Tracking Alcohol Consumption Over Time

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Researchers are tracking long-term changes in alcohol consumption and related behaviors or outcomes in order to detect trends in the entire population or certain subgroups, test models of alcohol-related outcomes, and understand the consequences of interventions. Such analyses must consider the complexity of typical lifetime consumption patterns. Major approaches to measuring alcohol consumption over time include aggregate measures of consumption (e.g., sales data), cross-sectional surveys, and longitudinal or panel surveys. When analyzing the data, researchers must try to ensure the comparability of measurements over time. The stability of various measures and the potential for combining different types of data are also important considerations when tracking alcohol consumption over time. If these requirements are met, the regular collection of data on aspects of alcohol consumption will greatly increase researchers' understanding of the forces influencing a population's alcohol consumption and its consequences. *Key words: research and evaluation method; research quality; aggregate AOD (alcohol and other drug) consumption; cross-sectional study; survey; longitudinal study; population study; trend; statistical modeling; epidemiology*

Epidemiologists not only monitor current alcohol consumption and its consequences (e.g., traffic crashes) as well as other alcohol-related behaviors, they also analyze long-term trends in these variables. This article summarizes some of the goals of such trend analyses, reviews three major types of trend measurements, and explores the comparability of such measurements over time. The article also discusses the stability of various measures and the possibilities for combining different types of data.

Epidemiological Goals of Tracking Alcohol Consumption Over Time

Regular and detailed monitoring of a nation's alcohol consumption has several benefits. First, each measurement provides a current portrait of drinking practices, and repeated measurements allow for early detection of trends in drinking patterns both for the entire nation and for population subgroups. Certain subgroups, such as ethnic minorities whose health problems and access to health care may differ from those of the majority of the population, may warrant particular attention in such analyses because they may be more vulnerable to alcohol-related and other health problems.

Second, by tracking alcohol consumption over time, investigators obtain the information needed to test temporal models of alcohol consumption behaviors and related outcomes, such as alcohol-related mortality and morbidity, including the development of alcohol dependence.

Third, close monitoring of the consumption patterns of a population subgroup or of people residing in a given geographic area may be vital for understanding other alcohol-related social harms, such as spousal violence, urban blight, or poor academic performance in a school setting.

Fourth, routine monitoring with rapid reporting allows investigators to

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Major Approaches to Measuring Alcohol Consumption Over Time

Aggregate Measures of Consumption

Epidemiologists usually are interested in consumption volume summarized across individuals, yielding a group or subgroup's total or average amount of alcohol consumed. The average alcohol consumption can be estimated from aggregate-level data (e.g., based on sales or taxation sources) and from individual-level survey data. Although aggregate-level data may be easier to obtain, surveys allow assessment of other aspects of drinking as well, such as the prevalence of heavy drinking or of alcohol-related problems during the reference period. Although analyses of average alcohol consumption obscure a great deal of information (e.g., the proportion of heavy versus light drinking), they offer the broadest measure of a group or population's consumption. The average consumption across a population always changes more smoothly than individual measurements, because people vary their drinking in different ways (e.g., increasing, decreasing, or fluctuating consumption). Consequently, average consumption generally can be estimated more accurately than any individual's particular drinking pattern.

A commonly used measure of aggregate alcohol consumption is the per capita consumption of members of a larger group (e.g., a State or Nation) within a given time period (e.g., a year, a month, or a quarter). Monthly and quarterly aggregate measures will be subject to seasonal patterns—such as increased beer consumption in the summer and increased liquor consumption in the November and December holiday season—that may distort the finding. Even shorter reference periods would further increase the risk of biases attributable to weekly and seasonal cycles. Accordingly, researchers typically favor annual reports.

To determine aggregate measures of consumption, such as the annual per capita consumption by a population, researchers determine the total amount of alcohol sold in that population during the reference period and divide it by the number of potential (not actual) drinkers. In the United States, potential drinkers are typically defined as all people age 14 and older. Acknowledging that many adolescents drink, albeit illegally, this lower age cutoff is designed to include the majority of those population groups that potentially contribute to alcohol consumption (although some people begin drinking even earlier). In the United States, these aggregates are separately measured for the broad categories of beer, wine, and spirits and for the populations of each State as well as the Nation as a whole. These per capita estimates based on sales, taxation, or industry-based shipment data are a major component of the effort to track alcohol consumption over time. The per capita estimates are thought to be more accurate than self-reported survey data and have been collected continuously for many years.

Several factors influence the accuracy of per capita consumption data. Data sources for these estimates usually are records of sales or tax receipts if available, but they also include other industry documents and monthly data on shipments from wholesale warehouses (Nephew et al. 2000). These analyses omit, however, self-imported alcohol as well as homemade or illegally produced alcohol (Giesbrecht et al. 2000). In addition, alcohol is sold at a later date than that shown in shipment data, so the timing of consumption is unknown. These discrepancies between the time of shipment, sale, and consumption make yearly data inherently more accurate than monthly data.

Inaccuracies in per capita consumption data also derive from the populations included in the analyses. For example, estimates generally are based on a State or country's census of its population, but not all of these people drink, and the per-person average therefore includes abstainers. Moreover, residents of a particular area are generally not the only drinkers of the alcohol sold in that area; tourists, other visitors, and military personnel not included in population counts will drink some of the alcohol or may take alcohol back to their State or country for later consumption. Similarly, a State's residents will drink when traveling and may make purchases in other States for consumption at home. These variations are usually small but can be large in some States, such as Nevada and New Hampshire. Also, not all alcohol sold is actually consumed; a portion may be spilled, left untouched, spoiled, or otherwise wasted. Furthermore, shifts in the demographic composition of the population age 14 or older may affect aggregate levels of consumption. For example, an aging population may show a decrease in overall consumption even if the age-specific rates are not changing (in populations where older drinkers drink less than younger drinkers).

Per capita consumption generally is expressed in terms of grams or liters of absolute alcohol consumed during the reference period; however, the alcohol content of the beer, wine, and spirits that make up the aggregate varies across the beverage groups, over time, and even within a brand. For example, studies found that the average alcohol content of spirits as determined through Federal tax collection and sales volume data fell from about 45 percent in the early 1960s to about 38 percent in the mid-1980s (Kling 1989, 1991).

Because the alcohol content of beer and wine varies across the range of products, differences in consumer choices can result in variations in average alcohol content across States and over time. These variations can be illustrated with the example of beer consumption. Whereas a typical light beer has an alcohol content of 4.2 percent, most premium beers contain 5 percent alcohol, and malt liquor, ice beers, and many microbrewery beers contain 5 to 7 percent alcohol or more (Adams Business Research 2001). If investigators use a constant mean alcohol content for all States and all years, such as the 4.5 percent used in National Institute on Alcohol Abuse and Alcoholism Surveillance

Drinking Trends From Repeated Cross-Sectional Surveys—Examples of Measures not Available From Aggregate-Level Data

	1984 (*n* = 5,221)	1990 (*n* = 2,058)	1995 (*n* = 2,178)	$\chi 2^{\dagger}$ 1984 vs. 1990	$\chi 2$ 1990 vs. 1995
All respondents, % (SE)					
Current drinking	69.4 (1.6)	65.0 (1.4)	64.6 (1.6)	4.04*	0.03
Wine	51.2 (1.8)	43.6 (1.5)	42.7 (1.9)	10.65**	0.20
Beer	51.5 (1.3)	45.2 (1.4)	48.0 (1.6)	9.61**	2.19
Spirits	51.8 (1.8)	43.5 (1.3)	42.6 (1.7)	13.85***	0.07
Weekly drinking	35.9 (1.5)	29.0 (1.2)	29.2 (1.3)	13.90***	0.12
5+ drinks ever in prior year	30.0 (1.2)	28.6 (1.2)	27.6 (1.4)	0.66	0.42
5+ drinks weekly in prior year	6.1 (0.6)	3.9 (0.5)	4.5 (0.6)	8.66**	0.93
				$t^{\dagger\dagger}$	t
Current drinkers, mean (SE)				1984 vs. 1990	1990 vs. 1995
Total drinking days	109.7 (4.6)	82.9 (3.9)	87.7 (3.9)	4.00***	0.05
Wine	39.8 (2.5)	39.3 (3.0)	39.5 (3.0)	0.13	0.05
Beer	95.8 (4.1)	72.2 (3.9)	75.4 (3.6)	4.19***	0.59
Spirits	34.1 (1.9)	31.5 (1.9)	26.2 (1.9)	0.98	1.98*
Total heavy drinking days	19.3 (1.5)	13.2 (1.2)	13.2 (1.3)	2.71**	0.07
Wine	1.9 (0.4)	1.5 (0.4)	1.0 (0.2)	0.63	0.99
Beer	13.9 (1.1)	9.4 (0.9)	10.5 (1.0)	2.74**	0.91
Spirits	3.7 (0.5)	2.6 (0.5)	1.9 (0.3)	1.37	1.26

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

† The chi-square statistic is used to test a hypotheses concerning the probability of whether a behavior or characteristic found in a sample—or in this case, the change in that behavior or characteristic found from one sample to another—is found to the same degree in the population as a whole.

†† The *t* test assesses whether the means of two groups are statistically different from each other.

NOTE: This table is based on weighted data obtained from U.S. respondents participating in the 1984, 1990, and 1995 National Alcohol Surveys. The table displays percentages and means, as well as the standard error (SE).

SOURCE: Adapted from Greenfield et al. (2000).

face-to-face, mail, and telephone interviews (Greenfield 2000). A secondary problem—that is, declining response rates over time—leads to questions as to whether the same population is actually being measured at each time.

Longitudinal Surveys (Panel Surveys)

Longitudinal or panel surveys allow researchers to study the development of individual consumption patterns (including those of members of ethnic groups) over extended periods and to identify subgroups of drinkers, such as chronic heavy drinkers (Caetano and Kaskutas 1995). Longitudinal designs are also valuable for examining trends in consumption patterns and associations between these patterns and related problems over time (Caetano and Kaskutas 1996; Muthen and Muthen 2000). Although such relationships are also studied in periodic cross-sectional surveys, longitudinal designs help establish relationships at the individual level and allow researchers to make stronger causal attributions. Finally, these studies allow for tracking of mortality and morbidity outcomes, particularly outcomes related to chronic consumption (Shaper and Wannamethee 1998).

Longitudinal surveys are similar to cross-sectional surveys in the types of behaviors and outcomes they measure. Compared with cross-sectional analyses, however, longitudinal studies add measurement opportunities across time from as little as a month to many years apart. Prospective surveys offer particularly accurate insight into consumption over time because they avoid the recall problems regarding past consumption that are associated with retrospective lifetime measures. Finally, longitudinal surveys can uncover longer-term changes in patterns of consumption and relate these changes to individual and societal factors.

One potential problem with longitudinal studies is that often they are not representative of the general population on all measurement points because they may suffer from considerable attrition or from the researchers' inability to locate and secure reinterviews with still-living participants.[3] If longitudinal surveys are representative of the general population at the first measurement, however, and if researchers can take into account the effects of attrition, these designs offer a picture of consumption trends that augments and complements representative cross-sectional surveys. The issues related to measuring aggregations of consumption are important here as well. Foremost, measures and methods must be comparable with each other, but even then the choice

[3]Nonresponse is an increasing problem for both cross-sectional and longitudinal surveys.

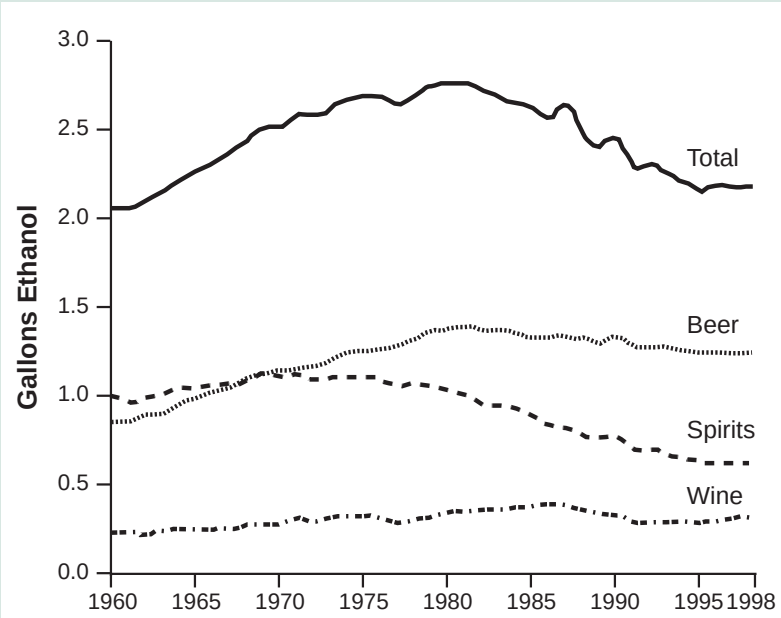
In the past, only aggregate sales data have been available on a continuous basis. In recent years, however, several national surveys tracking alcohol consumption and related problem trends over time have become available (see the sidebar).

Conclusions

In their efforts to track alcohol consumption and related variables in a population over extended periods of time, researchers rely on aggregate data, cross-sectional surveys, and longitudinal or panel studies. Aggregate alcohol consumption data are used primarily to establish models of alcohol-related outcomes, such as mortality and morbidity from alcohol-related causes, injury rates, or traffic fatalities. These data also allow for the development of models linking aggregate consumption with demographic and policy variables, such as tax rates, minimum drinking age limits, and warning labels. These models are based either on time series of the relevant variables from a single population (e.g., the entire United States) or on cross-sectional data from several populations (e.g., different States). Identifying time-series relationships is complicated by a number of issues, including the possibility of spuriously correlated trends (see Norstrom and Skog 2001).

The regular collection of survey measures on aspects of alcohol consumption will increase researchers' understanding of the dynamic forces involved in a population's changing consumption pattern. By tracking alcohol consumption through surveys, researchers can begin to answer questions such as the following:

- Do changes occur primarily among current drinkers or among people moving in or out of drinking?
- Are the heaviest drinkers relatively immune to economic or cultural forces that affect other drinkers (i.e., do they appear to form a separate group)?
- Do the differences in consumption widely observed between men and women converge over time?



Per capita consumption of beer, wine, and spirits, and total alcohol consumption in the United States, 1960–1998.

SOURCE: Adapted from Nephew et al. 2000.

Sometimes it is difficult to determine the sources of changes in individual consumption patterns observable in repeated surveys. Such changes may be attributable to a person's age (i.e., a maturation effect) to the period (i.e., societal conditions prevailing at the time of the survey), or to the birth cohort (e.g., the cultural ambience related to drinking during the formative years, when many people begin to drink). Age-period-cohort (APC) models are one strategy that analysts can use with series of surveys in an effort to distinguish these various possibilities. Despite these caveats, however, efforts to track alcohol consumption with repeated representative surveys that employ consistent measures and procedures can help answer important epidemiological questions.

Prospective longitudinal surveys offer the best opportunity to link individual characteristics to the time course of alcohol use and alcohol-related problems as well as to reveal the causal sequences involved. Although cross-sectional surveys can be useful for this purpose, longitudinal designs best address questions regarding the individual's response to policies (e.g., taxation changes) or interventions (e.g., improved availability of treatment services). Longitudinal studies also are important for estimating alcohol-related morbidity and mortality as well as other alcohol-related problem outcomes over longer periods. These studies offer multiple live measures, which have been found to be more accurate than retrospective assessments and which can be linked with outcomes assessed at followup.

The three types of data used in tracking alcohol consumption over time complement one another for many purposes. Data from representative

influence the results of later assessments. Cross-sectional surveys do not introduce this problem. In general, each method of tracking alcohol consumption and related problems over time has some trade-offs; consequently, the use of multiple methods in such studies is often desirable. ■

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