

ALCOHOL INCIDENCE IN TRAFFIC FATALITIES IN CUYAHOGA COUNTY

A FOUR YEAR STUDY

Paper before NATIONAL ASSOCIATION OF CORONERS' CONVENTION,
Sept. 15th, 16th, and 17th, 1941.

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- Mr. Chairman, Members of the Association and Guests;

The purpose of this report is to bring up to date and correlate the studies engaged in during the past four years at the Cuyahoga County Coroner's Office, Cleveland, Ohio, on the incidence of alcohol in fatal vehicular accidents. In this interval we have had occasion to observe 999 fatalities of this nature. We have been able to test for the presence of alcohol in 513 of these cases. The other cases could not be tested because in some the victim had survived the accident for a period of 12 hours or more, in which time the alcohol in the majority of the cases, would have ordinarily disappeared from the body by the usual processes of oxidation and excretion. Individuals 14 years of age or under were not tested for the presence of alcohol, on the assumption that it is hardly probable that persons of that age group would indulge in the consumption of intoxicating beverages. This may or may not be entirely valid, but if

some did indulge, the number of cases would be far too few to influence the statistical evaluation of the study at hand.

The method employed by the laboratory of the Cuyahoga County Morgue in the determination of the presence of alcohol in the body fluids is a modification of a technique originally proposed by Nicloux, the French investigator, in the early part of the twentieth century. The technique of the test is extremely simple and entirely practical. The steps employed are as follows:

(FIRST SLIDE; Point to the apparatus as the discussion continues)

The fluid to be tested, urine, blood or spinal fluid, is placed in a flask. Ordinarily 10 cc of fluid is employed. To this is added 10 cc of a half saturated solution of picric acid. The flask is then connected with the condenser. The contents of the flask is gently heated with a flame from a Bunsen burner and the gas coming from the mixture is condensed by means of the cold water in the condenser. An aliquot amount of distillate is collected in a graduated tube. If only 5 cc of fluid is employed in the process of distillation, then only 5 cc of distillate is collected. Three cc of Anstie's Reagent is placed in a test tube to which is added 1 cc of the distillate. This mixture is heated in boiling

water for 4 minutes and if any alcohol is present there will be a graduated color change depending upon the concentration of alcohol in the solution. The concentration of alcohol in the solution is quantitatively determined by comparing the color change with permanent color standards. In this manner the concentration of alcohol in the body fluid can be definitely determined. Any more sensitive test for the detection of alcohol is entirely useless for practical purposes, since a difference of 0.005% would have no greater effect upon the evaluation of the clinical condition of the patient than 0.01 or 0.02%. The chemical re-action involved in this test is present at the bottom of the chart.

(SECOND SLIDE) For those of you who may be interested, the following are the advantages of the test we employ.

- 1-- Of extreme importance is the simplicity of the test.
- 2-- The alcohol concentration in the fluid can be determined within 0.02 of a percent, and the results duplicated to within 0.01 of a percent.
- 3-- Concerning the specificity of the test, it is admitted that there are many substances that would change the color of the Anstie's Reagent when brought in contact with the solution. However, to offset that drawback, it must be remembered that most of the substances which might interfere

with the test are not volatile and therefore would not be found in the distillate. Those substances that are volatile and could give false positive reactions, it has been found, would not be present in the distillate in concentrations materially affecting or simulating any appreciable concentration of alcohol. Among these are acetone, phenol, acetaldehyde, paraldehyde, methyl alcohol, ether, chloroform, and formalin.

(THIRD SLIDE) This slide presents a composite sagittal section of the brain, in part median and in part paramedian, in order to best portray the pharmacological action of the alcohol. As is well known by many, ~~THE~~ the action of alcohol on the brain is like that of a narcotic drug, in that it acts to anesthetize the brain beginning with the higher centers.

→ On affecting the frontal lobes of the brain (usually by concentrations between 0.01 to 0.10%) the apparent stimulation of the individual is due to a removal of the inhibitions but the reactions are colored by his personality. There is loss of self-control, feeling of well being, exaltation, increased confidence, expansiveness, generosity, loss of judgment, increased good fellowship, loquaciousness and dulling of the senses. When the concentration of alcohol in the blood reaches 0.10 to 0.20%, the psychomotor

area of the parietal lobe is affected and there results apraxia, agraphia, ataxia, tremors, slurred speech and loss of skill. When the alcohol concentration reaches 0.10% to 0.30% the somesthete-psychic area is affected and this results in dulling or distorting of the sensibilities. With concentrations of 0.20% to 0.30% of alcohol, the visuo-psychic area is affected and results in the disturbance of color distinction, form, distance and direction and may also result in diplopia. When the concentration of alcohol in the blood reaches 0.15% to 0.35%, the cerebellum is affected and there results a distinct disturbance of the equilibrium. In the concentration of 0.25% to 0.40% of alcohol, the diencephalon is affected and this results in inertia, tremors, cessation of automatic movements, sweating, dilatation of the surface capillaries, stupor and sometimes coma. With concentrations of alcohol as high as 0.40% to 0.50% the medulla is affected and this results in depression of respiration, peripheral vascular collapse, subnormal temperature and sometimes death.

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The caricatures represent, pictorially, the intoxicated states most obvious to the laity when the various portions of the brain are affected by these concentrations of alcohol.

(FOURTH SLIDE) An evaluation of the incidence of alcohol in fatal vehicular accidents brought to the Cuyahoga County Morgue, will be presented in a series of comprehensive charts and tables which will simplify presentation of a very complex analysis. In the first chart to be seen, that of the 999 cases, 513 could be tested for the presence of alcohol. Of this group it can be seen in the first column that in approximately fifty-four percent of the cases tested, varying concentrations of alcohol were found. We have here divided the cases with alcohol in the body fluid in three different groups. Those cases with alcohol concentrations of 0.04% or less are few in number, comprising less than five percent of the cases, and are represented on the chart by the diagonal lines tipped to the right. The next group with concentrations of 0.05% to 0.19% comprise a slightly larger percentage of cases, approximately twenty-four percent, and are represented on the chart by the diagonal lines tipped to the left. The remaining twenty-six percent of the cases had concentrations of 0.20% or more, and are represented on the chart by the dotted area. This first column shows the proportion of these cases with alcohol in the body fluid contrasted with those cases with no alcohol in the body fluid. In the next two columns,

the incidence of alcohol in the male and female is studied for this group of cases. It is quite obvious from this chart that the percentage of incidence is greater in the male than in the female, and that the total number of females is considerably less than the total number of males.

In the last three columns, the incidence of alcohol is studied according to the status of the victim. The number of pedestrians involved in the accidents is far greater than any other type of victim. The incidence of alcoholism among the pedestrians is approximately fifty-five percent with a very few of these in the group having low concentration of alcohol. Of the 114 drivers approximately fifty-eight percent of these had alcohol in their body fluids. By contrast, the incidence of alcohol was relatively less in that group of victims who were merely occupants or passengers of the cars.

(FIFTH SLIDE) In this chart we have an analysis of the incidence of fatal vehicular accidents according to the month of the year, and at the same time the incidence of alcoholism during these months. The total number of fatalities appear somewhat less during the summer time with an unexpected peak in October. The incidence of alcoholism, however, does not follow

the incidence of the vehicular fatalities as can be seen from this chart.

The incidence of alcoholism is highest in April and May. It is interest-

ing to note that those fatalities with concentrations of alcohol of 0.04%

or less are found chiefly in the summer months. However, those individuals

with higher concentrations of alcohol predominate in the entire picture.

The incidence of alcohol, varied from a low of forty-seven percent in

December to a high of seventy percent in May.

(SIXTH SLIDE) Study of this chart reveals, as is commonly known or suspected,

that the greatest incidence of fatalities occur over the week end. The in-

idence of alcoholism among these cases is found to vary in a similar manne-

er. The lowest incidence occurs on Tuesday with only thirty percent of the

cases showing any alcohol in the body fluids. On Saturday and Sunday the

incidence of alcoholism is highest.

(SEVENTH SLIDE) In this chart we have a study of the incidence of al-

coholism according to the hours of the day. It is interesting to note

that the fewest cases occur in the late morning, and that in these cases

the incidence of alcoholism is very low. For the hours of nine to eleven

there were no cases of alcoholism. There is a peak in the incidence both

of the number of vehicular fatalities and of the incidence of alcoholism

From eight to ten in the evening with a small secondary peak from 11.00 P.M., to 1.00 A.M. Although the number of cases of alcoholism is lower in the early morning hours, the incidence in terms of percentage is extremely high reaching eighty-six percent from 3.00 A.M., to 4.00 A.M.

(EIGHTH SLIDE) In this chart we have made a study of the ages of the individuals involved in these fatal vehicular accidents. Those persons fourteen years of age or less are not included. From this chart it is noted that there is a moderate peak in the number of vehicular fatalities in the ages from twenty to thirty years, with a much higher peak in the age group from forty to forty-four years inclusive and fifty to fifty-four years inclusive. The number of victims then taper off gradually. There have been none older than eighty-four years of age. The number of cases of alcoholism varies with the number of vehicular fatalities, but the highest percentage however, occurs in the age group between forty and fifty-five. It is interesting to note the existence of a number of cases of alcoholism, though the incidence is low (8 to 14 percent) among the elderly individuals, i.e. from seventy-five to eighty years of age.

During progress of this study of the fatal vehicular accidents, we became curious about the incidence of alcohol in the non-fatal vehicular accidents. The only way we could determine this would be to ask the co-operation of the hospitals in Cleveland. This co-operation was readily secured. At our request, we were given urine and the necessary information concerning individuals fifteen years of age or more, brought to the hospital as a result of non-fatal injuries from vehicular accidents. This study extended over one month, during which time we secured information on 178 cases. We applied the same criteria of analysis to these victims of non-fatal vehicular accidents that we had to the fatal cases.

(NINTH SLIDE) One striking feature is the fact that the incidence of alcoholism among these cases is considerably less (thirty-nine percent). These cases have been distributed into three groups, according to the concentration of alcohol in the body fluids, similar to the treatment of the fatalities. From this chart it can also be seen that there are far fewer females than males involved and that the incidence of the alcohol in the body fluid of the female is considerably less than the male. Only among the pedestrians did the incidence of alcohol exceed fifty percent.

Among the drivers the incidence was merely thirty-three percent and among the occupants of the cars only thirty-one percent. The relative distribution of cases in this set of charts follows ^{closely} that in the previous set.

(TENTH SLIDE). In this chart we have arranged the cases according to the days of the week. We find that the total number of cases is highest during the week end, as in the group of fatal cases, but that the incidence and the number ^{of cases of} ~~of~~ alcoholism is not similarly distributed. ~~The number of cases with~~

~~alcohol in the body fluids is highest on Saturday, but the incidence is only fifty percent. Though there are far fewer cases on Tuesday, the incidence of alcoholism at this time is also fifty percent. The difference may be due to the relatively few cases employed in the latter study.~~

(ELEVENTH SLIDE) A study of these non-fatal vehicular accidents according to the hour of the day is presented here. The incidence of cases in this study varies roughly with the incidence noted among the fatal vehicular accidents, being higher in the late evening, mid-night and early morning. The number of cases with alcohol in the body fluids varies similarly but much more irregularly. This irregularity is undoubtedly due to the fact

that there is only a small number of cases in this study. However, it has also been noted that although the total number of cases is small, the incidence in terms of percentage is highest at 4.00 A.M., similar to that observed in the group of fatal cases.

(TWELFTH SLIDE) In the study of cases by age group, it is noted that in this group of cases, in contrast with the first group, the total number of cases is highest in the age group of twenty to twenty-four years of age, inclusive. Although the total number of cases with alcohol in the body fluids varies with the total number of victims, the percentage of alcohol is highest in that age group from fifty to fifty-four years of age inclusive.

This study would not be complete without reference to certain other additional information. It is true that the incidence of alcohol among the cases studied is extremely high, in exact figures, 54.1%. The finding of such a high incidence of alcohol in these cases would naturally lead one to suspect that the alcoholism played a decided role in the causation of the accidents. That other factors exist such as the lighting condition, the time of accident, the weather condition, the condition of the road, the presence of physical or physiological abnormalities in the victims, the question of speeding and the type of accident, must not be overlooked. All of this information is not available to us. That portion which is available is hereby presented.

(TABLE NO. 1.) In this table we have divided the vehicular fatalities into groups indicating the lighting condition at the time of the accident. As is obvious, the greatest number of cases occurred at night under good lighting conditions. The next greatest number occurred in day light. Only a relatively few cases occurred at dusk or under poor lighting conditions. It would appear, therefore, that the question of light is not one of the major factors in the cause of these accidents. A study of the incidence of alcohol reveals that seventy-nine percent of the cases dying

from the results of the accidents occurring at night under good lighting conditions had alcohol in the body fluids. The incidence of alcohol, however, is lower during the day time. It would appear therefore, that the role of alcoholism in the cause of this group of accidents is relatively low. It was also noted that the incidence of alcoholism, in those few cases occurring at dusk or at night under poor lighting conditions, is relatively high, forty-two percent and fifty-six percent respectively and may have contributed materially to the handicap of poor visibility.

(TABLE NO. 2) A study of the condition of the weather at the time of the accident reveals that the majority of cases occurred in clear weather.

A large number of cases (420) occurred when the weather was cloudy, when it was raining or when it was snowing. From this, it would be inferred that poor weather conditions may also play an important role in the cause of these accidents. Relatively fewer cases occurred in very bad weather such as fog, sleet, and mist. It may be noted, however, that in spite of the clear weather a large number of accidents occurred and that the incidence of alcoholism in this group of cases is extremely high (sixty-two percent). Furthermore, in the second group of cases, those occurring in cloudy weather, or when it was raining or snowing,

the incidence of alcohol is also relatively high, varying from fifty percent to fifty-five percent. Undoubtedly the combination of the poor weather and the alcoholic intoxication, united to produce fatal accidents.

(TABLE NO. 3) A study of the road conditions at the time of the accident reveals that by far the ^{majority of the} roads on which the accidents occurred were dry and well paved. The incidence of alcohol under such excellent circumstances was high (fifty-nine percent to sixty percent). Under such conditions, the fact is inescapable, that the alcoholism must have played an important part in the cause of these fatalities. It is true that approximately 290 cases occurred when the roads were slippery but here too the incidence of alcohol is relatively high, and undoubtedly played a contributing part.

(TABLE NO. 4) The incidence of alcoholism and study of the type of accident is rather interesting. In that type of accident that involved a moving vehicle and pedestrian, there are 640 fatalities, of which fifty-six percent had varying concentrations of alcohol in the body fluids. There are 211 fatalities resulting from accidents involving vehicles, and fifty-three percent of the victims of this group were under the influence

of alcohol. In the type of accident involving a moving vehicle striking a stationary object, forty-five percent of the fatalities were under the influence of alcohol. Of the forty-four vehicular fatalities, the result of accidents in which the driver lost control of a moving vehicle, fifty-seven percent were under the influence of alcohol. In the twelve cases, dead as a result of falling from a moving vehicle, seventy-five percent were under the influence of alcohol. These figures of the incidence of alcoholism appear consistently high. Undoubtedly, the presence of alcohol in the body fluids of these victims altered their mental faculties to such an extent as to play an important role in the cause of the accident.

(TABLE NO. 5) A study of the type of individual and occupation of the individual involved in these vehicular fatalities, reveals that the greatest number of victims were those classed as skilled and non-skilled laborers. Housewives, and students and business men also produced a relatively large group of victims. Of the total number, 999 cases, forty-eight or about five percent were actually engaged in an occupation at the time of their death. The study of this group of cases reveals the highest incidence of alcohol occurred among the professional men (Seventy percent). The next highest incidence of alcohol in the body fluids occurred

in that group of cases defined as skilled and unskilled labor. As is to be expected, the lowest incidence of alcohol was among the group of students.

(TABLE NO. 6) Study of the cause of death reveals interesting distribution

of cases. By far the greatest number of cases died with a fractured skull.

There is another relatively large group of cases which did not come to autopsy and in which the cause of death is not obvious. This group of cases

is labeled as undetermined ~~external causes~~ and internal injuries. The

categories
remaining causes of death have relatively small numbers of cases. A study

of the incidence of alcohol in these cases reveals that in the first group,

fifty-three percent of the victims had alcohol of varying concentrations

in the body fluids. The second group had sixty percent of the cases which

had alcohol in their body fluids. In the remaining cases, the incidence

of alcoholism varies from twenty-three to one hundred percent.

(TABLE #7) Since the advent of our studies on the incidence of alcohol

in vehicular accidents, there has been a striking decrease in the number

of fatalities for Cuyahoga County from the years of 1937 to 1940. The

number of cases in 1937, were 350. In 1938, the number decreased to 234,

a decrease of 33.1%. In 1939, the number of cases decreased to 224, which

represents a decrease of thirty-six percent from 1937. In 1940, there were

191 cases which represent a decrease of 45.5% over 1937. However, in very striking contrast to the relative decrease in the number of cases there is no appreciable decrease in the incidence of alcoholism among these victims. In 1937, the percentage was 54.7----- in 1938 it was 53.5----- in 1939 it was 54.5 and in 1940 it was 53.6. This can be considered as a stationary incidence. The average for the four years is 54.1%.

The significance of this is not, at first, fully appreciated. If this improvement in the number of the fatalities from year to year is merely the result of an education of the would be victims of traffic accidents in regard to traffic rules and increase vigilance without reference to the question of drinking of intoxicating beverage, it would then be expected that the incidence of alcohol among the victims should increase when the number of fatalities decreased. Since this did not occur, it would be proper to conclude that there was, at least, a similar decrease in the propensity to drink intoxicating liquor. There is a tendency to believe, at least by us, that this is due in part to the effect of agitation and education imposed upon the citizens of Oryahoga County by the local publicity given to these studies.