This paper discusses two dimensions of the amount of drinking involved in alcohol consumption, as well as methods of handling them in studies. The importance of data on both frequency and quantity is emphasized. Data from the California Drinking Practices Study are used to illustrate the discussion.

SOME METHODOLOGICAL PROBLEMS IN THE EPIDEMIOLOGY OF ALCOHOLIC BEVERAGE USAGE: DEFINITION OF AMOUNT OF INTAKE

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THERE is increasing acceptance of the idea that patterns of alcoholic beverage usage in the general population are important in the study of alcoholism: information about the normal helps to understand the abnormal. Drinking practices are seen as distributed along a continuum from less to more pathological. Among the aspects of drinking that have been used in attempts at defining pathology are symptoms of addiction, inability to earn a living, deviance from what is customary, and amount of intake. It is the latter factor that we shall discuss in this paper.

Many surveys are conducted to ascertain "how much" people drink. If we think of amount as an "intensity" factor, we can see an analogy to many other symptoms and disease entities: there are forms of the phenomenon which are so mild as to be negligible from a point of view of defining a pathology. A mild headache or a mild upper respiratory infection would not constitute a serious health problem, whereas pneumonia or an incapacitating migraine would be a health problem. But there are very few other diseases that present quite the problem of defining "intensity" which we find when we try to classify drinking patterns. Amount of intake has to be related to some time unit, and the selection of this time unit is of crucial importance. I cannot think of any other health hazard where this is true, except perhaps the amount of physical exertion viewed as a strain on the cardiovascular system. It matters a great deal whether the muscular work is done in a minute, an hour, or a day. This is well known from elementary principles of physics: power is defined as work divided by time—it takes less power to do the same work over a longer period of time.

Frequency versus Quantity

In drinking alcoholic beverages it seems obvious that the effect of a given amount of intake depends upon the time period over which the intake occurs. Yet this factor is usually neglected in

surveys of drinking patterns. Now, obviously, in a survey we cannot achieve the accuracy of an actual blood alcohol determination in terms of effective amount of alcohol delivered to the brain. The question is, what sorts of compromises can be made between this and such gross figures as yearly consumption per capita?

Efforts to answer the question "how much do people drink?" have employed many different conceptual and methodological approaches. The aim of the present paper is to review some of these concepts and methods, with particular attention to the relation between two dimensions of "amount of drinking": frequency and quantity. It will be our contention in the following pages that:

(a) Frequency of drinking is not an adequate indication of amount;

(b) Estimates of total intake, per year or even per week, are not meaningful descriptions of drinking patterns;

(c) Handling combinations of frequency and quantity as descriptive categories, rather than as points on an amount of drinking continuum, present several advantages for analysis and interpretation of data.

Data from a recent survey done in San Francisco will be used to illustrate these points. The earliest measures of amount of drinking in a population were based upon records of alcoholic beverage sales. Such figures, when standardized to give annual consumption of gallons of absolute alcohol per capita of the adult population, can be used to compare populations in different countries and in different years. They have the advantage over surveys (where individuals are asked how much they drink) of giving a more exact figure on amount consumed. They have the disadvantages inherent in using an over-all mean for a very heterogeneous population. For example, in 1959, the consumption in the United States per adult was about two gallons of absolute alcohol, the equivalent, roughly, of 1½ ounces of whiskey a day. If each person did in fact drink 1½ ounces of whiskey every day, there would be no alcoholics and no abstainers, only light drinkers. If, however, the entire amount were consumed by 10 per cent of the people, there would be only alcoholics and abstainers, no light drinkers. Obviously, a meaningful picture of drinking patterns requires information on individual behavior, and on the distribution of individuals by amount of drinking.

The idea has been advanced that the distribution of amount of drinking in a population follows a predictable mathematical curve, so that we need only know the total in order to know how many people are drinking what yearly amounts. Reasoning along such lines, Lederman, for example, estimates that 25 per cent of the alcohol in France is consumed by 7 per cent of the adult population which, he calculates, would mean over 20 centiliters per day for the 7 per cent.[1] In the United States, where social science is more empirically oriented, such a solution is not likely to be accepted. The approach here has been to conduct polls on representative samples of the population, polls in which people are asked how much they drink. The problems then center on what questions to ask and what descriptive categories to use in classifying drinkers.* It is to the latter problem that we address ourselves in the present paper.

Suppose an exact account of the alcoholic intake of our respondents for every day in one year were available. The classification problem would be enormous, except for those very few people whose pattern is exactly the same every day. There are several relatively simple classificatory methods of an arbitrary nature which would not do a good job as meaningful description. For ex-

* Fink, R. Survey Method in the Study of Drinking Behavior. A paper delivered at the Annual Meeting of the Society for the Study of Social Problems, Washington, D. C., 1962, in which one aspect of this problem was discussed.

ample, one could calculate an average intake per week, per month, or per year, but this would not distinguish between binge drinkers and light drinkers. The same weekly total could be obtained for the person who takes two drinks every day, the one who takes 14 drinks every Saturday night, and the one who takes seven drinks twice a week. It is reasonable to assume that these three types represent different kinds of living and drinking patterns. The point is obvious, but it is worth emphasizing because surveys that are limited to one question tend to use frequency* of drinking, while surveys that do obtain data on both frequency and quantity sometimes use a rough weekly total as a classificatory concept, thus obscuring the difference between the frequent light† and the infrequent heavy drinker. The fallacy of the concept of weekly intake can be illustrated by data from a recent survey done in San Francisco.‡

Comparisons

Let us compare two groups of people whose total weekly intake of alcohol is roughly the same, but who differ on the frequency of intake. For convenience we shall call them the "daily light drinkers" and the "weekly heavy drinkers," respectively. Because a large number of questions on frequency and quantity was used in the definition of these groups, the exact method is too complex to be presented here. In summary, they were defined as follows: (a) the daily light drinkers are those who drink nearly every day or every day and who never take more than two drinks in a day; (b) the weekly heavy drinkers are those who drink approximately the same total amount as the daily light drinkers but who consume this amount in one to four "sittings" or days per week.*

The contrast between these two groups with respect to most of the other variables included in the study is striking, as shown in Table 1. Consider, first, those items that describe a home-centered drinking pattern suggestive of the customs of Italy and other southern European countries—usual beverage: wine; religion: Catholic; usual place of drinking: at home; usual companions: family; father's drinking frequency: nearly every day. For all of these items the proportions of daily light drinkers are greater than the proportion of weekly heavy drinkers. The contrast in the proportion preferring wine is particularly marked: 54 per cent vs. 7 per cent.

The two groups also differ considerably in basic social characteristics: the daily light drinkers have much larger proportions of women and of older, poor, less well-educated people. More of them are engaged in white collar occupations, and more of them grew up in either rural areas or very small towns.

The tendency to drink for the intoxicating effect rather than for sociability is reflected in two items in Table 1. A number of reasons for drinking were presented to respondents and they were

* The term "frequency" is used to mean number of days in a week or a month when any drinking is done; the term "quantity" refers here to number of drinks taken at a sitting. The term "amount" is used as a nonspecific term to cover any method of combining frequency and quantity. Bradburn[2] shows one example of a survey using frequency and not quantity.

† This is not always explicit but, for example, Mulford's[3] group of "light drinkers" was formed by combining his Types 1 and 2. These are both infrequent drinkers (drink once a month at most), but Type 1 consumes small amounts at a sitting, while Type 2 may consume large amounts.

‡ Details on the sample and the questionnaire may be obtained from the Drinking Practices Study, 2223 Shattuck Ave., Berkeley, Calif. 94704.

* The weekly intake for each group ranges from 5 to 14 drinks. This may seem a rather wide range to be used for the definition, of equivalent intake, but it should be remembered that the range for all drinkers is enormously greater: from 1/50 of a drink per week to 42 drinks per week. Knupfer[4] gives more details about the questions on which these categories were based.

Table 1—Comparison of two groups with approximately the same weekly intake: daily light and weekly heavy drinkers (%)

	Daily Light (N=91)	Weekly Heavy (N=54)
Drinking Patterns: European Wine Culture		
Usual Beverage: Wine	54	7
Religion: Catholic	58	40
Drinks most often at home	93	56
Drinks most often with family	66	27
Father drank nearly every day	50	22
Drinking Patterns: Value of Intoxication		
Does not enjoy getting drunk	97	57
Does not drink for tension relief	47	26
Sociability Patterns		
Friends visit less than once a week	57	46
Visits friends less than once a week	66	48
Goes to parties less than 5 times a year	60	13
Frequents taverns less than once a month	76	7
Mixes socially with church people	32	21
Attends church once a month or more	57	26
Social Characteristics		
Sex: female	56	43
Age: 40 or over	76	33
Income: less than $7,500	73	66
Education: less than college	75	60
Occupation of main earner: white collar	55	46
Residence at age 15 in a place with less than 5,000 population	39	7

asked which of them was very important, fairly important, or not at all important. All of the reasons involving change of mood, including "I drink to feel better"; "I drink to forget my worries"; and so on, were for the purposes of this analysis termed "drinking for relief of tension." The proportion of people in each group who said "not at all important" to all of the "relief of tension" reasons is presented in Table 1: 47 per cent of the daily light drinkers, 26 per cent of the weekly heavy drinkers deny relief drinking in this sense. Another item tapping the same factor consists of replies to the question, "I enjoy getting drunk once in a while (Would you say you sometimes or never feel this way)": 97 per cent of the daily light drinkers, 57 per cent of the weekly heavy drinkers answered "never" to this statement.

The sociability patterns of the two groups also differ. More of the weekly heavy drinkers visit friends, go to parties, frequent taverns, while more of the daily light drinkers attend church services and socialize with church members. Thus, it is apparent that the two groups differ on a number of variables which would be relevant for a variety of sociological and psychological studies.

The groups compared in Table 1 form a very small proportion (15 per cent) of the total drinkers in the sample. They were selected to make a point about equivalent weekly intake. Special types of drinking patterns, characteristic of only a small number of people, are often of considerable interest. However, it

is not always possible or even desirable to focus on such specialized groups. Let us turn, then, to a more general example of the value of considering quantity-frequency groups as specific categories rather than as part of a continuum.

For this example, we will classify all drinkers into four groups based on high and low frequency, and high and low quantity. Instead of attempting to arrange them in a continuum of small to large amounts of drinking, we simply group them as (1) high quantity, high frequency; (2) high quantity, low frequency; (3) high frequency, low quantity; and (4) low frequency, low quantity.*

* The same point could be made, perhaps more elegantly, using a ninefold classification, if frequency and quantity were each defined in three steps instead of two. The fourfold grouping is used here for the sake of simplicity.

When the percentages of each group possessing a given characteristic are compared, we find a number of different patterns of relationship between the groups, depending upon the characteristic selected for study. One pattern occurs when one of the groups stands out as different from the other three, while the other three are similar.

Statistically speaking, this may be described as an *interaction effect.* Consider, for example, the relationship between motivation for drinking and amount of drinking (lines 1 and 2 in Table 2). Whether amount be measured by quantity or by frequency, the relationship depends chiefly upon the conjunction of high quantity and high frequency. Thus, we might say there is a relationship between frequency and drinking for tension relief, but only among heavy drinkers. Or we might

Table 2—Similarities and differences among four frequency-quantity groups with respect to selected variables

	Heavy Drinkers		Light Drinkers	
	A Frequent (418)	B Infrequent (165)	C Frequent (203)	D Infrequent (180)
Interaction Effect A				
Enjoys getting drunk	28%	10%	4%	2%
Drinks for tension relief	27	10	12	6
Interaction Effect C				
Usual beverage wine	18	13	41	23
Drinks most often with family	42	39	59	46
Quantity Effect				
Age: under 40	47	49	27	28
Education: high school	68	74	54	55
Frequency Effect				
Father drank nearly every day	32	20	35	23
Friends visit once a week or more	48	39	46	38

equally well describe the findings as a relationship between quantity and drinking for tension relief which exists only among frequent drinkers.

A similar interaction effect is shown in lines 3 and 4 in Table 2. Here the combination of characteristics which produces the interaction effect is the conjunction of high frequency with low quantity. Frequent light drinkers are much more likely to prefer wine and to do their drinking in the company of their family than are any of the other three types of drinkers.

Another pattern, illustrated by lines 5 and 6 in Table 2, is characterized by a *quantity effect*, but no frequency effect. Thus, groups C and D are very similar to each other in age and education, but they differ from groups A and B which differ little from each other.

A third pattern shows a *frequency effect*, but no quantity effect. This is found less often in our data. In fact, the two examples given in Table 2 (last two lines) are the only ones we could find, whereas the examples shown of the other patterns are selected from among many.

Conclusion

Methods of handling the two dimensions of amount of drinking were discussed. The usefulness of obtaining data on both frequency and quantity and of using the two independently for classifying drinking patterns was emphasized. Flexibility in classification permits refinement in the study of relationships in different areas of investigation. Data from the California Drinking Practices Study were presented to illustrate the argument.

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