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## Frequency of Serious Visual Defects

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## FREQUENCY OF SERIOUS VISUAL DEFECTS

EDITH BURMA AND A. R. LAUER

### PROBLEM

Many practitioners have thousands of cards in their patient files which might be used to determine the visual conditions of clinical patients when they appear for examination. From the standpoint of the motor vehicle administrator, two other problems exist. One treats of what the practitioner would find if he were to examine a random sampling of the population to ascertain the extent of visual defects, using regular clinical methods. The other deals with the percentage of defects which a trained examiner giving regular drivers license examinations might find in a non-clinical population.

By non-clinical we mean a sampling of the population which would voluntarily submit for an examination on general psychophysical traits without exclusive consideration of the eye as a sense organ. It is felt that the data secured by such a study may be of value in helping the practitioner decide the merits of any specific case which may be brought up for consideration in states where mandatory regulations must be interpreted by expert testimony in order to settle questions of legality.

It must be kept in mind, at all times, that laws can be enforced no better than the public will support their enforcement. Whether we like it or not, the practical visual limitations of drivers will always be determined by the percentage of cases which must be given restricted licenses or denied the privilege of driving. Should, by any freak of nature, man's vision suddenly drop to a minimum of 20/100 Snellen at best, we would need to drastically revise standards, as the public would not stand for 80 per cent of the population being kept from driving. Such an hypothetical case may well illustrate what we mean by the interdependence of existing conditions and enforcement of laws governing such conditions.

Our studies have shown some differences in various sections of the country, but the accompanying data may be taken as more or less typical of the country as a whole. Some areas show a smaller percentage while others show a larger percentage of defects.

## METHOD AND PROCEDURE

The regular Portable Driving Clinic, as described by Lauer (1935), was used and a free examination given to anyone over 15 years who wished to take advantage of the clinical information which might aid him in being a safer driver, or to determine whether or not he could pass a satisfactory drivers' license examination. Most of the examinees already had a driver's license. The ages ranged from 15 to 80 with a majority of those examined being between 20 and 35 years old. While the age groups were not normally distributed, the interest in driving which probably characterized this group might well make them a more nearly representative sampling such as any driver's license examination would embrace. The conclusions offered are probably on the conservative side since some of the worst cases may not have volunteered.

Each examinee was given a complete checkup in addition to the visual measurements. About fifty minutes were required for completion of the tests, one-third of the time was spent on vision. Only those measurements relating to refractive errors astigmatism and muscle imbalance are reported in this paper, since it is these which are chiefly regulated by statutes. For other types of defects see Lauer (1936) and Lauer and Getman (1937).

## RESULTS

From a total of 1244 cases studied, about 27 per cent wear glasses, at least part of the time. It was thought advisable to make the acuity measurements both with and without glasses, while the astigmatism and phoria measurements were made as the examinee usually appears, with or without glasses.

*Acuity:* Under the conditions described, the examinees were measured by means of the Clason Acuity Meter. Each eye was measured separately, and in a certain percentage of cases the two eyes were measured jointly.

It is shown that with glasses the two eyes are nearly equal; 26 per cent of the left eye measurements and 22 per cent of the right eye being above 100 per cent or 20/20 Snellen. (See Lauer and Schepler, 1938). Forty-nine per cent of those with two-eye measurements had vision of 20/20 or better, while the other fifty-one per cent were below normal. Acuity for both eyes taken together rarely was below 50 per cent or 20/40, while one-eye measurements showed frequent cases below 5 per cent. Previous studies have suggested that a minimum vision of 40 per cent should be allowed for either eye separately. This would mean a failure of

about 2.25 per cent of the population on the right eye and 2.74 per cent on the left eye measurement for examinees who do not wear glasses. If 60 per cent vision for both eyes is used as a minimum, but 1.50 per cent of this group would fail. When those wearing glasses are considered, using the same criteria, the percentages of failures would run as follows: right eye 1 per cent, left eye 3.4 per cent and none for both eyes.

On the other hand, if all drivers were brought up to 90 per cent vision or restricted in speed and other driving conditions, the following summary of what would happen is given in table I.

Table I—Percentage of Drivers Below 90 Per cent Vision

	Right	Left	Both
Without glasses	34.3	36.2	12.3
With glasses	45.7	46.1	15.9

These data indicate that much educational work is necessary to make the driving population safety conscious. Lowered acuity is particularly dangerous at night and under conditions of poor visibility. The fact that persons with glasses do not show up so well may be explained in two ways: (1) either they are not properly corrected or, (2) their visual condition is such that bringing the eye up to normal is not desirable or feasible. In either case the driver should reduce his speed when visibility is poor.

*Astigmatism:* The measurements were made with the 4-ball test slide of the Clason Acuity Meter. The differences represent the multiple-line resolving points of the two meridians of each eye taken separately, as the slide is gradually moved in to increase the size of the projected image. Of the 1244 cases studied, 9 or slightly less than 1 per cent were blind or nearly blind in the right eye, while 13 or about 1 per cent were blind or nearly blind in the left eye. A difference of 40 units is considered sufficient to impair motor vision appreciably. Thus about 2.5 per cent have enough astigmatism to warrant a restricted license for this defect. The prevalence of astigmatism in some degree is quite noteworthy. The experimental error in such measurements would probably rule out the significance of differences below 10 and 14. Using this as a criterion, 44.7 per cent of the population have differences greater than 15, regardless of correction, which included 27 per cent of the cases. This difference is fairly significant and is sufficient to cause eye strain in any type of work requiring accurate discrimination.

*Phorias:* The tabulation in these categories overlaps somewhat

and a few extra cases are noted. Summarization of the results shows right hyperphoria to be least common.

If 5 diopters are set as a reasonable limit, the following table II shows the frequency of cases which may conceivably constitute a danger group on the highway.

*Table II — Percentage of Drivers Having 5 Diopters or More of Phoria*

R. Hyper	L. Hyper	Eso	Exo
.16	.40	2.5	1.4

Here we see that esophoria is much more common than the other types while exophoria is a close second. About 79 per cent of the population show some slight tendency toward muscle imbalance. It is to be noted that 23.6 per cent of those who do not have phoria wear glasses. This is probably due to the fact that: (1) there is some association between eye defects, and (2) those who do not need glasses have better muscle balance.

#### SUMMARY AND CONCLUSIONS

A study of 1244 non-clinical cases were made to determine the frequency of visual defects which might reduce driving efficiency. From previous studies it is established that drivers should have at least 90 per cent vision (20/20 Snellen) to merit an unrestricted license for all conditions of driving. Special restrictions should be imposed upon those with vision below 60 per cent and those with vision below 40 per cent should drive only after a special examination by a regular practitioner and their seeing-distance is stamped definitely on the license. Compare with limitations given by Lauer (1936), (1937), and (1938).

Using these limits as a criterion, various percentages of problems cases are described. At 60 per cent vision, the proportion of cases failing in the two-eye test is 1.5 per cent. At 40 per cent vision, 2 or 3 per cent of the population will need special examinations for one eye. If 90 per cent is used as the criterion, the respective failures raise to approximately 40 per cent for right eye, 40 per cent for left eye and 15 per cent for both eyes. This is obviously too high for practical application in denying licenses, but could be used as a warning stamped on the license to decrease driving speed under certain conditions of visibility.

Astigmatism is sufficient to suggest a special professional examination for about 2.5 per cent of applicants. Approximately 2.5 per cent of examinees for a driver's license have sufficient phoria to warrant a careful examination of the muscle conditions to de-

termine the likelihood of diplopia before an unconditional license is granted. The limitations which seem practically feasible are suggested for special appeal cases. It seems that states will need to follow some system of review, and restriction of licenses will be necessary, if the drivers license examination is to be made workable. This is equally true from the standpoint of enforcement as well as from that of maintaining safety on the highways. Successful enforcement will thus be based upon the percentages of persons affected by statutes and satisfactory methods of dealing with those who may be considered borderline cases. It is hoped that the present study may be of value in establishing a satisfactory basis of judgment which will aid in solving some of our most difficult problems in highway safety.

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