The Totally Deaf Driver in California

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•IN JULY 1963, the California Department of Motor Vehicles issued a report on the totally deaf driver in California (1). Basically a descriptive report, it concerned itself with a statistical portrayal of a large representative sample of California deaf drivers, and, in addition, presented comparisons between the deaf and non-deaf drivers based on a number of variables. The deaf drivers were found to differ from the non-deaf drivers in that (a) the deaf had more accidents and violations on their records; (b) the deaf drove a greater number of miles per year; (c) the distribution of deaf drivers among occupational categories differed from that of the non-deaf; and (d) the two groups differed with respect to the shape of their age distributions. Despite the fact that deaf drivers had poorer driving records, it could in no way be inferred that their increased accident and violation records were somehow caused by deafness or any ramifications of deafness because they differed on variables other than hearing (such as mileage and occupation) in a direction which previous empirical research has shown to be related to increased violation and accident frequency.

From this earlier report the following question evolved: if the deaf sample were matched with the non-deaf sample on all possible variables other than deafness, would the violation and accident frequencies of the deaf still be higher? It was to answer this basic question that the study presented herein was conceived. The present study also was designed to analyze the deaf sample with respect to other variables such as annual mileage, occupation, age, and types of violation. However, it was subsequently decided that this last aspect could best be handled as a separate report.

Before describing the methodology, we should define the term "deafness" as used in this study. The deaf in our sample may be considered totally deaf, in that their sense of hearing is either totally absent or so minimal as to be nonfunctional for the ordinary purposes of life; no distinction was made between the congenitally and adventitiously deaf. Because deafness may be correlated with other sensory anomalies and certain personality characteristics, the relationship between driving performance and the inability to hear could not be assessed apart from the influence of other correlated anomalies. Thus, it should be understood that when the authors make a statement regarding the apparent effects of deafness, they are referring to the entire syndrome in all of its manifestations and not just the inability to hear.

This study, then, is concerned exclusively with the problem of driving performance differentials between the deaf and non-deaf driving populations in an attempt to arrive at a definitive evaluation of the role of deafness in driving.

The basic problem confronting the researchers was the obtainment of matched samples of deaf and non-deaf drivers for the purpose of making driving record comparisons and statistical tests of significance. The specific purpose of such tests is to indicate the probability of a certain quantitative difference having occurred by random sampling fluctuation (chance). If the probability of such an occurrence is small, it is generally concluded that the difference is significant or real. An important fact to remember is that a significant difference does not necessarily indicate a serious discrepancy, as even small inconsequential differences can sometimes be "statistically" significant.

Before describing the matching procedure in detail, however, something more should be said about the exact nature of the samples involved. In the earlier study (1) two non-

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deaf samples were involved in the comparisons between the deaf and non-deaf. The larger sample (95,000) was used for driver record comparisons, and the smaller one (7,000 to 8,000) was used for comparisons with regard to those variables not available in the larger sample. Since the four matching variables were available for only the smaller sample, it was necessary to use this as a basis for deriving the matched non-deaf group and making subsequent driver record comparisons.

The sample size of the deaf varied, depending on which variable was being considered, because information was available on certain variables (such as mileage and occupation) for only those who responded to the department's questionnaire. For other variables (such as driver record, age, and sex), information was available for both the respondents and non-respondents. As with the non-deaf, this restricted the pool of deaf subjects to those on whom information was available for all four matching variables. Thus, the initial pool of subjects to be matched consisted of 486 respondent deaf and approximately 8,000 non-deaf. (The fact that the deaf sample was restricted to respondents was not felt to be a serious limitation since the information on the non-deaf was also obtained through their voluntary cooperation.)

Four variables were involved in the matching—sex, age, annual mileage, and occupation. The initial matching was accomplished by a card collator and resulted in an exact card-for-card match for sex, age, and annual mileage. The matching of occupations was done by card-to-card sight matching of the machine-collated decks.

To counteract shrinkage in sample size, the matching restrictions were relaxed slightly by adding subjects who could not be exactly matched by the original machine collation. In all cases these inexact matches were very close, as deviations greater than four years on age and 4,000 miles on annual exposure were not allowed. The number of such inexact matches represented a minority of subjects in the final sample, and the direction of the deviations was allowed to operate randomly. No deviations were allowed with respect to occupation, and in all cases the machine and sight collating was done in such a way that all within-group frequencies were matched. In other words, the final samples were equated in terms not only of the four variables taken separately, but also of the frequency interrelationships between the four variables. In this way, the samples were equated with respect to interaction.

Tables 1, 2, and 3 show the results of the matching with respect to age, annual mileage and occupation, respectively. It can be seen that the matching was very close

TABLE 1

DISTRIBUTION OF MATCHED SAMPLES BY AGE

Age (yr)	Total		Male		Female	
	Deaf	Non-Deaf	Deaf	Non-Deaf	Deaf	Non-Deaf
21-25	32	32	20	20	12	12
26-30	40	40	27	27	13	13
31-35	61	59	33	31	28	28
36-40	69	69	49	49	20	20
41-45	73	75	50	52	23	23
46-50	62	62	43	43	19	19
51-55	37	37	30	30	7	7
56-60	36	36	24	24	12	12
61-65	24	24	20	20	4	4
≥65	19	19	17	17	2	2
Total	453	453	313	313	140	140
Mean age	43.04	43.08	44.13	44.19	40.60	40.60
Std. dev.	12.12	12.10	12.49	12.38	11.11	11.11

TABLE 2

DISTRIBUTION OF MATCHED SAMPLES BY NUMBER OF MILES DRIVEN PER YEAR

No. Miles	Total		Male		Female	
	Deaf	Non-Deaf	Deaf	Non-Deaf	Deaf	Non-Deaf
<2,500	27	31	7	8	20	23
2,500- 7,400	99	107	39	45	60	62
7,500-12,400	184	177	136	132	48	45
12,500-17,400	80	80	72	73	8	7
17,500-22,400	42	38	38	35	4	3
≥22,500[a]	21	20	21	20	-	-
Total	453	453	313	313	140	140
Mean annual mileage	11,164	10,900	12,966	12,749	7,136	6,711
Std. dev.	6,873	6,967	7,061	7,190	4,245	4,112

[a]Means and standard deviations computed with the interval expanded to 50,000 miles at 5,000-mile intervals.

TABLE 3

OCCUPATION DISTRIBUTION OF MATCHED SAMPLES

Occupation	Total		Male		Female	
	Deaf	Non-Deaf	Deaf	Non-Deaf	Deaf	Non-Deaf
Professional	2	2	2	2	-	-
Laborer	85	86	72	73	13	13
Tradesman	184	184	170	170	14	14
Clerk	32	30	6	7	26	23
Exec. prof., semi., w, c drivers	45	48	29	29	16	19
Housewife, student	67	67	-	-	67	67
Other	38	36	34	32	4	4
Total sample	453	453	313	313	140	140

on all variables. Statistical tests of significance confirm that the resultant discrepancies can be attributed to chance.

Z (mileage): Males = 0.39, $P > 0.49$; Females = 0.74, $P > 0.45$.
F (mileage): Males = 1.04, $P > 0.25$; Females = 1.07, $P > 0.25$.
Z (age): Males = 0.06, $P > 0.94$; Females = 0.00, $P > \infty$.
F (age): Males = 1.00, $P = 0.50$; Females = 1.00, $P = 0.50$.
χ^2 (occupation): Males = 0.12 at 4 d.f., $P > 0.99$; Females = 0.44 at 5 d.f., $P > 0.99$.

Thus, we can safely conclude that the two samples represent similar underlying populations relative to all three matching variables.

Table 3 indicates that the occupational schema is some what atypical, and that in some cases rather dissimilar categories have been combined. This was necessary to achieve valid comparisons and was dictated by the occupation categories used for the non-deaf sample in 1958. The table also indicates that the matching on the fourth variable, sex, was exact—313 males and 140 females in each sample.

In addition to these matching variables, a fifth—area of residence—also had to be considered because the deaf sample was selected from all areas of the state, whereas the non-deaf sample represents only the Los Angeles and San Francisco areas. Since the probabilities of being convicted of traffic violations and being involved in accidents may differ throughout the state, the possible effects of area must be controlled or eliminated before any definitive conclusions can be reached.

To evaluate the effects of this area bias, all deaf subjects who did not reside in either San Francisco (S.F.) or Los Angeles (L.A.) were separated from those living in these areas. Respective accident and conviction counts were then derived for comparison (Tables 4 and 5).

Statistical tests of significance were subsequently performed on the area breakdowns and indicated that for both accidents and convictions, the L.A.-S.F. males had significantly poorer driving records than deaf males residing in other areas of the state.

$$Z'_c \text{ (conviction points)} = 3.24,\ P < 0.003;\ Z'_c \text{ (accidents)} = 3.47,\ P < 0.001$$

For the females, however, all differences could be attributed to chance.

$$Z'_c \text{ (conviction points)} = 0.59,\ P > 0.55;\ Z'_c \text{ (accidents)} = 0.82,\ P > 0.40$$

TABLE 4

DISTRIBUTION OF DEAF DRIVER SAMPLE BY NUMBER OF CONVICTION POINTS

No. of Conviction Points	Total				Male				Female			
	L.A.-S.F. Areas		Other Areas		L.A.-S.F. Areas		Other Areas		L.A.-S.F. Areas		Other Areas	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	92	39.8	128	57.6	52	30.6	71	49.6	40	65.6	57	72.1
1	79	34.2	51	22.9	65	38.2	41	28.7	14	23.0	10	12.7
2	33	14.3	28	12.6	29	17.1	20	14.0	4	6.6	8	10.1
3	15	6.5	9	4.1	14	8.2	5	3.5	1	1.6	4	5.1
4	9	3.9	3	1.4	8	4.7	3	2.1	1	1.6	-	-
5	3	1.3	1	0.5	2	1.2	1	0.7	1	1.6	-	-
≥6	-	-	2	0.9	-	-	2	1.4	-	-	-	-
Total	231	100.0	222	100.0	170	100.0	143	100.0	61	100.0	79	100.0
Mean no. of points	1.04		0.74		1.24		0.88		0.56		0.48	

TABLE 5

DISTRIBUTION OF DEAF DRIVER SAMPLE BY NUMBER OF ACCIDENTS

No. of Accidents	Total				Male				Female			
	L.A.-S.F. Areas		Other Areas		L.A.-S.F. Areas		Other Areas		L.A.-S.F. Areas		Other Areas	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	166	71.9	186	83.8	113	66.4	118	82.5	53	86.9	68	86.0
1	49	21.2	34	15.3	41	24.1	24	16.8	8	13.1	10	12.7
2	11	4.8	2	0.9	11	6.5	1	0.7	-	-	1	1.3
3	4	1.7	-	-	4	2.4	-	-	-	-	-	-
4	1	0.4	-	-	1	0.6	-	-	-	-	-	-
Total	231	100.0	222	100.0	170	100.0	143	100.0	61	100.0	79	100.0
Mean no. of accidents	0.377		0.171		0.465		0.182		0.131		0.152	

From here on, we must talk only of L.A.-S.F. subjects when comparing male deaf and non-deaf subjects. This same restriction does not apply to the females since the statistical tests indicate that the deaf females share a common underlying population with regard to accidents and conviction points.

In the forthcoming sections, all driver record comparisons between deaf and non-deaf males involve only subjects residing in the L.A.-S.F. areas, thereby reducing the deaf male sample from 313 to 170. This reduction did not significantly alter the previous matching by age, occupation and mileage because the male deaf did not differ significantly by area with respect to the matching variables. The female deaf sample, of course, remains the same—140 subjects.

RESULTS AND FINDINGS

This study covers the three-year period, 1959 to 1962. In the formula for determining number of convictions, certain equipment and technical violations have been excluded from the count. Also, an additional count was given to the more serious major violations. Conviction points were used instead of total convictions to make the deaf driver data completely conparable to that of the non-deaf sample.

Conviction Points

In the earlier study (1), it was found that the deaf had significantly more total traffic convictions on their driving records than the non-deaf. This was true for each sex separately and combined. The same was true when the comparisons were limited to "countable" convictions. However, since this previous study did not match the two samples by certain relevant variables, the differences in conviction rates could not be attributed to deafness.

The present problem, then, is to ascertain whether or not any conviction differentials exist now that the two groups have been adequately matched. Comparisons of mean conviction points of the matched groups are presented in Figure 1 and Table 6.

Statistical tests for the significance of the difference between rank sums[1] indicate that any differences can be attributed to chance.

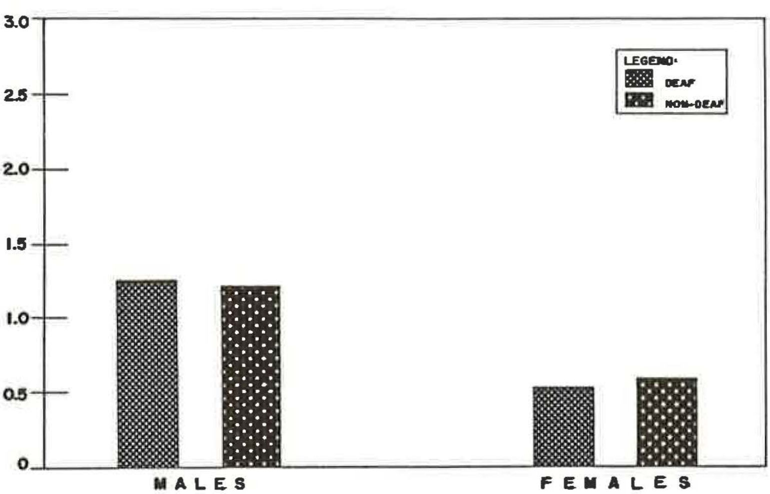

Figure 1. Mean number of conviction points of deaf and non-deaf drivers, three-year record.

[1] The Mann-Whitney test has been used throughout the report to test driving record differentials. Since the matching procedure introduced some correlation between samples, the probability levels derived from the tests are slight underestimates of the actual significance. In most cases, incidentally, parametric tests for mean differences produced Z ratios similar to those produced by the Mann-Whitney. The only exception concerned Table 6, where the parametric test on the male means yielded a critical ratio much further from significance than that produced by the Mann-Whitney test.

TABLE 6

DISTRIBUTION OF MATCHED SAMPLES BY NUMBER OF CONVICTION POINTS

No. of Conviction Points	Deaf Drivers				Non-Deaf Drivers			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
0	52	30.6	97	69.3	134	42.9	93	66.5
1	65	38.2	24	17.1	78	24.9	30	21.4
2	29	17.1	12	8.6	58	18.5	7	5.0
3	14	8.2	5	3.6	19	6.1	7	5.0
4	8	4.7	1	0.7	12	3.8	2	1.4
5	2	1.2	1	0.7	6	1.9	-	-
≥6	-	-	-	-	6	1.9	1	0.7
Total	170	100.0	140	100.0	313	100.0	140	100.0
Mean no. of points	1.24		0.51		1.21		0.57	

$$Z'_c \text{ (males)} = 1.42,\ P > 0.16;\quad Z'_c \text{ (females)} = 0.42,\ P > 0.67$$

Therefore, it is certain that deaf and non-deaf drivers do not differ with respect to the number of conviction points on their driving records—at least in those areas from which the samples were drawn. Since all areas of the state could not be represented in the sampling, we cannot legitimately generalize these conclusions to all areas of the state and all types of driving situations. It is not inconceiveable that a different relationship might exist in those areas where the types of exposure differ from the L.A.-S.F. areas.

We have at least provided a partial answer to the question concerning the relation between deafness and violation frequency: there is no evidence from driving record histories that deafness results in an increase or decrease in traffic violation frequency.

Accidents

The most important variable in any study of this nature is accident frequency. In the previous study (1) the deaf were found to have 1.78 times the accident rate of the non-deaf sample. Statistical tests indicated that the differences for each sex, singly and combined, significantly favored the non-deaf driver. The question remained, however, as to whether the differences were directly related to the deafness syndrome or merely the indirect manifestations of other coincidental factors such as mileage, occupation, and area of residence. As was seen from the preceding discussion on conviction points, the role played by coincidental factors was indeed a dramatic one, for when these factors were held constant through matching, the deaf male and deaf female were no longer significantly worse than the non-deaf in terms of conviction points. Could the same also be true of accidents? The mean number and distribution of accidents by sex for the matched samples of deaf and non-deaf drivers are presented in Figure 2 and Table 7.

We again remind the reader that we are comparing only L.A.-S.F. area males and cannot evaluate deaf males in other areas of California. With this in mind one notices that the difference between males is rather dramatically in favor of the non-deaf driver and is highly significant.

$$Z'_c = 3.01,\ P < 0.003$$

On the other hand, the small difference for females could easily have resulted by chance.

$$Z'_c = 0.48,\ P > 0.63$$

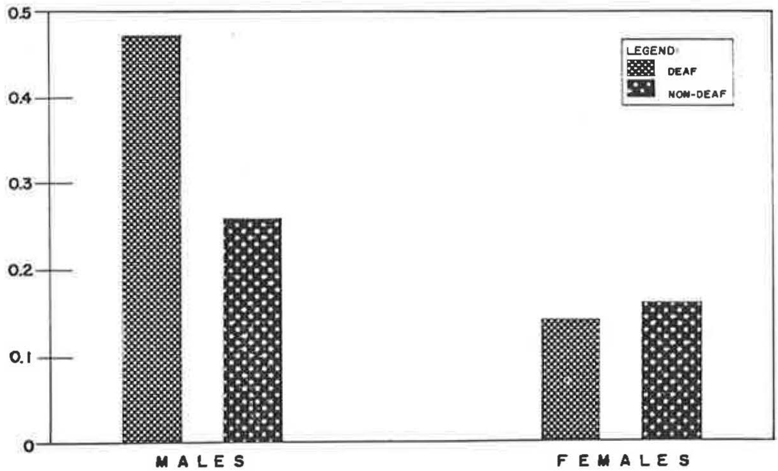

Figure 2. Mean number of accidents of deaf and non-deaf drivers, three-year-record.

TABLE 7

DISTRIBUTION OF MATCHED SAMPLES BY NUMBER OF ACCIDENTS

No. of Accidents	Deaf Drivers				Non-Deaf Drivers			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
0	113	66.4	121	86.4	244	78.0	118	84.3
1	41	24.1	18	12.9	60	19.2	22	15.7
2	11	6.5	1	0.7	7	2.2	-	-
3	4	2.4	-	-	2	0.6	-	-
4	1	0.6	-	-	-	-	-	-
Total	170	100.0	140	100.0	313	100.0	140	100.0
Mean no. of accidents	0.465		0.143		0.256		0.157	

Our conclusion, then, is that in the type of driving typified by our samples, deaf males have a disproportionately high number of accidents, whereas deaf females do not differ in this respect from their non-deaf counterparts. Some possible explanations for this rather interesting finding are offered in the next section.

DISCUSSION

Theoretical Interpretation

The finding in regard to accident frequency raises some rather interesting theoretical questions. At first glance the existence of a sex by deafness by accident interaction may seem paradoxical. In other words, why should deafness affect the driving performance of males but not females. One possible explanation—admittedly a very speculative one—is that male drivers, by nature of their driving habits, patterns, and needs, are more often subjected to driving situations in which auditory cues play a relatively more important role than is the case with females. If a greater proportion of male driving occurs in situations where sound stimuli serve as important cues, then we might expect the deaf males to do poorly relative to their sex, but not necessarily to the females. In other words, males may drive more in situations where traffic is heavy and where hearing may be a comparatively relevant factor; for example, effective hearing may be more essential in driving to and from work on crowded city streets and freeways than in other locals.

This physiological-environmental explanation of the sex interaction is, of course, highly speculative and the possibility of psychological determinants certainly cannot be excluded. For example, it could be hypothesized that males react differently to their deafness than do females and the resulting male personality configuration, in turn, articulates with driving in such a way as to produce a predisposition to accidents for deaf males. In the opinion of these authors, such an hypothesis is not supported by the finding with regard to violation frequency. If the accident frequency of deaf males were largely a function of attitudinal and personality variables, one would expect the deaf male to be a more frequent violator of traffic laws. However, as we have shown, such is not the case. Despite this, personality variables cannot be entirely dismissed on the basis of these findings, since it is not inconceivable that personality factors could affect accident frequency without increasing violation rate. A final answer to this question must await rigorously controlled experimentation.

Methodological Qualifications

Before summarizing the findings and presenting recommendations, it seems appropriate that the methodological limitations of the study be made explicit, for these contingencies may have a bearing on the interpretation and evaluation of the findings. In so doing we will, whenever possible, indicate the possible influence which these qualifications have in regard to the empirical results.

Nonrandomness of Sample Selection.—Strictly speaking, neither sample represents a random sample of California drivers. The deaf sample was selected from members of the California Association of the Deaf (CAD), on a voluntary basis. None of the nonrespondents could be included in this study. The non-deaf sample was also composed of volunteers and, in addition, was selected from two areas of the state.

In the earlier study (1), the implications of the membership factor were discussed in detail, and it was felt that its effects were negligible. It was reasoned that the deaf, by nature of their anomaly, are a relatively homogeneous group and that there are no stringent economic requirements which would preclude their joining such a deaf organization. Support of this assumption can be found in the fact that the great majority of all deaf people belong to one or more organizations, and the CAD is the only statewide organization in California. At most, the membership factor might slightly limit the generality of any findings.

Although the non-deaf sample does not represent all areas of the state, this factor was controlled by matching. In addition, the non-deaf, like the deaf, represent volunteers and, therefore, both samples actually represent populations of volunteers. The authors do not feel this nonrandomness necessarily invalidates any findings emanating from the study, although one must be cautious in describing the nature of the population about which he is generalizing. The fact that the deaf were selected from an organization would, if anything, seem to favor the deaf in any comparison with the non-deaf. If this were true and if we wish to generalize about all deaf drivers, the findings regarding males are all the more significant.

Differential Response Bias.—As indicated, both samples were composed of volunteer subjects. This would present no serious difficulty, had the response media not differed for each group—the deaf having been contacted by a mailed questionnaire, whereas the non-deaf were selected in person at the time of drivers' license renewal. It is known that a considerably greater proportion of the deaf failed to respond to the questionnaire than did non-deaf to the department's verbal request for their participation. It is also known that the respondent deaf had significantly superior violation records than did the non-respondent deaf. Because of this, the possibility exists that the samples were unequally biased, at least in terms of violations. To a certain extent, this factor was undoubtedly mitigated by the matching process. If, after matching, a differential bias still remained, it would seem likely that the deaf would again be favored.

Unlike violations, the accident frequencies of the respondent and non-respondent deaf studied previously did not differ significantly. Therefore, we have no grounds for suspecting that an unequal bias may presently exist between the deaf and non-deaf with respect to accidents and our conclusions in this study regarding accidents require no additional qualifications.

Limitation of Accident and Violation Frequency Data to Departmental Records.— Although implicit throughout the study, it should be emphasized that the driving performance criteria are those events contained on departmental records. It is known that many accidents and some violations are not reported to the Department of Motor Vehicles. To generalize from departmental records to actual driving behavior, one must assume the events to be linearly correlated; that is, that those who have the most violations or accidents on their records also violate most frequently or are involved in the greatest number of total accidents. This assumption, of course, is inherent in all such studies.

Although we have no evidence in this regard, it is not impossible that the proportion of deaf driver accidents reported to the Department differs from the non-deaf proportion. Such a difference could emanate from a variety of sources. For example, it could be that the deaf are more likely to suppress an accident from fear of being discriminated against because of their handicap. On the other hand, it could also be that the deaf are more conscientious and, therefore, more likely to report an accident. Another possibility would be that traffic officers are more likely to report an accident involving a deaf driver. Such occurrences could result in a distorted picture since departmental accident records would not be proportionally representative of the overall incidence. We should emphasize that there is no evidence to support the existence of these distortions and in the absence of such, we must assume that the Department's records present a representative picture.

Conclusions and Recommendations

In the earlier study (1, p. 28), it was stated that it "does not appear that the California deaf driver, as a group, constitutes a special problem from the standpoint of traffic safety. Subsequent analysis, however, may indicate possible areas in which the deaf driver is in need of further training." Whether the matched analysis indicates the existence of a "serious" problem cannot be determined from the present research. A great deal, of course, depends on how one defines or quantifies seriousness and on the values of society. It appears to these authors that some type of problem is at least suggested. One possibility is that there are certain types of driving circumstances in which hearing may be an important sensory modality, and the lack of hearing a definite handicap. This is contrary to the generally held belief that sound is a neutral or negative stimulus in relation to driving and suggests that under certain circumstances auditory cues may play a more relevant role in driving than was formerly anticipated.

If subsequent research confirms the findings of this study, then further or specialized training of at least some deaf drivers might be indicated. As pointed out in the previous study, only one in eight of the drivers comprising the deaf sample had received any formal driver training. Whether an increase in the formal training of deaf drivers is indicated and would prove beneficial is, of course, at this point speculative. However, to the extent (if any) that formal driver training is or can be an effective means of reducing accident frequency, an extension of such training to a greater number of deaf drivers should prove beneficial.

Despite some rather definitive findings, the authors wish to emphasize that a number of questions have been left unresolved by the present study, and that additional research is necessary before the practical and theoretical significance of deafness as a factor in driving can be completely assessed. Further deaf driver research should involve a consideration of the specific types of accidents and their precipitating circumstances. Another fruitful avenue of research would be the testing of a sample of deaf drivers on driver simulators evoking appropriate sound cues to determine experimentally whether their responses to various traffic situations differ from non-deaf drivers. A survey of comparative accident frequencies in all areas of the state might also prove illuminating. Finally, future research in this area should involve an analysis of driving performance by type of deafness (age at onset, precipitating trauma, associated defects, etc.).

SUMMARY

1. Two large samples of deaf and non-deaf drivers were matched on five variables—age, annual mileage, occupation, sex, and area of residence. A total of 313 males and 140 females remained in the sample after matching by four of the variables. A subsidiary analysis was undertaken with the samples matched by the fifth variable—area of residence. Satisfactory matches were obtained on all variables, as differences were not statistically significant.

2. The matched samples were compared and statistical tests of significance performed on two driver record variables: conviction points and reported accidents.

3. Deaf females did not differ significantly from a matched sample of non-deaf females on any of the driver record variables, regardless of whether the samples were matched by area. All differences were slight and could be attributed to chance.

4. When matched on area, deaf males had a significantly greater number of accidents on their driving records than a matched sample of non-deaf males. In the case of accidents, the deaf male frequency was 1.8 times higher than the non-deaf accident frequency. With regard to total conviction points, the males did not significantly differ from each other.

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REFERENCES

1. Coppin, R. S., and Peck, R. C. The Totally Deaf Driver in California, Part I. Sacramento, Calif. Dept. of Motor Vehicles, 1963.
2. Coppin, R. S., and Samuels, I. Control of the Negligent Operator, Part I. Sacramento, Calif. Dept. of Motor Vehicles, 1961.
3. Coppin, R. S., and Van Oldenbeek, G. Control of the Negligent Operator, Part II. Sacramento, Calif. Dept. of Motor Vehicles, 1961.
4. Calif. Dept. of Motor Vehicles. California Driver Record Study. Sacramento, 1958.
5. Calif. Dept. of Motor Vehicles. California State Vehicle Code. Sacramento, California State Print. Office, 1962.
6. Partial Summary of Papers Presented at the Symposium. National Symposium on Deaf Drivers, Denver, Colo., March 1962.
7. Newcomb, Theodore. Social Psychology. New York, Dryden Press, 1950.
8. Siegel, Sidney. Non Parametric Statistics. New York, McGraw-Hill, 1956.
9. U. S. Bureau of the Census. California General Population Characteristics. In U. S. Census of the Population. Washington, D. C., U. S. Govt. Print. Office, April 1960.
10. Walker, H. M., and Lev, J. Statistical Inference. New York, Henry Holt and Co., 1953.