NOTES ON THE IMPLICATIONS OF THE LOG-NORMAL CURVE

(1) Work by Ledermann and the ARF staff (e.g., deLint and Schmidt, 1971) has established that the distribution of consumption of alcohol among drinkers forms a skewed curve approximating the log-normal distribution in a wide variety of national contexts.

(2) Curve-fitting is to a considerable degree a matter of aesthetics, and there are undoubtedly other distributions which would also provide a close fit to the empirical data. Undoubtedly, however, any curve chosen must conform to the general requirements of describing a distribution which is unimodal and of positive skewness (so that the mode is less than the median is less than the mean).

(3) The log-normal distribution forms a good approximation of a wide variety of empirical phenomena in nature (J.Aitchison and J.A.C. Brown, 1957), including for instance the distributions in individual animals of a given animal population of tolerance for particular drugs,and distributions of the size of rock particles after repeated crushing operations. The distribution is notably applicable to the distribution of incomes in a population, and to the distributions of consumer spending for particular classes of consumption. Aitchison and Brown show that the marginal propensity to spend relative to income for six general commodity groups in working-class households is well fitted by log-normal curves, although the shape of the curves are very different: marginal propensity to spend on food peaks sharply at one-eighth of the range of income shown, while the curve for durable goods does not even reach its mode in the same range (p. 128). Logarithmic relations in fact seem to be so common in economic material that they are often built in as an unexamined assumption in econometric models using regression techniques, just as straight-line relations tend to be the common-or-garden assumption in analogous sociological models. Floyd Allport's finding (1934) of approximately log-normal distributions of behaviors in a wide variety of normed but not explicitly economic situations suggests that the straight-line assumption should not be an automatic choice in sociological analysis. A logarithmic distribution on a variable might be expected whenever a given stimulus produces a change in behavior which is proportional to the previous position on the variable.

(4) Although, as Ekholm (1972) notes, there are empirical reasons to expect that the mean consumption and the proportion of the population above a given consumption level will tend to vary in the same direction, it should be borne in mind that, without abandoning a log-normal distribution, the proportion of the population above a given consumption level can decrease while the mean is increasing, if there is a sufficient decrease in the variance of consumption in the population. Log-normal distributions come in a variety of "shapes."

(5) The problem of the inclusion vs. exclusion of abstainers in plotting distributions of consumption needs to be discussed more explicitly. The assumption involved in excluding abstainers from the distribution is that the "decision" whether or not to drink is a separate and prior "decision" from deciding how much to drink. In a predominantly "dry" or a predominantly "wet" milieu this assumption makes a good deal of sense, since the question of whether or not to drink at all is of some social significance. For people in social situations where drinking is not a pressing issue one way or another, it may be more reasonable to regard abstaining as simply one more step on the distribution of consumption: this month they may happen not to drink at all, in December last year they may have drunk once or twice, etc. Whether or not sips of communion wine in church are counted in alcohol consumption, for another example, might make a considerable difference in the distribution of consumption, by adding a large class of very light consumers who would otherwise be counted as abstainers. If communion-sipping is excluded from consumption because of its social definition, we are no longer simply measuring "objective" consumption.

Drinking and Drug Practices Surveyor #7 (January 1973), pp. 18-20.

(6) The existence of the log-normal distribution as an approximation of cross-sectional empirical realities does not demand that prevention measures, to be effective, must apply to all consumers, as for instance a rise in price does. To demand this would be analogous to demanding that governmental efforts to redistribute income should not be undertaken because of the empirical distribution of incomes; that the only way to influence incomes is by general measures, e.g., a higher but flat tax percentage on all incomes; that is, that income cannot be redistributed but only systematically reduced.

Conversely, a measure aimed at specific populations or behaviors does not in fact apply with full force only to a sharply-defined population and not at all to other populations, so that the distribution of its effects takes a step-shape: ⌐‾‾‾ .

For a measure which criminalizes a given behavior, for instance, we might expect that individuals will differentially continue to engage in the behavior in rough proportion to their previous behavior, and that there will be a considerable degree of randomness in the "catching" of the at-risk behavior by criminalizing agencies. The effect of the countermeasure might thus be expected to take a roughly log-normal shape, acting multiplicatively on the original log-normal distribution to produce a new log-normal distribution (Aitchison & Brown, p. 11). The difference between a measure directed at specific target populations and a measure directed at the whole drinking population, then, becomes a matter of differences between different log-normal distributions, within the very wide variation of shapes that a log-normal distribution can assume.

It might be noted that there are differences within the general class of those measures which apply to the whole drinking population in terms of their curves of effect. A rise in taxes means a strict flat percentage rise in costs according to volume of consumption. A charge per drinking occasion--e.g., a "cover charge" or "seat charge" at the beginning of a drinking occasion--would have a different distribution of effect, although it would apply to all drinkers: frequent light drinkers would have to pay more per ounce of alcohol consumed than infrequent heavy drinkers. The opposite effect would perhaps be more desirable but generally more difficult to attain in practice. One can occasionally see it in effect in bars in the U.S. where drinks of the same price are mixed progressively weaker as a customer becomes drunker--there is nice mixture of motives on the part of the bartender of profits for himself and protection of the customer.

The log-normal distributions of behaviors and effects--or, to put it in Allport's terms, the J-curve of conforming behavior--should remind us that no measure is likely to be absolutely successful in its intended effects: even a stiff rise in price will not totally wipe out heavy consumption, even the establishment of a norm, as Chafetz (1970) favors, that getting drunk as often as four times a year be excluded from the norms of acceptable behavior, will still leave a "tail" of the distribution consisting of those getting drunk more often--a tail that will presumably be larger or smaller according to the effectiveness of the norm, but which will not totally disappear. We are up against the problem of all control and legal measures, that on the one hand they do influence the definition of normality, and on the other hand by their own and human nature they do "produce" a class of deviants from the norm. The ethical justification of such measures must be not only in terms of their relation to the definition of normality, but also in terms of what they do to the "deviants."

(7) The work on the log-normal curve in effect proposes and elucidates a kind of empirical reality which had not previously been noticed. It joins a considerable list of other empirical regularities about alcohol use--"social facts," in Durkheim's term--which can be found in the alcohol literature, e.g., the consistent differences between American ethnicities in rates of drinking problems, and the different composition of drinking problems in traditionally wet vs. traditionally dry regions or countries. Like these other empirical

realities, the log-normal regularity has been used as circumstantial evidence on behalf of particular policy perspectives. It has been interpreted in terms of assumptions to which it bears no necessary relationship--e.g., a contagion model, and a "boule de neige" image of the individual drinker's progression from light drinking in youth to heavy drinking in middle age. Like examples of overinterpretation can easily be found for the other empirical realities we mentioned--e.g., the common assumption that the Jewish example argues unanswerably for a prevention policy based on teaching children "responsible" drinking in school, and the common supposition that a high rate of drinking problems among drinkers in abstaining milieux is a clinching argument against prohibitory norms or laws. The regularities do not "prove" or even strongly support the interpretations laid upon them. Their power as evidence is in fact limited; at best, they can serve to explode some of the more naïve notions in the literature, or at least to force their restatement in more sophisticated terms. Thus in the past the pattern of cultural differences served as an effective argument against climate as the explanation of alcoholism. The log-normal regularity is similarly an effective argument against the notion that "normal drinking" and "alcoholic drinking" are separate phenomena which bear no relation to one another. Beyond this minimum function of pricking overinflated theories, however, the theoretical and policy implications of the log-normal distribution are by no means clear. Like the other empirical regularities, it is in fact susceptible to a large variety of competing and overlapping potential "explanations." These explanations carry highly divergent implications for policy, but the work of elucidating the competing models and theories and turning them into hypotheses subject to empirical testing has not even begun.

-- Robin Room

(These notes have benefitted from discussions with Anders Ekholm. He is not, of course, responsible for their defects.)

References

Aitchison, J., and J.A.C. Brown (1957) The Lognormal Distribution: With Special Reference to Its Uses in Economics. Cambridge: Cambridge University Press, reprinted 1966.

Allport, Floyd (1934) "The J-Curve Hypothesis of Conforming Behavior." Journal of Social Psychology 5:2 (May), pp. 141-183.

Chafetz,Morris (1970) "The Prevention of Alcoholism." International Journal of Psychiatry 9 , pp. 329-348.

deLint, Jan and Wolfgang Schmidt (1971) "Consumption Averages and Alcoholism Prevalence: A Brief Review of Epidemiological Investigations." British Journal of Addictions 66:2 (September), pp.97-107.

Ekholm, Anders (1972) "The Lognormal Distribution of Blood Alcohol Concentrations in Drivers." Quarterly Journal of Studies on Alcohol 33:2 (June), pp.508-512.

= = = = = = = = = = = = = = = = = = = = = = =

REFERENCES FOR SKOG, "LESS ALCOHOL - FEWER ALCOHOLICS?" -- cont'd from p. 14.

Ledermann, S.: "Kann man den Alkoholismus ohne gleichzeitige Anderung des Gesamtverbrauches einer Bevolkerung reduzieren?" 27. Internationaler Kongress, Alkohol und Alkohol Alkoholismus, Deutscher Hauptstelle gegen die suchtgefahren, 1964b.

O'Neill, B. & Wells, W.T.: "Blood alcohol Levels in Drivers Not involved in Accidents and the Lognormal Distribution" Quart. J. Stud. Alc. 32, 798-803, 1971.

Popham, R.E.: "Indirect methods of alcoholism prevalence estimation: a critical evaluation." In "Alcohol and Alcoholism," R.E. Popham (ed.) University of Toronto Press, Toronto 1970.

Skog, O.J.: Alkoholkonsumets fordeling i befolkningen. Mimeo. Statens Institutt for alkoholforskning, Oslo 1971.

Smart, R.G. & Schmidt,W.: "Blood Alcohol Levels in Drivers Not Involved in Accidents" Quart. J. Stud. Alc., 31, 968-971, 1970.