and Technician Retraining

Quality control of NHANES I spirometry data was a sequential, iterative process involving five reviews of hard-copy Forced Expiratory Spirogram (FES) tracings and progressively sum-

marized reports, resulting in technician retraining when necessary. Also, an expert spirometrist made periodic field visits to observe technician and system performance and to provide retraining if deemed necessary.

At regular intervals during field-site data collection, the Chief Technician would review all the paper tracings made for each FES. In particular, he or she would look for indications of errors in test administration that indicated some lack of understanding or motivation on the part of the Health Technician. After attempting to remedy any problems, he or she would send the tracings to headquarters along with a summary report. At headquarters, the Supervisory Technician would review the tracings according to the same objectives, and a summary report for the site would be transmitted to the medical officer. The tracings were also reviewed by the Division of Health Examination Statistics Biomedical Engineer in order to detect any equipment problems. After review by the medical officer, the reports and a sample of indicative tracings were sent to the spirometric consultant for review and comment. The consultant then communicated to the field staff any criticisms, compliments, or suggestions.

During field visits the spirometric consultant observed each technician's performance and, if necessary, corrected any procedural errors that had developed since the previous visit. Usually some time was spent discussing spirometric function with the technicians as a group, after which a sample of tracings was reviewed to point out to the technicians ways of detecting their own errors and improving overall performance. Also, any newly hired technicians received the basic training necessary for correctly administering the FES.



APPENDIX VI
DATA TAPE SUMMARY

SUMMARY OF SPIROMETRY MICRODATA TAPE (NHANES I CATALOG NO. 4250)

	<u>Tape position</u>
Catalog number 4250.....	201
Technician number	215
Reliability code.....	217
Trial number	218
Time of 0.2 liter volume.....	226
Flow at 0.2 liter volume.....	231
Volume at 0.25 second.....	236
Flow at 0.25 second.....	241
Time of peak flow.....	246
Volume at peak flow.....	251
Peak flow rate	256
Time of 1.0 liter volume.....	261
Flow at 1.0 liter volume.....	266
Volume at 0.50 second.....	271
Flow at 0.50 second.....	276
Volume at (time of peak flow + 0.10 second).....	281
Flow at (time of peak flow + 0.10 second).....	286
Time of 1.2 liters volume.....	291
Flow at 1.2 liters volume.....	296
Volume at 0.75 second.....	301
Flow at 0.75 second.....	306
Volume at (time of peak flow + 0.50 second).....	311
Flow at (time of peak flow + 0.50 second).....	316
Time of 2.0 liters volume.....	321
Flow at 2.0 liters volume.....	326
Volume at 1.0 second.....	331
Flow at 1.0 second.....	336
Volume at (time of peak flow + 1.0 second).....	341
Flow at (time of peak flow + 1.0 second).....	346
Time of 3.0 liters volume.....	351
Flow at 3.0 liters volume.....	356
Volume at 2.0 seconds.....	361
Flow at 2.0 seconds.....	366
Volume at (time of peak flow + 2.0 seconds).....	371
Flow at (time of peak flow + 2.0 seconds).....	376
Time of 4.0 liters volume.....	381
Flow at 4.0 liters volume.....	386

	<u>Tape position</u>
Volume at 3.0 seconds.....	391
Flow at 3.0 seconds.....	396
Volume at (time of peak flow + 3.0 seconds).....	401
Flow at (time of peak flow + 3.0 seconds).....	406
Time of 5.0 liters volume.....	411
Flow at 5.0 liters volume.....	416
Volume at 4.0 seconds.....	421
Flow at 4.0 seconds.....	426
Volume at (time of peak flow + 4.0 seconds).....	431
Flow at (time of peak flow + 4.0 seconds).....	436
Time of 6.0 liters volume.....	441
Flow at 6.0 liters volume.....	446
Time of 25 percent of FVC.....	451
Flow at 25 percent of FVC.....	456
Time of 50 percent of FVC.....	461
Flow at 50 percent of FVC.....	466
Forced vital capacity.....	471
Mid-expiratory flow rate.....	476
Maximal mid-expiratory flow rate.....	481
Time of 75 percent of FVC.....	486
Flow at 75 percent of FVC.....	491
Time of FVC.....	496
Body temperature and pressure, saturated with water vapor (BTPS) factor.....	501
Calibration factor.....	508
Diagnostic code.....	515
Reproducibility code.....	516



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