

A RETROSPECTIVE ANALYSIS OF AEROMEDICAL CERTIFICATION DENIAL ACTIONS

January 1961 - December 1967

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I. Introduction.

Prior to this time relatively little has been known about the collective characteristics of airmen denied medical certification. Empirically, certain factors, or characteristics, have been recognized by professional personnel associated with the medical certification of airman applicants but these known factors have been limited to the obvious derivatives of workload, such as the percentage of denied airmen from total application receipts, what class of medical applicants are most frequently denied, and generally what pathological conditions represent the majority of denials.

This study is an effort to quantify some of the unknowns or uncertainties with respect to the medical and general descriptive attributes of those airmen denied medical certification. The most obvious reason for the study was to illuminate areas deserving of further consideration with respect to the amendment of medical certification program objectives as concerns standards and appellate procedures. Secondly, the data are important in connection with aeromedical research, particularly as it may provide insight into the early recognition of disqualifying pathology, and the subsequent likelihood of successful rehabilitation.¹

The study presents descriptive data concerning age, sex, occupation, and total flying time of initially denied airmen, i.e., those denied by the AME, Regional Flight Surgeon, or FAA physicians of the Aeromedical Certification facility at Oklahoma City, Oklahoma. Certification actions at the appellate level are considered to in-

clude Federal Air Surgeon reconsideration actions and the FAA Administrator's actions.

II. Methods and Source Material.

The Aeromedical Certification magnetic tape files maintained in Oklahoma City, Oklahoma provided the source of initial denial data as presented in this study. This "Active Master Tape File" contains the most recent record of an airman's medical application for certification. The tape includes applications issued, pending, denied, and abbreviated records of significant pathology cases retained for future medical reference in the event an airman decides to again exercise his flying privileges. The latter being the only instance when a record is maintained on the active master tape file for a period of time greater than 3 years from the date of application. After 3 years, providing that a record has not been superseded by a more current examination from the airman, the record is either converted to a shorter record (if significant pathology is present or if the airman was denied), or it is transferred to a history tape file.

The initial denial data was accumulated during May 1967 in connection with a separate research effort. At that time, records were selected for enclosure in the study if they reflected a date of examination within the time period of May 1964 through June 1966. The earlier cut-off of May 1964 was mandatory because this was the maximum length of time a complete record could be maintained on the active master tape file, i.e., 36 months prior to the date of computer extraction in May 1967. Timing of the computer extraction was accomplished so that May 1964 would be the cut-off since numerous automatic data processing system revisions were initiated in May 1964. The May 1964 cut-off date thus provided for maximum consistency of coded medical data input. The latter date, June 30, 1966, was chosen to allow sufficient appeal time for the airman and

¹Much is already being done in the area of rehabilitation of individuals who have suffered cardiac accidents. Reference AM 66-17, Problems in Aeromedical Certification: Cardiovascular Responses to Exercise Following Myocardial Infarction by J. Naughton, K. Shanbour, A. Armstrong and M. T. Latogola; AM 66-21, Clinical Aviation Medicine: A Physical Conditioning Program for Cardiac Patients—A Progress Report by J. Naughton, M. T. Latogola and K. Shanbour.

thus assure reasonable certainty that the final action taken was a denial of medical certification as of the date of computer extraction in May 1967.²

A total of 5,727 airmen were identified by automated means as having been denied medical certification during the time period of May 1964 through June 1966. Elements of data from these airmen's medical records were then classified by the computer into various frequency tables to reflect the medical and general descriptive characteristics mentioned in the introductory remarks and presented later in the study.

It should be observed that medical certification criteria changed dramatically in favor of the airman during the time period May 1964 through June 1966.³ The initial denial data presented should, therefore, be viewed as a pessimistic approximation in any proportional extrapolation to future airman populations.

Data pertaining to appellate actions by the Federal Air Surgeon or the Administrator were extracted from summary reports published periodically by the Aeromedical Standards Division and the Administrator's Medical Advisory Panel. Data were also obtained from appellate case monitoring activities conducted by Aeromedical Certification personnel in Oklahoma City, Oklahoma.

Some problems are recognized with respect to individuals appealing on more than one occasion. This would appear to produce some bias in the data as concerns dual accounting. This is not, however, a serious limitation; to the contrary, it presents no limitation when it is realized that actions taken are based on medical circumstances at the time of the appeal. Presumably, a change in medical condition is the only reason for an airman to appeal on more than one occasion.

III. Findings and Discussion.

A. Initial Denials.

1. General comments. Between May 1964 and

²The appeal procedure would not normally involve a time span from July 1, 1966 to May 1967. The June 30, 1966 "cut-off" was arbitrarily chosen to minimize the chance of including an airman in the study who was still appealing the denial action (e.g., cases where numerous medical consultations or follow-ups were required for a final decision). Additionally, some time lag is realized between the time of appellate decision and the time the computer is updated to reflect the decision.

³Reference Change 2 (Special Medical Flight or Practical Test or Medical Evaluation for Special Issue of Medical Certificate) October 21, 1965, and Change 3 (Distant Visual Acuity: First and Second Class Medical Certificates) November 23, 1965, to Federal Aviation Regulations, Part 67—Medical Standards and Certification.

June 1966, 726,112 applications for medical certification were received by the Aeromedical Certification Branch in Oklahoma City, Oklahoma. Denials for a similar period totaled 5,727 or 0.79% of application receipts. The 726,112 application receipts must be viewed as representing approximately 500,000 active airmen since four applications would have been received from some first-class airmen during this time period; two applications would have been received from some second-class airmen; and third-class airmen would have submitted application only once. Assuming approximately 500,000 airmen were involved, the denial rate is only slightly increased to 1.14% when the number of denials is applied to individuals versus applications. As noted in Table V, the vast majority of denials are accounted for by student airmen (2,862 or 49.97%) and private airmen (1,526 or 26.65%).

The Office of Aviation Medicine recognizes that many airmen, in effect, deny themselves medical certification because of a known medical condition and subsequent attrition from an active airman status. This occurrence is less likely, however, among airmen occupationally connected to aviation since more is obviously at stake and since this group is probably more aware of the appeal channels.

TABLE I. Denials by Age and Class of Medical Certificate Applied for by the Airman
May 1964 - June 1966

Age*	First Class	Second Class	Third Class	Unknown**	Total	Percent of Total
Less than 20	11	36	232	1	280	4.89
20-24	48	102	1,014	3	1,167	20.38
25-29	33	91	412	2	538	9.39
30-34	15	80	401	1	497	8.68
35-39	22	108	488	4	622	10.86
40-44	53	202	512	5	772	13.48
45-49	60	152	430	6	648	11.31
50-54	56	98	410	1	565	9.87
55-59	31	66	255	1	353	6.16
60-64	3	23	142	2	170	2.97
65-69	3	10	63	-	76	1.33
70 and over	-	-	38	1	39	0.68
TOTAL	335	968	4,397	27	5,727	
PERCENT OF TOTAL	5.85	16.90	76.78	0.47		100.00

*Age at the time of examination recorded to the nearest year.

**Class applied for was unknown and therefore was treated as an unknown in the table.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

TABLE II. Age Distribution of Active Airmen by Class of Medical Certificate
January 1, 1968

Age	First Class	Second Class	Third Class	Total	Percent of Total
Less than 20	2,182	3,400	24,989	30,571	4.89
20-24	10,868	24,316	59,213	94,397	15.10
25-29	17,596	30,127	55,676	103,399	16.54
30-34	14,118	28,813	49,029	91,960	14.71
35-39	8,794	28,843	52,657	90,294	14.44
40-44	7,067	25,866	49,369	82,302	13.16
45-49	8,544	27,594	34,632	70,770	11.32
50-54	3,394	11,482	20,828	35,704	5.71
55-59	1,230	4,248	10,473	15,951	2.55
60-64	312	1,812	4,621	6,745	1.08
65-69	41	572	1,657	2,270	0.36
70 and over	8	153	708	869	0.14
TOTAL	74,154	187,226	363,852	625,232	
PERCENT OF TOTAL	11.86	29.95	58.19		100.00

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

2. *Age distribution of denied airmen.* Tables I, II, and III consider the age distribution of denied airmen, the age distribution of active airmen⁴ as of January 1, 1968, and a proportional comparison of the denied versus certified airmen, respectively. The mean age of the active airman population as of January 1, 1968, was 35.0 years; whereas, the mean age of denied airmen included in this study is 37.5 years. Statistically speaking, this is a significant difference in age when compared via conventional statistical methodology. The probability of a difference this large (2.5 years) due to chance is considerably less than .0001. The alternate hypothesis that the mean age of denied airmen is greater than the mean age of the active population would seem to be supported. See Appendix A for further details concerning the statistical methodology.

Reference to Tables I and III indicates that the largest proportion of denied airmen come from the age group 20-24 years. It may also be observed from Table I that the largest group of denied airmen (1,014 or 17.7%) are third-class airmen between the ages of 20-24 years. The proportional distribution of denied airmen is, however, higher in the older age groups, thus raising the mean age of denied airmen.

3. *Denials by sex and previous application status.* Table IV reflects data concerning the sex of denied applicants and whether a previous FAA examination was recorded for the indi-

⁴Active airmen are defined as having been medically certified within the previous 25 months.

TABLE III. Age Distribution Comparison—Active Airmen Versus Denied Airmen

Age	Denied Airmen*	Percent	Active Certified Airmen†	Percent
Less than 20	280	4.89	30,571	4.89
20-24	1,167	20.38	94,397	15.10
25-29	538	9.39	103,399	16.54
30-34	497	8.68	91,960	14.71
35-39	622	10.86	90,294	14.44
40-44	772	13.48	82,302	13.16
45-49	648	11.31	70,770	11.32
50-54	565	9.87	35,704	5.71
55-59	353	6.16	15,951	2.55
60-64	170	2.97	6,745	1.08
65-69	76	1.33	2,270	0.36
70 and over	39	0.68	869	0.14
TOTAL	5,727	100.00	625,232	100.00

*May 1964 through June 1966.

†November 1965 through December 1967.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

TABLE IV. Denials by Sex and Whether a Previous Examination was Recorded* May 1964-June 1966

Sex	Previous Examination		Total	Percent of Total
	Yes	No		
Male	2,387	3,109	5,496	96.0
Female	48	183	231	4.0
TOTAL	2,435	3,292	5,727	
PERCENT OF TOTAL	42.5	57.5		100.0

*The indication of previous examination was taken from Item 20 of the FAA Form 1004 (since replaced by FAA Form 8500-8). This item requests the airman to indicate the date of his previous FAA examination, if any. As such, it is not known whether the previous application (examination) was also denied.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

TABLE V. Denials by Occupation and Class of Certificate Applied for by the Airman Applicant*
May 1964-June 1966

Occupation	First Class	Second Class (Commercial Pilot)	Second Class (Commercial Pilot and ATC**)	Second Class (Observer & FAA ATC**)	Second Class (Other ATC**)	Second Class (Engineer/Navigator)	Third Class (Private)	Third Class (Student)	Private Pilot & ATC**	Unknown	Total	Percent of Total
Pilot, scheduled and non-scheduled airlines only (includes captain, co-pilot, etc.)	126	1	-	-	-	-	-	-	-	1	128	2.24
Flight Engineer	-	8	-	-	-	5	1	-	-	-	14	0.24
Flight Navigator and Flight Radio Operator	-	1	-	-	-	1	-	-	-	-	2	0.03
Business/Executive Pilot	30	5	-	-	-	-	-	-	-	-	35	0.61
Commercial Pilot, Self-Employed	1	29	-	-	-	-	1	-	-	-	31	0.54
Commercial Pilot, Not Self-Employed	-	27	-	-	-	-	-	-	-	-	27	0.47
Aero Application (Agriculture)	-	-	-	-	-	-	-	-	-	-	-	-
Air Traffic Controller	1	18	13	92	6	-	1	5	7	-	143	2.50
Flight Instructor	8	11	-	-	-	-	-	-	-	-	19	0.33
Other Aeronautical Occupation	26	28	-	1	-	2	21	33	-	1	112	1.96
Non-Aeronautical Occupation	143	661	2	49	-	8	1,502	2,824	2	25	5,216	91.08
TOTAL	335	789	15	142	6	16	1,526	2,862	9	27	5,727	100.00

*As indicated by the applicant on FAA Form 1004 (now FAA Form 8500-8) Block 10 for occupation and Blocks 9A and 9B for class of certificate requested.

**ATC means Air Traffic Control.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

vidual. It is pointed out in the footnote to Table IV that it is not absolutely known whether those individuals who had previous examinations recorded were also denied on the previous application. However, assuming all to have been previously certified, the 2,435 denied airmen with previous FAA examinations represent less than one-half of all applications denied (42.5%) during the 2-year period. The remaining 57.5% of denials were from new applicants. To assume that all who had a previous examination were, in fact, certified on the previous examination is obviously an exaggeration; however, recognizing this exaggeration further emphasizes the fact that less of the total denials came from the "hard core" aviation population.

Statistical summaries as of July 1965 defined an active airman population consisting of 450,936 (96.2%) active male airmen and 17,969 (3.8%) active female airmen, as recorded on the medical certification tape files. Proportionally, therefore, denials by sex were consistent with their respective representation in the active population (5,496 of 5,727 or 96.0% denied males and 231 of 5,727 or 4.0% denied females).

4. *Recorded occupation of denied airmen.*⁵ It is immediately apparent from Table V that the vast majority of denied airmen are not connected occupationally to civil aviation. A total of 5,216 of 5,727 (91.1%) denied airmen indicated in-

⁵As recorded by the airman applicant in Block 10 of the FAA Form 1004 (now FAA Form 8500-8).

volvement in non-aeronautical occupations. The next largest group of denied airmen (2.5%) indicated that their primary occupation was air traffic control; 98 of 143 airmen in this category were air traffic controllers only and the remaining 45 were pilots in addition to being air traffic controllers. One hundred and twenty-eight denied airmen indicated that their primary occupation was "airline pilot." These airmen comprise the third largest group of denied airmen and represent 2.2% of all denials.

5. *Total flying time as recorded by denied airmen.*⁶ Data presented in Table VI further supports what has previously been said with respect to the primary source of denied airmen. A total of 3,219 denied airmen had recorded total flying time of less than the 40 hours required for a private airman rating.

⁶As recorded in Block 16 of the FAA Form 1004 (now FAA Form 8500-8).

TABLE VI. Denials by Total Flying Time
May 1964 - June 1966

Total Flying Time	Frequency	Percent of Total
0 - 10	2,896	50.57
11 - 39	323	5.64
40 - 99	304	5.31
100 - 299	530	9.25
More than 300	1,674	29.23
TOTAL	5,727	100.00

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

TABLE VII. Presence of Denial Pathology by Pathology Series and Class of Medical Certificate Applied for by the Airman*
May 1964-June 1966

Pathology Series	First Class	Second Class	Third Class	Unknown**	Total	Percent of Total
Eye	26	49	183	5	263	7.86
Ear, Nose, Throat	6	18	56	-	80	2.39
Respiratory System	5	6	51	-	62	1.85
Cardiovascular System	110	240	930	9	1,289	38.50
Abdominal	13	31	148	3	195	5.83
Nervous and Mental	49	155	454	3	661	19.74
Bones and Joints	4	6	38	-	48	1.43
Muscles	3	2	13	-	18	0.54
Miscellaneous Defects	36	108	582	6	732	21.86
TOTAL	252	615	2,455	26	3,348	100.00

*The table above was based on the presence of a denial prefix in conjunction with a specific pathology code. The prefix to indicate denial for specific pathology was not incorporated into the automated system until February 1965. The summary total is thus lower than what might be expected given the 5,727 denials during the time period covered by the study. The significance of particular groups of pathology is quite obvious however.

**Class applied for was unknown and therefore was treated as an unknown in the table.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

6. *Medical characteristics of denied airmen.* Table VII reflects pathology associated with the cause for denial as recorded on the medical records of the 5,727 denied airmen. The most significant pathologies reflected in Table VII are respectively (a) cardiovascular, (b) miscellaneous defects, which include alcohol and drugs, endocrinopathies, general systemic conditions, and administrative denials for failure to provide further requested medical information concerning conditions reflected on the application, (c) nervous and mental pathologies, (d) eye pathology and deficient vision, and (e) abdominal pathologies.

B. Federal Air Surgeon Reconsideration Actions.

During the time period 1961 through 1967 the Federal Air Surgeon considered and took action on 4,009 appeals of initial denial. Of this total, the Federal Air Surgeon certified 1,011 (25.2%) airmen and denied certification in 2,998 (74.8%) cases. Table VIII provides information concerning the appeals considered by the Federal Air Surgeon by year.

TABLE VIII. Appeals Considered by the Federal Air Surgeon
1961-1967

Year	Certified	Denied	Total
1961*	70	204	274
1962	189	372	561
1963	147	472	619
1964	149	711	860
1965	242	661	903
1966	119	344	463
1967**	95	234	329
TOTAL	1,011	2,998	4,009

*Incomplete figures for January through March 1961.

**These figures include reconsideration actions only. They do not include opinions rendered or other decisions.

Source: Office of Aviation Medicine, Aeromedical Standards Division.

Appeal cases and actions taken have been recorded by gross pathological classification since January 1963. Table IX summarizes appeals to the Federal Air Surgeon from January 1963 through December 1967 by pathological area representing the reason for appeal. Table X reflects certification action taken by the Federal Air Surgeon on these appeals.

Table IX clearly indicates that the most important pathological conditions among appeals are cardiovascular, nervous and mental, and deficient vision, respectively. Historically, 82.3%

TABLE IX. Pathology Representing the Basis for Appeal to the Federal Air Surgeon
January 1963 - December 1967

Pathology	Frequency	Percent of Total
Eye	655	20.6
Ear, Nose, Throat	28	0.9
Respiratory	76	2.4
Cardiovascular	1,210	38.1
Abdominal	105	3.3
Nervous/Mental	748	23.6
Bone/Joint	32	1.0
Muscles	16	0.5
Miscellaneous*	304	9.6
TOTAL	3,174	100.0

*Miscellaneous includes alcohol and drugs, endocrinopathies and general systemic conditions.

Source: Office of Aviation Medicine, Aeromedical Standards Division.

of appeal cases considered by the Federal Air Surgeon are concerned with problems in one of these three pathological areas.

Actions by the Federal Air Surgeon, as shown in Table X, also reflect the significance of these three pathological areas. With respect to favorable action in these areas, it is observed from Tables IX and X that approximately one out of six airmen appealing on the basis of a cardiovascular problem is finally issued medical certification. About one out of five airmen appealing with nervous or mental problems is issued medical certification, and approximately two out of five airmen with vision problems are issued medical certification. It should be noted that issuances are not always for the same class appealed for by the airman and limitations on certificate usage are not uncommon. In many cases, these airmen must also present follow-up evidence of medical condition more frequently than is normally required by regulation in order to more closely monitor those airmen whose condition is subject to change.

C. Petitions to the Administrator.

Petitions to the Administrator of the FAA represent the next higher level of appeal available to airmen denied certification at lower levels. The Administrator may, on the basis of medical evidence presented, exempt the airman from disqualifying regulations in recognition of the fact that the airman does have the specified medical problem but is considered to be a "good risk". The Administrator is advised in these decisions by a panel of consultant medical specialists.

TABLE X. Reconsideration Actions by
the Federal Air Surgeon
January 1963 - December 1967

<i>Pathology</i>	<i>First Class</i>	<i>Second Class</i>	<i>Third Class</i>	<i>Total</i>
<i>Issued</i>				
Eye	43	103	117	263
Ear, Nose, Throat	3	1	9	13
Respiratory	2	5	12	19
Cardiovascular	35	52	108	195
Abdominal	1	9	18	28
Nervous/Mental	22	29	117	168
Bone/Joint	2	4	7	13
Muscles	-	1	3	4
Miscellaneous*	3	11	35	49
TOTAL	111	215	426	752
<i>Denied</i>				
Eye	61	207	124	392
Ear, Nose, Throat	4	4	7	15
Respiratory	6	9	42	57
Cardiovascular	107	201	707	1,015
Abdominal	10	15	52	77
Nervous/Mental	70	136	374	580
Bone/Joint	-	5	14	19
Muscles	1	3	8	12
Miscellaneous*	21	53	181	255
TOTAL	280	633	1,509	2,422

*Miscellaneous includes alcohol and drugs, endocrinopathies and general systemic conditions.

Source: Office of Aviation Medicine, Aeromedical Standards Division.

During the time period 1961 through 1967, the Administrator considered 1,945 petitions from

airmen denied medical certification by the Federal Air Surgeon. These 1,945 petitions indicate that approximately 65% of the airmen denied by the Federal Air Surgeon petitioned the Administrator for exemption from the regulations.

Table XI summarizes the pathology represented in petitions to the Administrator, as well as decisions rendered. As before, cardiovascular, nervous and mental, and deficient vision were the most frequent pathological conditions considered. Cardiovascular problems represented 60% of the petitions to the Administrator. Approximately one out of four petitions based on cardiovascular problems was favorably considered. About one out of five of the petitions based on nervous and mental problems was favorably considered, and approximately one out of three petitions based on deficient vision problems was favorably considered. Overall, approximately 25% of all petitions to the Administrator received favorable action.

Since cardiovascular problems accounted for 60% of the petitions to the Administrator and 67% of the total favorable actions, in terms of grants of exemption to existing regulations, further analysis seems appropriate with respect to observed mortality experience among these individuals as compared to the total United States population.

During the time period January 1961 through December 1967, 325 petitions based on cardio-

TABLE XI. Petitions Granted or Denied by
the Administrator*
1961-1967

<i>Pathology</i>	<i>Granted</i>				<i>Denied</i>				<i>Total</i>	<i>Percent of Total</i>
	<i>First Class</i>	<i>Second Class</i>	<i>Third Class</i>	<i>Subtotal</i>	<i>First Class</i>	<i>Second Class</i>	<i>Third Class</i>	<i>Subtotal</i>		
Eye	10	19	25	54	8	59	22	89	143	7.4
Ear, Nose, Throat	-	1	-	1	-	1	-	1	2	0.1
Respiratory	-	-	4	4	3	1	10	14	18	0.9
Cardiovascular	6	32	287	325	120	204	524	848	1,173	60.3
Abdominal	2	-	6	8	3	5	14	22	30	1.6
Nervous/Mental	-	12	70	82	49	91	214	354	436	22.4
Bone/Joint	-	-	1	1	1	4	4	9	10	0.5
Muscles	-	-	-	-	-	-	2	2	2	0.1
Miscellaneous	-	2	8	10	11	15	95	121	131	6.7
TOTAL	18	66	401	485	195	380	885	1,460	1,945	100.0

*Counts are based on number of petitions considered rather than number of airmen petitioning.

Source: Office of Aviation Medicine, Aeromedical Standards Division.

vascular problems received favorable consideration. These 325 petitions represent 320 airmen granted exemptions from medical standards. During the same time period, 12 of the 320 airmen have died; 11 due to cardiovascular disease. Adverse change in medical condition has required that grants be terminated for an additional 23 of the airmen.

A statistical technique, which considers age at entry into the observed group, person-years of observation in age intervals, and subsequent mortality, has indicated that airmen granted exemptions for cardiovascular problems experienced a higher mortality rate than would be expected in the white male population of the United States.⁷ Table XII summarizes the comparison of mortality experience among panel grants with expected mortality based on death rates in the white male population of the United States.

IV. Summary.

The study has served to quantify several important factors concerning airmen denied medical certification. As mentioned previously, some of the conclusions to be drawn from the foregoing analysis were empirically observed some time ago by Office of Aviation Medicine personnel. In

⁷Reference Chapter 10, *Practical Statistics in Health and Medical Work*, by Ruth R. Puffer, Dr. P.H., McGraw-Hill, 1950, and the Appendix B for further details regarding the statistical technique.

these instances, however, validation and quantification of a premise has been achieved.

It has been noted that denial data accumulated to date is partially reflective of an era much more restrictive with respect to medical criteria. Medical standards are constantly under review, and if the past few years are indicative of a trend, it appears likely that denial data to date would provide pessimistic projections to future airman populations.

Retrospectively, denials have amounted to less than 1% of application receipts (0.79%). This represents a 1.14% denial rate when applied to active airmen. Females make up 4.0% of the active population and the denial rate among females is virtually the same as among males. Voluntary attrition resulting from known medical condition and the regulatory certification process is unmeasurable but probably contributes very little to the total denial rate since most airmen use the frequency of airman medical certification to satisfy their desires for periodic medical examination.

The average age of denied airmen (37.5 years) exceeds the average age of the active airman population (35.0 years). This would be expected, however, since most disqualifying pathology is associated with age. Table I indicates that the majority of denied airmen are third-class applicants and that the greatest frequency of these

TABLE XII. Observed and Expected* Deaths from
Cardiovascular Disease Among Panel Grants
1961-1967

Age Group	Person Years	Death Rates Per 100,000, United States**	Expected Deaths	Observed Deaths	Excess Deaths Among Grants (%)
TOTAL	909.75		4.64	11	137.1
15-24 years	0.50	0.6	†	-	-
25-34	8.50	10.1	†	-	-
35-44	191.00	86.6	0.16	2	1,150.0
45-54	412.75	346.0	1.43	6	319.6
55-64	270.25	905.8	2.45	3	22.4
65-74	22.75	1,972.9	0.45	-	-
75-84	4.00	3,812.8	0.15	-	-

*Expected deaths were obtained by applying age specific death rates for arteriosclerotic heart disease, including coronary disease, in the white male population of the United States for 1965 to person-year observations.

**Vital Statistics of the United States, 1965, Volume II, Part A, Section I, Table 1-10.

†Less than 0.05.

Source: Civil Aeromedical Institute, Aeromedical Certification Branch, Medical Statistical Section.

applicants is in the age group 20-24 years. Data contained in Table V further indicates that the majority of these denied third-class applicants are student airmen. About 60% of the active population are third-class airmen and approximately one-third of the total active population falls in the age interval 20-30 years. It is not, therefore, surprising that the greatest frequency of denials should come from this interval. Additionally, it is recognized that the majority of the denials in the 20-30 age range are initial applicants. Reference to Table IV indicates that more than half of total denials are among new applicants.

Data presented in Table V indicates that 91.1% of the denied airmen in the study group were

not occupationally connected to aviation. Air Traffic Controllers have the highest denial rate among applicants involved in an aeronautical occupation and the majority of these individuals were not pilots in addition to their air traffic controller duties.

As expected, the study has indicated rather conclusively that the most important medical problems among denied airmen are cardiovascular, nervous and mental, and deficient vision. The important consideration in this respect has been to define the prevalence of these problems and to appraise the success of appeal actions and procedures.

APPENDIX A

Test For Significance Between The Mean Age of Denied Airmen and the Mean Age of Active Airmen

I. Hypothesis Tested:

A. Null Hypothesis: $\bar{X}_P = \bar{X}_S$

No difference between the mean age of active airmen (\bar{X}_P) and the mean age of denied airmen (\bar{X}_S).

B. Alternate Hypothesis: $\bar{X}_S > \bar{X}_P$

Mean age of denied airmen is greater than the mean age of active airmen.

II. Significance Level: 0.05

III. Standard Error of the Mean:

$$\begin{aligned}\sigma_{\bar{X}} &= \frac{\sigma \text{ (Population Standard Deviation)}}{\sqrt{N}} = \frac{10.91}{\sqrt{5,727}} \\ &= \frac{10.91}{75.68} \\ &= \underline{\underline{0.144}}\end{aligned}$$

$$\text{IV. } \frac{x}{\sigma} = \frac{\bar{X}_S - \bar{X}_P}{\sigma_{\bar{X}}} = \frac{37.5 - 35.0}{0.144}$$

$$= \frac{2.5}{0.144}$$

$$= \underline{\underline{17.36}}$$

V. $P < .0001$ that a difference this great could be due to chance.

VI. Inference: The mean age of denied airmen is significantly greater than the mean age of the active airman population.

APPENDIX B

Statistical Appraisal of Mortality Experience Among Panel Grants as Compared To The White Male Population of the United States

Person-Years (L_x) in age intervals as reflected in Table XII were computed by use of the formula:

$$L_x = l_x + \frac{1}{2}h_x - \frac{1}{2}(a_x + d_x + w_x) + \frac{1}{4}b_x$$

Where:

L_x = Person-years in the interval.

l_x = Individuals under observation (issued grants) at the beginning of the interval.

h_x = Individuals entering observation (issued grants) during the interval.

a_x = Individuals leaving observation (termination of grant) during the interval due to adverse change in medical condition.

d_x = Individuals leaving observation during the interval because of death.

w_x = Individuals withdrawing from observation alive during the interval for all other reasons including termination of the study.

b_x = Individuals both entering and leaving observation in the same interval.

Individuals entering observation are counted as being present one-half year each in the entering interval. Individuals leaving observation for

whatever reason are counted as being present for one-half year each. Individuals entering and leaving during the same interval are counted as being present for one-quarter year each.

This technique of evaluating mortality experience following entry into the observation group is discussed in Chapter 10 of "Practical Statistics in Health and Medical Work" by Ruth R. Puffer, Dr. P.H., and involves the comparison of the number of deaths that occurred in a group under observation with the number that would be expected in such a population if mortality experience were similar to that of some other comparison group; in this case, that of the white male population of the United States during 1965.

The death rate for the comparison group is multiplied by the person-years of life experience in a given age interval of the group under observation to obtain expected deaths in the observed group if mortality experience were similar to that of the comparison group. Expected deaths are then compared with observed deaths, by age interval, to indicate mortality experience in the observation group (See Table XII).