PROBLEMS OF CONSISTENCY ARISING FROM CAA MEDICAL EXAMINATIONS

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U. S. DEPARTMENT OF COMMERCE

CIVIL AERONAUTICS ADMINISTRATION

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The medical examination is a link in administrative practice as well as a professional instrument. Among those who are interested and economically able, it is one of the chief limitations placed upon the increase of private pilot licenses. As such it is important to examine the standards used and the manner in which the examination is applied so that the public may be assured that the limitation is both fair and necessary. Another urgent reason is that in the present emergency medical examinations interrupt a smooth transition from civil training to the Armed Services by rejection for military service of candidates who have been fully qualified by civil examinations. The medical requirements also present a real problem in licensing by creating a series of disagreements among examiners.

The adequacy of the standards and the reliability of the examination should have more validation than by authority alone. The point at which selection standards are fixed should have an experimental foundation. There is no doubt that at some point in a scale of visual

acuity flying becomes dangerous, but that point is not necessarily 20/20. There is surely some definition of cardio-vascular inefficiency which will mark a pilot as unsafe but this definition may be unattainable through the medium of an observer and a stethoscope.

The problem of the best use to make of medical examinations in the selection and licensing of pilots is two-fold: (1) the construction of tests which may be economically and objectively administered, (2) the determination of standards for elimination.

One of the first steps in research solution of these problems is to determine the agreement existing between the records which are now available. We, therefore, studied the records on pilots who had been examined by more than one physician during the course of their flying experience. Comparison of these records means the comparison of medical examinations with either a year or six months interval between them. In the case of defects which are removable (hernia, for instance) such comparisons throw no light on our problem, but in the case of defects which are not likely to be removed (such as certain of the visual disabilities, for instance) the comparison will allow a statement of the consistency of the medical records which are being accumulated. In this study a record was counted as a visual defect whether corrected by glasses or not. This was done in order to compare the findings of physicians in respect to the vision of the applicant, whether or not he wore glasses at one or another period.

The problem is to find the probability that an individual who is noted as having a disability by one physician will encounter a like opinion from the next one who examines him. We fully recognize that the condition of the individual, as well as the methods of examination, is a source of disagreement. For administrative reasons, however, it is essential to know the hazards of having a disability assigned to a pilot. How much of the noted facts can be counted as true descriptions of the individual and how much must be assigned to the error of a particular examiner under particular conditions? Comparisons made between physicians in this study sometimes involve several examinations by one physician and only one examination by another.

Disagreement between physicians may arise for any combination of the following reasons:

1. Because there was a change in the pilot in the interval of a year or six months between two examinations.

2. Because the standards of the examining physician were different.

3. Because the technique and methods of examination which the physicians employed were different.

4. Because the examiner fails to report on account of his obligations to the pilot, previous actions of the Bureau, or other pressures*

5. Because the pilot successfully conceals a defect from the examiner*

* These two reasons were added at the suggestion of our Medical Division.

If there is a large amount of difference between examinations, which is due to the first cause, then the "defect" which is recorded is a function of changing conditions. If this defect is a correctible condition, this is, of course, a valuable consideration. At best we may hope that the medical examinations will help to maintain the health of the pilot as well as determine his fitness. We hope to define and preserve the minimum physical requirements which permit safe operation. If, however, the defect is one in which correction is unusual, such as most types of vision, hearing, and cardio-vascular defect, then the disagreement of examiners must be explained by some combination of the other reasons unless a progressive change has made a defect notable whereas it was formerly harmless. However, this exception can only apply if the disagreement is due to detection of a defect on the last examination. If serious abnormality truly appears and disappears within a year, then examinations must be more frequent if we are to use them as part of our pilot control. A system of annual measurement must be justified by diagnoses of elements of physical status which are sufficiently deep-seated to be changed by positive correction only.

It will be shown that there is a large amount of difference between records of examinations which is not due to changes which have occurred in the pilot. It is then apparent that the examinations must

be standardized. A wide range of standards is, of course, characteristic of all unobjective examinations and this, in turn, is related to the refinement intended by the measurements.

Problems of measurement and problems of diagnosis differ. It is one thing to render a clinical diagnosis which depends upon many interrelated factors and upon consideration of the organism as a whole, and quite another to say that an individual has or has not reached a particular point in a variable such as visual acuity. This latter problem has wide-reaching statistical and psychological elements. The sensible procedure would be to determine a point in the distribution where a distinction is desired and then to intensify materials which will test at that point. Obviously the present medical examinations do not do this. For this reason the lack of agreement which is the subject of this paper may be attributed in part to the character of the examinations and the point of view of examiners.

This statistical study was made on the basis of evidence found in the files of the Civil Aeronautics Administration Medical Division. The abstracts studied represent 18,400 cases who had a defect of any kind recorded at one of the last ten examinations.

The examinations included in this study were limited to ten. This covers a minimum of five years and a maximum of ten, since during the period studied commercial pilots were examined every six months and

others were examined every year. The data, therefore, are the last ten or all examinations of all cases having at some time been recorded as having a defect of any kind. The material, when there is disagreement between physicians, is illustrated by examples in Exhibit A. The records are read as follows:

Dr. A examined Pilot X on 5-18-37 and decided that he had a cardio-vascular defect sufficiently grave to warrant disqualification. He was also examined on 4-29-38 by Dr. B and was pronounced as fully qualified and free from any defect.

Dr. C examined Pilot Y on 8-2-37 and as a result Y was disqualified because of a hearing defect. On 12-20-37, and on two subsequent occasions he was reported by Dr. D to have no hearing defect and was granted a private license.

Dr. E examined Pilot Z on 5-28-36 and applied the following descriptions: "Mediocre intelligence, mental deficiency, inadequate personality, moronic type." On 10-17-38 he was examined by Dr. F and reported as clear of all defects. On that date he was given a commercial license.

Dr. G disqualified Pilot W on 8-16-30 because of "Diplopia in primary position due to a large amount of hyperphoria." Less than three months later Dr. H cleared this pilot of all defect (11-1-30), and again on 9-22-31).

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The method of analysis was to classify pilots by number of doctors examining and by defect found. This, of course, means that any one pilot may appear in more than one set of data if he has more than one defect. Such classification made possible statistics such as are displayed in Chart 1. Because of the small numbers involved, pilots who were examined by six or more physicians were not charted. Tabular material is available for these and the conclusions are no different from those presented.

Chart 1 is read in the following manner: There are in the files 3,703 cases who, in one of their last ten examinations have been recorded as having a visual limitation of some kind (corrected or not) and who have been examined by two and only two physicians. In 47% of these cases the disability was noted by one physician only. There are also 1,153 other cases who were examined by three and only three physicians, during the period studied, and who are recorded as having some visual disability. In 41% of these cases this disability was recognized by one physician only. The records of the examinations made by the other two physicians clear the case of any suspicion of visual disability.

Table 1, presented later in this report, will show that the disagreements presented in this chart more often arise from a finding in the first examination and a clearance in the last than the other way

EXHIBIT A

File No._____ Certificate No._____
Class_____

Name X
Address_____

Date	Results	Date of Birth	Examiner
5-18-37	Disq	Tonsils badly diseased P R 100-120-105 B P 140-80-144-74	Dr. A
4-29-38	Coml app S		Dr. B

Form ACA 59-Dept. of Commerce-C.A.A. (Rev. 11-15-40)

File No._____ Certificate No._____
Class_____

Name Y
Address_____

Date	Results	Date of Birth	Examiner
8-2-37	Disq	Hearing both ears 2ft. Arteries rather thickened	Dr. C
12-20-37	Pvt app S	Both eyes 20/30	Dr. D
10-31-38	"	"	"
8-18-39	"	"	"

Form ACA 59-Dept. of Commerce-C.A.A. (Rev. 11-15-40)

File No._____ Certificate No._____
Class_____

Name Z
Address_____

Date	Results	Date of Birth	Examiner
5-28-36	Disq	Mediocre intelligence, mental deficiency, inadequate personality, moronic type	Dr. E
10-17-38	Coml app S		Dr. F

Form ACA 59-Dept. of Commerce-C.A.A. (Rev. 11-15-40)

File No._____ Certificate No._____
Class_____

Name W
Address_____

Date	Results	Date of Birth	Examiner
8-16-30	Disq	Diplopia in primary position due to a large amount of hyperphoria	Dr. G
11-1-30	Qual P		Dr. H
9-22-31	"		Dr. H

Form ACA 59-Dept. of Commerce-C.A.A. (Rev. 11-15-40)

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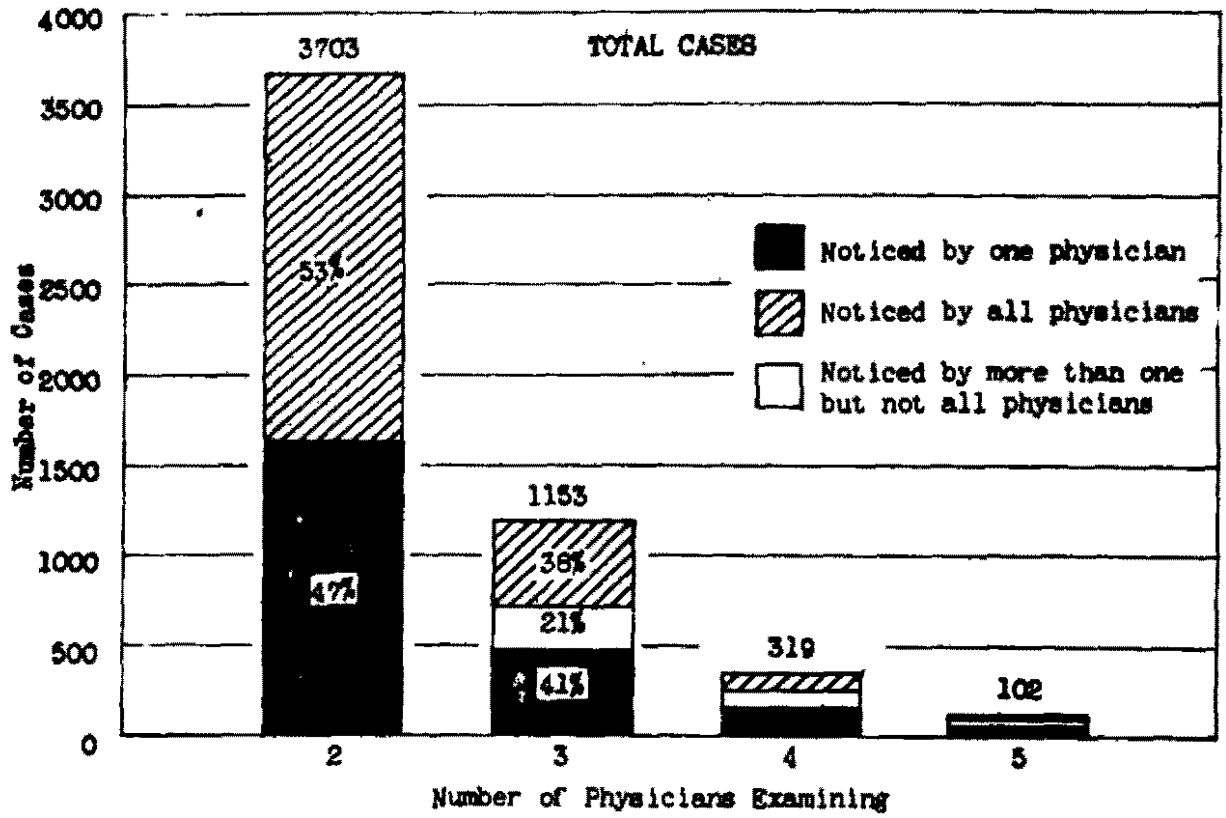
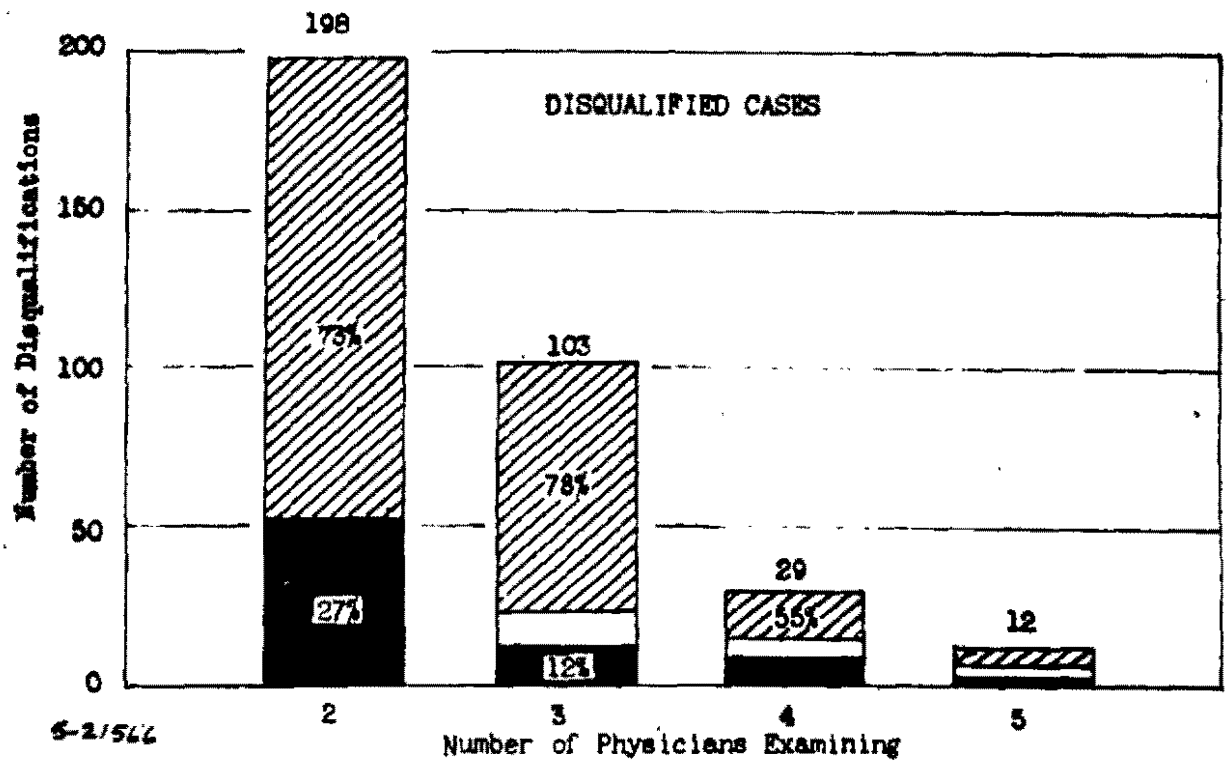
VISUAL DISABILITY CASES EXAMINED BY MORE THAN ONE PHYSICIANS WHERE DEFECT WAS NOTED BY ONE TO ALL PHYSICIANS

CHART 1

(Cases Noticed Given By Number Of Physicians Examining)
(Physicians Noticing Defect Given In Percent Of The Total Cases Noted)





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around. This sequence is natural since disqualification is likely to lead to change of physician. At the same time it points to a real disagreement and not development of a defect between examinations.

There are 198 cases in the records who have been examined by two and only two physicians and who have, at one time or another, been disqualified for a visual disability. This, then, is a more serious decision made by some examiner. In 27% of these cases the disability was recognized by one physician only. Full study of materials of this type indicates that medical notation of visual disability by any one physician is likely to be reversed by the next examination in from four to five out of every ten cases and that a medical opinion of visual disability, so serious that it disqualifies the pilot, will be reversed on the next examination in one out of four cases.

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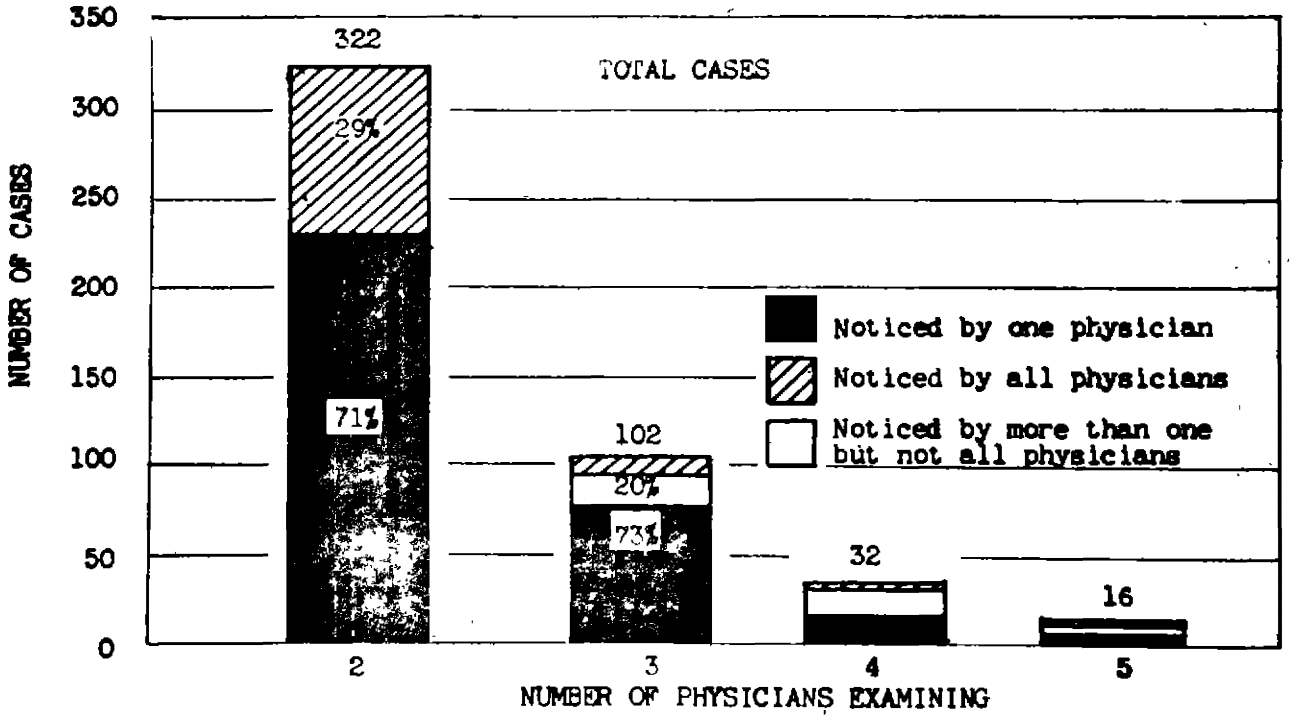
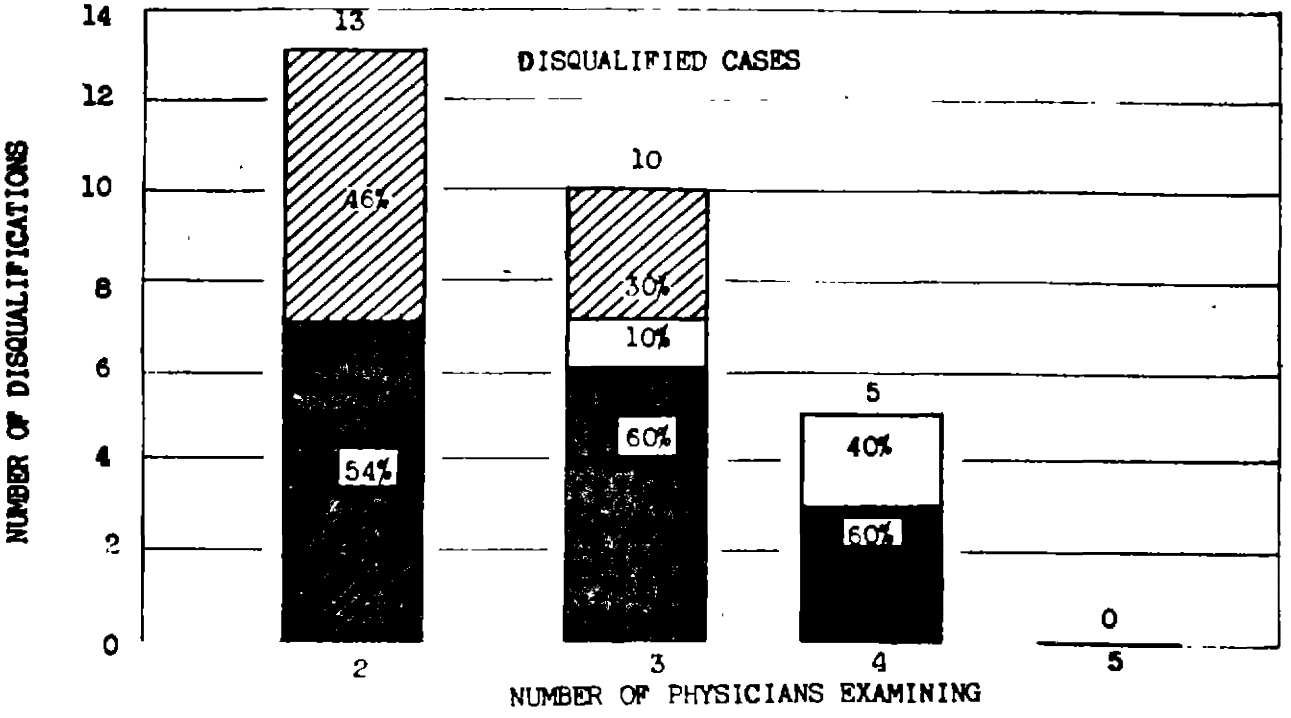
COLOR VISION DISABILITY CASES EXAMINED BY MORE THAN ONE PHYSICIAN WHERE DEFECT WAS NOTED BY ONE TO ALL PHYSICIANS

CHART 2

(Physicians Noticing Defect Given In Percent Of The Total Cases Noted)
(Cases Noticed Given By Number Of Physicians Examining)





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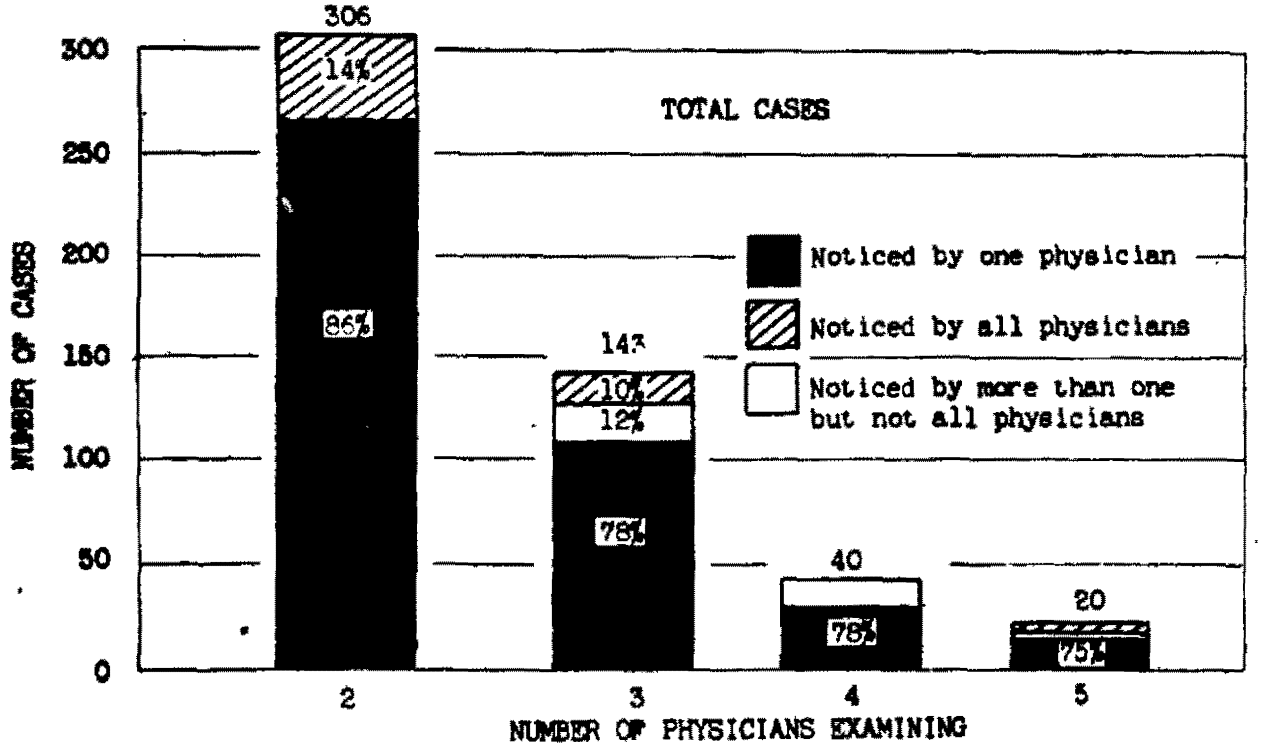
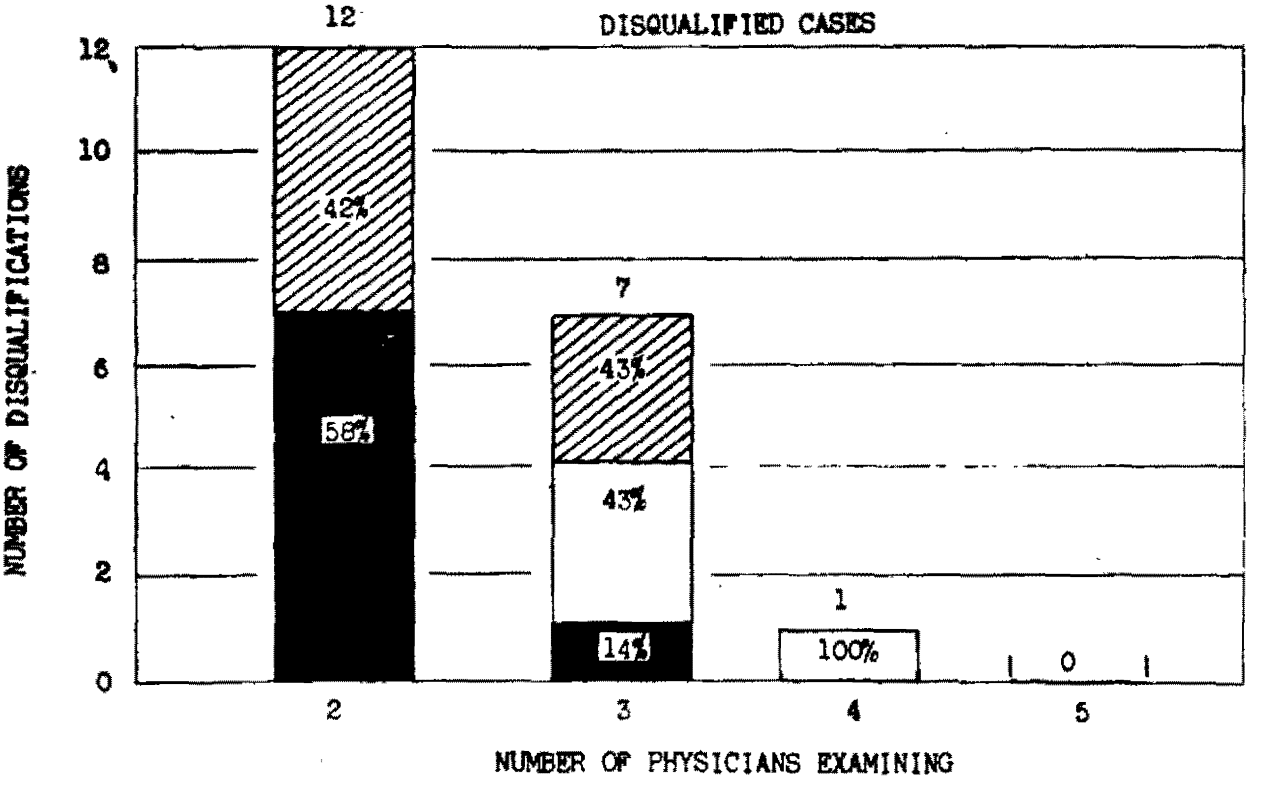
HEARING DISABILITY CASES EXAMINED BY MORE THAN ONE PHYSICIAN WHERE DEFECT WAS NOTED BY ONE TO ALL PHYSICIANS

CHART 3

(Cases Noticed Given By Number Of Physicians Examining)
(Physicians Noticing Defect Given In Percent Of The Total Cases Noted)





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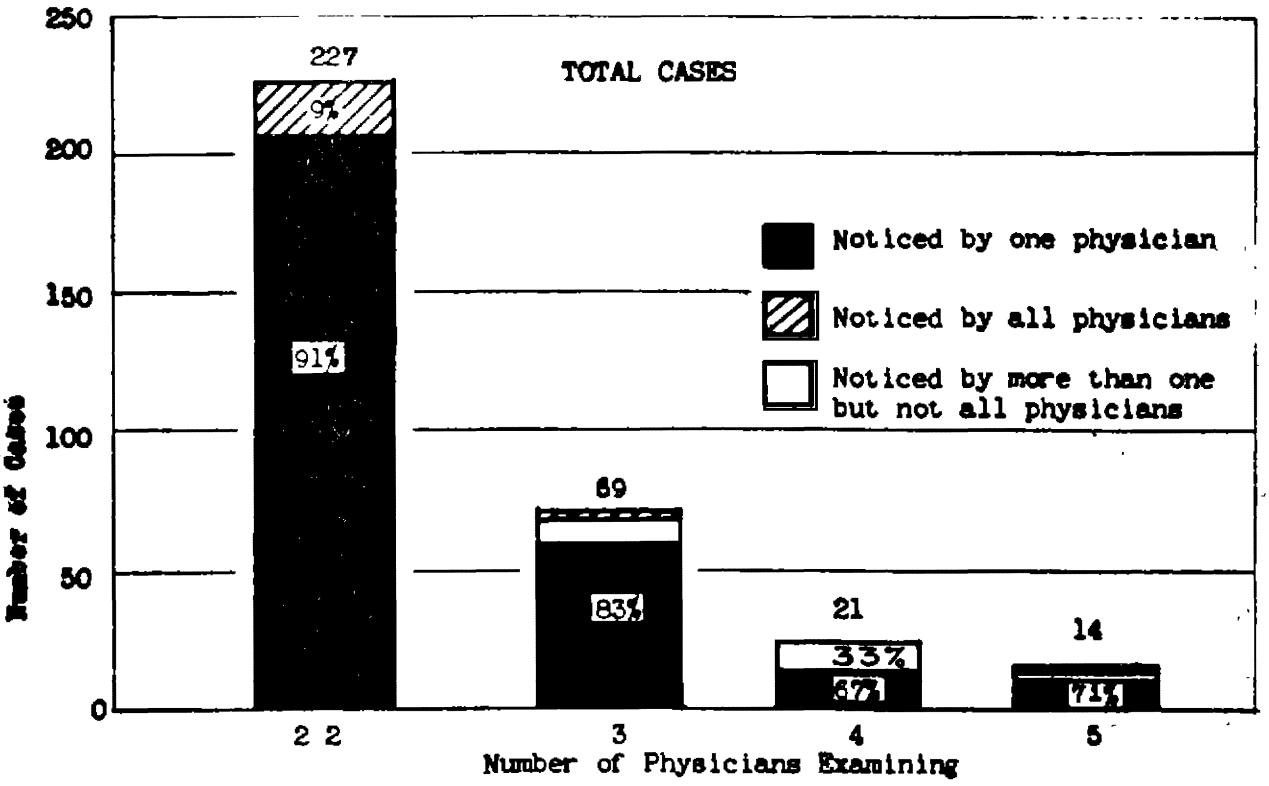
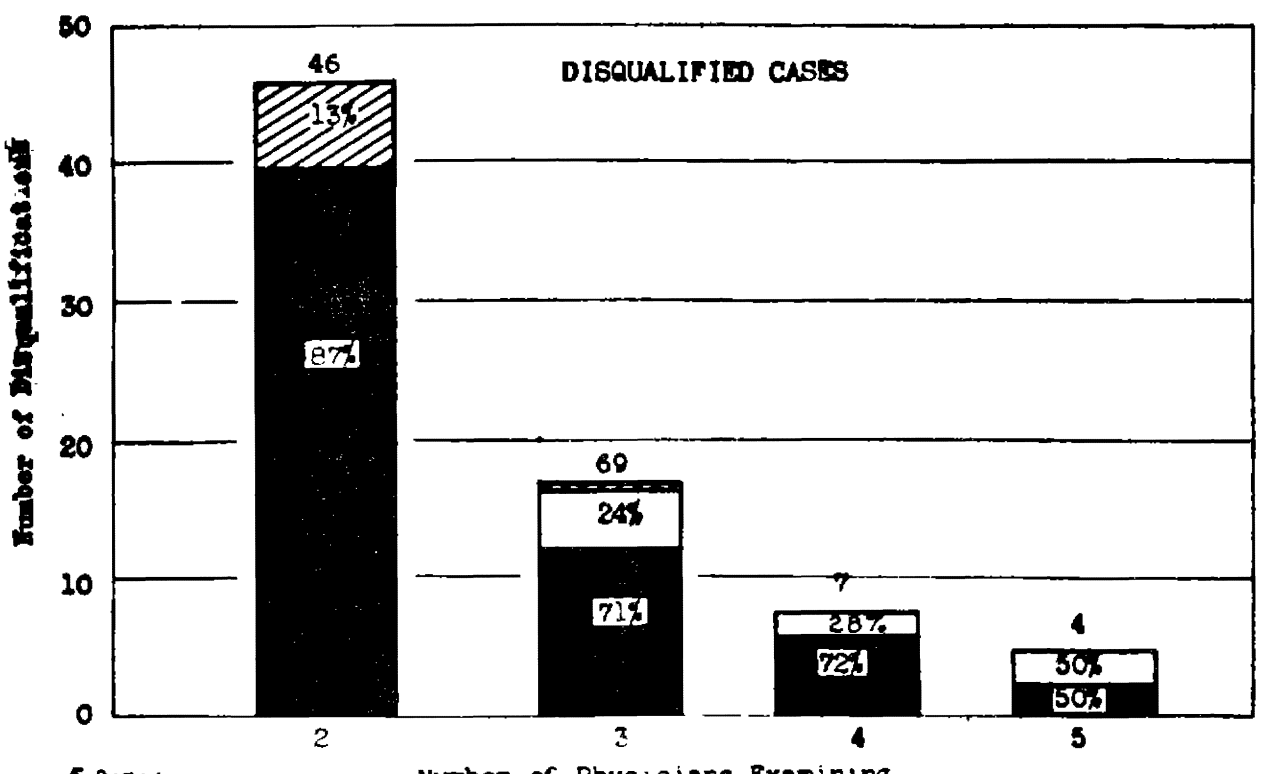
CARDIO-VASCULAR DISABILITY CASES EXAMINED BY MORE THAN ONE PHYSICIAN WHERE DEGECT WAS NOTED BY ONE TO ALL PHYSICIANS CHART 4

(Cases Noticed Given By Number Of Physicians Examining)
(Physicians Noticing Defect Given In Percent Of The Total Cases Noted)





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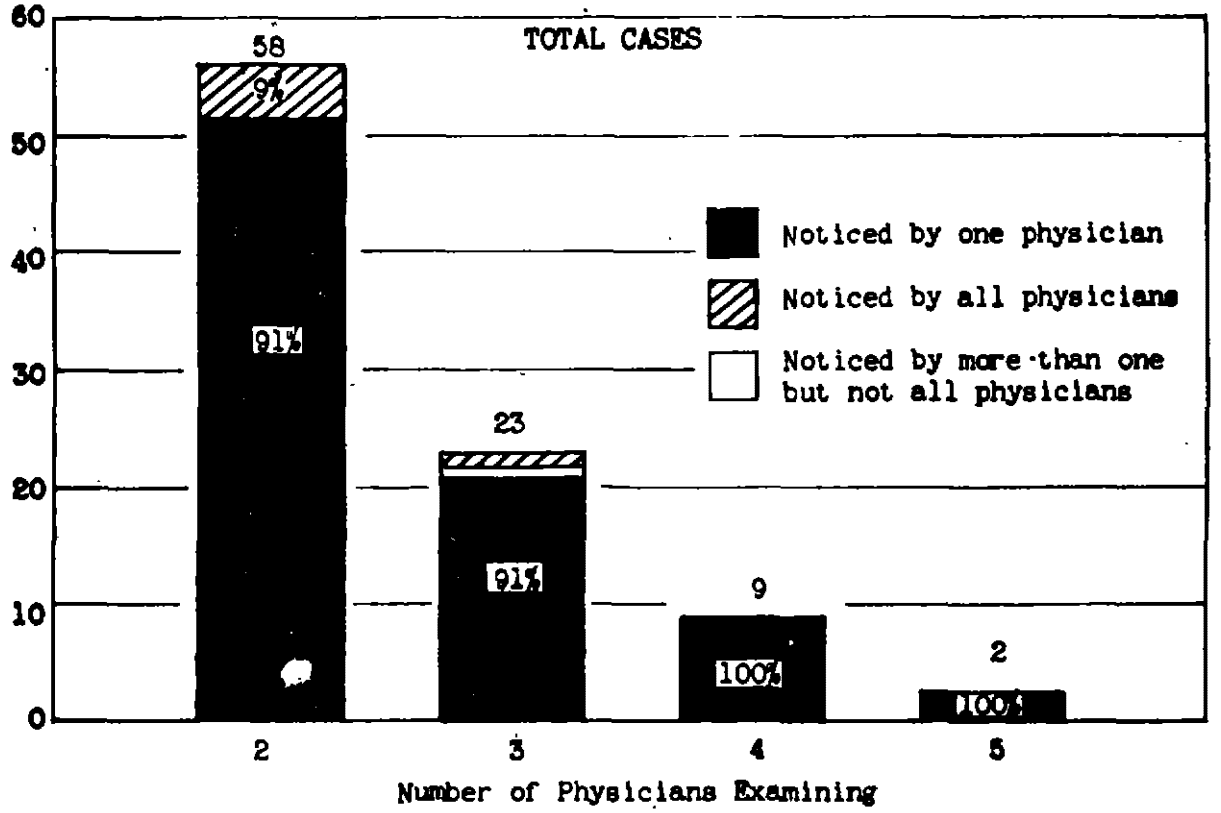
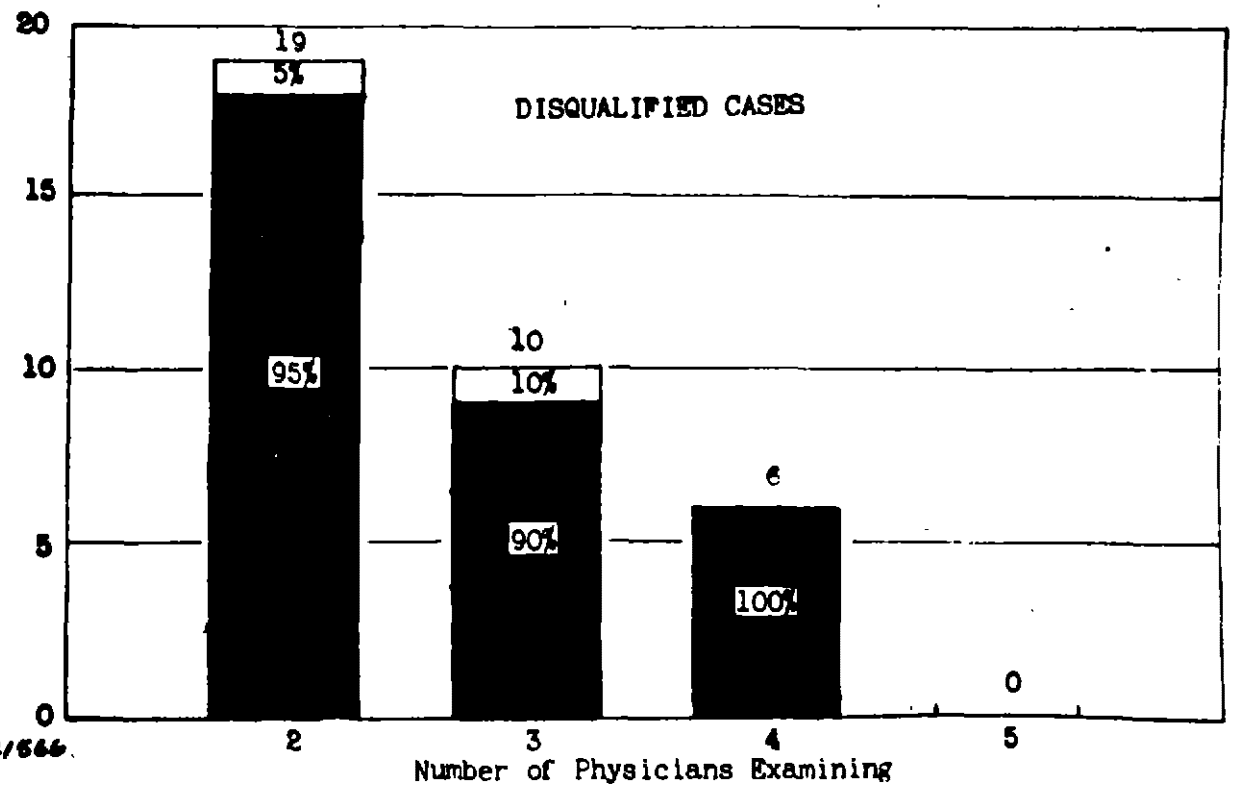
PSYCHIATRIC DISABILITY CASES EXAMINED BY MORE THAN ONE PHYSICIAN WHERE DEFECT WAS NOTED BY ONE TO ALL PHYSICIANS

CHART 5

(Cases Noticed Given By Number Of Physicians Examining)
(Physicians Noticing Defect Given In Percent Of The Total Cases Noted)





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Disagreements are, of course, much greater when we consider the more difficult traits to measure. Disagreement in respect to the detection of visual disability or hearing is to a large extent due to inadequate methods of examination. Disagreement in respect to other medical pronouncements is far more understandable but is of even more administrative importance.

There are 92 individuals in the materials studied who are recorded as having some psychiatric disability and who have been examined by more than one physician. In 91% of these cases the defect was noted by one physician only. Again, as will appear in Table 1, the direction of the disagreement is more often defect to clearance than vice versa. Thirty-five cases who have been examined by more than one physician were disqualified for psychiatric reasons. Only two of these 35 records contained any psychiatric comment from physicians other than the one who disqualified the pilot. Still, six of them were examined by four physicians, ten were examined by three and nineteen were examined by two. Table 2 will show that the defect was usually found by the first examiner.

Similar inconsistency appears in respect to color vision, hearing, and cardio-vascular defect. The evidence shows conclusively that there is very little agreement between examiners. It makes the immediate construction of objective methods of examination very important.

It has been noted that the question arises whether this disagreement is due to a defect being found which was previously missed or to

missing a defect which was previously found. It would, of course, affect the interpretation markedly if the last physician examining always was the one to have found the defect whereas former examinations had not. We could then assume that the defect was at the beginning slight or absent, that it grew progressively worse, and that it was detected as soon as it had reached a serious stage. We, therefore, examined consecutive examinations in which disagreement occurred. Tables 1 and 2 present these materials.

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TABLE 1

THE ORDER OF DISAGREEMENT BETWEEN TWO EXAMINERS ON CONSECUTIVE EXAMINATIONS (FIRST-SECOND, FOURTH-FIFTH AND SEVENTH-EIGHTH) IN THE ASSIGNMENT OF DISABILITIES TO PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING THE DEFECT

Defect	Defect Assigned by First Examiner	Defect Assigned by Last Examiner	Total Consecutive Disagreements Used
Vision	931	760	1691
Color Vision	149	91	240
Hearing	159	91	250
Cardio-vascular	125	48	173
Psychiatric	38	15	53

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Table 1 is read in the following manner: There are 1,691 cases in which there was a disagreement in respect to the presence of a visual defect using all first-second, fourth-fifth and seventh-eighth examinations. (The selection of paired examinations is arbitrary and is made for presentation purposes only. Other pairs yield the same conclusions). In 931 of these cases the defect was found by the first physician and in 760 the defect was found by the last. Table 2 presents similar materials for disqualifications using all cases instead of selected pairs.

Table 1 shows that in all defects studied there were more disagreements which progressed from defect to clearance than from clearance to defect. It is apparent from Table 2 that in a large proportion of the cases, in which the pilot was disqualified and in which only one of a number of examining physicians found the defect, the first of the physicians examining was the one to have found it, and those following were the ones who gave clearance. These conclusions point to an administrative difficulty of which we have long been aware. Pilots who have been warned of a defect or who have been disqualified, look for other doctors who will clear them. The record indicates that their search was not in vain.

In 59 cases disqualified for cardio-vascular reasons, for instance, 44 were so disqualified by one physician and later cleared by others. Fourteen only were cleared by the first physician examining and later

disqualified. These 14 may, of course, be cases that had developed a heart ailment subsequent to the first examinations. The same is true of one out of eight cases of hearing defect found by the last examining physician, and seven of 33 psychiatric disagreements. However, all cases who were disqualified by the first of a number of examinations and later cleared are cases of disagreement in medical standard or in method of examination.

TABLE 2

PLACE OF DISQUALIFICATION IN ORDER OF EXAMINATIONS

WHEN ONLY ONE PHYSICIAN NOTICED THE DEFECT*

Disqualification by:	Color Vision	Hearing	Cardiovascular	Psychiatric
First Physician	15	7	44	24
Intermediate	-	-	1	2
Last physician	1	1	14	7
Total	16	8	59	33

* Vision not used because the disagreement on defects severe enough to warrant disqualification is relatively small and assumed to be due to correction or change.

Paired comparisons were obtained by the selection of consecutive examinations involving two physicians. Again all cases in first-second, fourth-fifth and seventh-eighth were used. This selection was made so that examination agreement at various stages of a pilot's career might be compared.

These paired comparisons allow an estimate of chance agreement. Since we know total assignment of a defect (For each case: By neither doctor = 0; By both doctors = 2; By one of them only = 1) we can compute the number of times agreement would occur if this agreement were due to chance alone. Tables 3 to 7 present the actual and chance agreement of such paired examinations.

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TABLE 3

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF VISUAL DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A VISUAL DISABILITY

	#	%	% Distribution by Chance Alone
1st and 2nd Examinations			
Disability found by both	1661	48	46
Disability found by neither	416	12	10
Disability found by one only	1421	40	44
Total	3498	100	100
4th and 5th Examinations			
Disability found by both	281	40	31
Disability found by neither	203	28	19
Disability found by one only	225	32	50
Total	709	100	100
7th and 8th Examinations			
Disability found by both	54	38	29
Disability found by neither	43	30	21
Disability found by only one	45	32	50
Total	142	100	100

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TABLE 5

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF HEARING DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A HEARING DISABILITY

			% Distribution by

TABLE 4

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF COLOR VISION DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A COLOR VISION DISABILITY

	#	%	%Distribution by Chance alone
1st and 2nd Examinations			
Disability found by both	83	25	30
Disability found by neither	49	15	20
Disability found by one only	198	60	50
Total	330	100	100
4th and 5th Examinations			
Disability found by both	7	10	12
Disability found by neither	30	43	44
Disability found by one only	33	47	44
Total	70	100	100
7th and 8th Examinations			
Disability found by both	5	23	18
Disability found by neither	8	36	32
Disability found by one only	9	41	50
Total	22	100	100

TABLE 6

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF HEARING DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A HEARING DISABILITY

	#	%	% Distribution by chance alone
1st and 2nd Examinations			
Disability found by both	41	12	16
Disability found by neither	105	32	36
Disability found by one only	183	56	48
Total	329	100	100
4th and 5th Examinations			
Disability found by both	8	7	10
Disability found by neither	47	43	46
Disability found by one only	55	50	44
Total	110	100	100
7th and 8th Examinations			
Disability found by both	3	12	13
Disability found by neither	10	40	41
Disability found by one only	12	48	46
Total	25	100	100

TABLE 6

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF CARDIO-VASCULAR DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A CARDIO-VASCULAR DISABILITY

	#	%	% Distribution by chance alone
1st and 2nd Examinations			
Disability found by both	21	9	20
Disability found by neither	42	19	30
Disability found by one only	157	72	50
Total	220	100	100
4th and 5th Examinations			
Disability found by both	1	2	3
Disability found by neither	29	68	69
Disability found by only one	13	30	28
Total	43	100	100
7th and 8th Examinations			
Disability found by both	1	9	5
Disability found by neither	7	64	59
Disability found by one only	3	27	36
Total	11	100	100

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TABLE 7

AGREEMENT BETWEEN TWO EXAMINERS IN THE ASSIGNMENT OF PSYCHIATRIC DISABILITY ON CONSECUTIVE EXAMINATIONS OF PILOTS WHO AT SOME TIME WERE RECORDED AS HAVING A PSYCHIATRIC DISABILITY

	#	%	% Distribution by chance alone
1st and 2nd Examinations			
Disability found by both	4	6	18
Disability found by neither	13	20	32
Disability found by one only	48	74	50
Total	65	100	100
4th and 5th Examinations			
Disability found by both	-	-	3
Disability found by neither	8	67	69
Disability found by one only	4	33	28
Total	12	100	100
7th and 8th Examinations			
Disability found by both	-	-	2
Disability found by neither	3	75	76
Disability found by one only	1	25	22
Total	4	100	100

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Tables 3 to 7 are read in the following manner: (Table 3) 3,498 pairs involving two physicians occur in first-second examinations. All of these at some time were recorded as having a vision defect. In 1,661, or 48% of these, the disability was found by both. In 416 of these, or 12%, the defect was not recorded by either. In 1,421 cases, or 40%, the defect was found by one and not by the other. Considering the rate of defect detection in these cases, 46% would have been found by both by chance. Then the actual agreement and the chance agreement are almost the same. The chance agreement is found as follows: Twenty double examinations offer forty opportunities. Divide this into defects noted, - ten for example. Then, ten divided by forty, gives .25 as the probability of having a defect assigned. By pure chance, to get it twice would occur .25 squared and to get it neither time would occur .75 squared. To get it once and not again would be (.25) (.75). These theoretical agreements are compared with actual agreement. When they are about the same, then the agreement is chance. If noticeable disabilities make one pilot more likely to have a defect assigned than another, then actual agreement will be greater than by chance.

It is apparent from these tables that there is very little common designation of pilots. The table shows that except in the case of psychiatric disability there is a tendency for the agreement in

the seventh and eighth examinations to be larger than in the first and second. However, even in the seventh and eighth examinations, the disagreement is still very large. One hundred and forty-two cases, for instance, who at some time were recorded as having a visual defect, were examined by different physicians on the seventh and eighth examinations. In only 38% of these cases was the defect found by both. In 32% of the cases the defect was found by neither. By pure chance, considering the rate of finding a defect of this type in this group, 29% would have been found by both. There is, then, slightly more agreement than there would be by chance. In the first and second examinations the agreement in all types of defect is what we would find by chance, or less. The reason that there is sometimes more disagreement than we would find by chance is because some physicians tend to record one type of disability more than others and so, of course, disagreement is, in part, a foregone conclusion, based upon the difference in emphasis of the examiners. This difference in standards may be seen in Table 8.

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TABLE 8

FREQUENCY OF NOTING EACH DISABILITY

NUMBER OF PHYSICIANS EXAMINING FORTY OR MORE OF THE CASES STUDIED WHO NOTED EACH PERCENT OF EACH DISABILITY

Percent of total cases reported who were noted for:	No disability Noted	Vision
0	1	0
0 - 5	2	0
6 - 10	23	0
11 - 15	48	0
16 - 20	45	0
21 - 25	29	0
26 - 30	14	1
31 - 35	9	0
36 - 40	5	4
41 - 45	6	8
46 - 50	1	8
51 - 55	1	13
56 - 60	1	24
61 - 65	0	28
66 - 70	0	48
71 - 75	0	19
76 - 80	0	22
81 - 85	0	9
86 - 90	0	1
	185	185

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This table includes materials for only those physicians who have made at least 40 of the examinations with which we are dealing. This was done so the percentage of cases noted as having a particular disability would be somewhat stabilized. The number of examinations made by these physicians varies from 40 to 1000. This table includes 185 physicians. Over 60 of them have made more than 100 of the examinations used in this analysis. It should be noted that the tables all refer to cases who at some time have had a disability noted. Still, one of the physicians cleared 58% in respect to all defects, whereas another one cleared none at all. The others vary between these extremes.

The table is read in the following manner: One physician noted no disability in no cases, that is, he recorded a defect for all cases examined. Two physicians recorded no disability for between zero and 5% of the cases they examined; 23 recorded no disability for between 6% and 10% of the cases they examined; etc. One physician recorded only about 28% of the cases examined by him as vision defects. No physicians recorded between 36% and 40% of the cases they examined as vision defects. Eight of the physicians recorded between 41% and 45% of the cases they examined as vision defects. Etc.

It may be seen by the distribution of percent of cases recorded as having no disability, that there is a large spread in the

severity of the examination. The distribution of the percentages of cases reported as having a vision defect shows a wide difference in emphasis in respect to records for this disability. Table 9 presents similar material for the other defects.

TABLE 9

FREQUENCY OF NOTING EACH DISABILITY

NUMBER OF PHYSICIANS EXAMINING FORTY OR MORE OF THE CASES STUDIED WHO NOTED EACH

PERCENT OF EACH DISABILITY

Percent of total cases reported who were noted for:	Color vision	Hearing	Structural	Hernia	General systemic	Cardiovascular	Syphilis	Psychiatric	Epilepsy
0	29	14	12	52	61	47	162	111	178
0.1 - 1.0	4	9	0	24	18	8	13	32	5
1.1 - 2.0	20	34	22	41	47	29	7	25	2
2.1 - 3.0	19	35	29	24	24	30	1	6	0
3.1 - 4.0	17	20	29	15	15	21	0	7	0
4.1 - 5.0	19	23	20	8	5	20	2	2	0
5.1 - 6.0	17	7	22	5	6	7	0	1	0
6.1 - 7.0	17	12	17	2	4	6	0	1	0
7.1 - 8.0	14	6	13	2	2	3	0	0	0
8.1 - 9.0	6	4	4	0	1	7	0	0	0
9.1 - 10.0	5	3	3	1	1	3	0	0	0
10.1 - 11.0	4	2	3	0	1	2	0	0	0
11.1 - 12.0	6	5	3	1	0	1	0	0	0
12.1 - 13.0	2	1	4	0	0	1	0	0	0
13.1 - 14.0	1	4	1	0	0	0	0	0	0
14.1 - 15.0	1	3	1	0	0	0	0	0	0
15.1 - 16.0	1	0	0	0	0	0	0	0	0
16.1 - 17.0	2	0	0	0	0	0	0	0	0
17.1 - 18.0	0	0	1	0	0	0	0	0	0
18.1 - 19.0	1	0	1	0	0	0	0	0	0
19.1 - 20.0	0	2	0	0	0	0	0	0	0
20.1 - 21.0	0	0	0	0	0	0	0	0	0
21.0 - 22.0	0	0	0	0	0	0	0	0	0
22.0 - 23.0	0	0	0	0	0	0	0	0	0
23.0 - 24.0	0	0	0	0	0	0	0	0	0
24.1 - 25.0	0	1	0	0	0	0	0	0	0

The range of notice is large. Such a range in percentage of notice must, of course, apply to total examinations as well as to these examinations which include only individuals who at some time have had a defect. However, the percentages of notice of a defect will be lower and the percentage noticing no defect will be higher. We are here calling attention to individual differences between examiners, rather than to the level of notice.

The conclusions may be stressed by calling attention to particular cases. The ten physicians who reported more than 80% of the cases examined for a vision defect, together examined 800 cases. They reside in different portions of the country. It seems extremely unlikely that these localities actually are so heavily populated with vision defect or that the cases having a vision defect should be concentrated with these particular physicians for some other reason. Let us contrast this with the thirteen physicians who reported less than 45% of the cases examined by them for vision defect. These physicians together examined 1500 cases. They reside in various portions of the country. It seems extremely unlikely that the contrast exhibited between these thirteen and the ten mentioned above should be due to anything other than their professional emphasis. It is clear that this difference in standards (that is, number of defects noted in a random group) alone could give rise to the type of disagreement found. It becomes imperative

to take administrative steps to standardize the levels of detection of a visual disability so that more agreement may be reached.

The range for other defects seems sufficiently large to challenge the standards. Four physicians, for instance, have reported more than 10% of the cases examined by them for cardio-vascular difficulty. Whereas it is true that we are now talking about only cases that have at some time been reported for a defect and that, therefore, the level cannot be considered characteristic of a normal population, still, when this 10% is contrasted with 47 physicians who reported none of the cases examined by them for cardio-vascular defect, we must assume that it is due in part to some characteristic of the examiner. The four physicians reporting more than 10% cardio-vascular defect examined 331 cases and live in four different states.

It is challenging to note that two physicians reported more than 5% of the cases examined by them for psychiatric defect. Even with a biased population this is extraordinary. One of these physicians examined 62 cases. The other examined 53.

Tabulations were made by age of pilot in order to determine the degree to which the disagreements found were concentrated in given age levels. No differences were found in relation to age, that is, the percentage of disagreement remained the same for pilots 15 to 25 years old at the time of the last examination, pilots 26 to 35 years old at the time of the last examination, pilots over 35 years old at the time of

the last examination. Tables showing these age differences are on file, but, for reasons of space are omitted from this report.

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Interpretations

1. There is a great deal of disagreement between physicians examining pilots on successive occasions with six months or one year interval. These disagreements are almost as large late in the order of examinations as they are early.
2. A disagreement between two reports more often means that the first examiner has found the defect than vice versa.
3. Defects found to be important enough to disqualify by one physician are often not found by another. The usual order of this disagreement is that the first physician finds the defect and the examination that follows clears the pilot.
4. There is a large range in the severity with which physicians conduct examinations.
5. Physicians are very different in the emphasis they place upon various defects and, as a consequence, the hazard of being noted with a given defect depends upon the physician who does the examination.
6. Standardized tests and standardized methods of examination are essential.