

Slide 1

# The Epidemiology of Alcohol Use, Alcohol Abuse, Dependence, and Alcohol-Related Morbidity and Mortality

**Marcia Russell, Ph.D.**

**RSA Lecture Series, 2001**

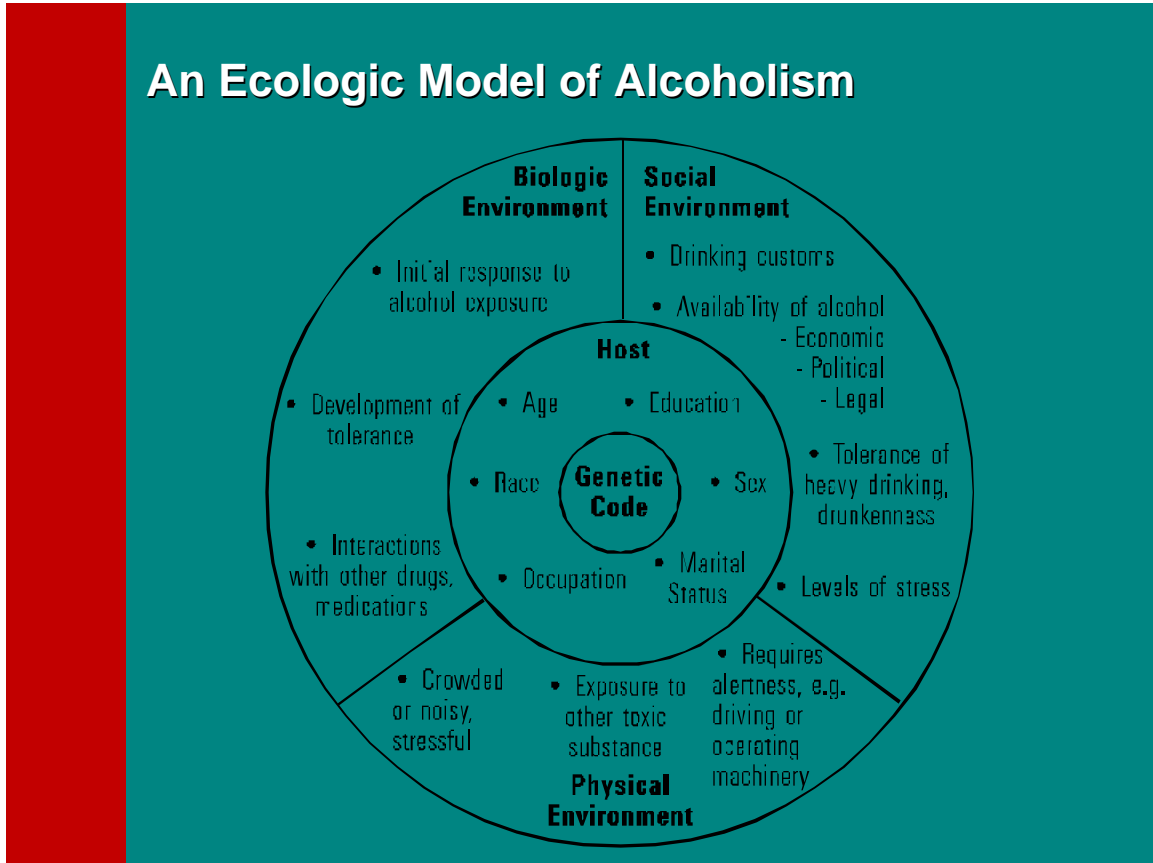
## **Definition**

Epidemiology is the study of the distribution and determinants of disease in man. This lecture covers the epidemiology of alcohol from three vantage points, only two of which pertain directly to disease. Alcohol consumption, the first topic to be covered, is not, in and of itself, considered a disease, although it is possible for individuals to drink enough to poison themselves. The second topic, the alcohol psychiatric disorders, alcohol abuse and dependence, is defined by consumption that is associated with repetitive, maladaptive behavior that causes problems serious enough to interfere with one's life. The third topic deals with acute and chronic health problems that are caused or made worse by drinking alcohol.

## **The role of measurement in alcohol epidemiology**

The role of measurement is central to all empirical sciences, no matter how qualitative the theories under investigation. As a science matures and hypotheses are refined, new measurement techniques are often needed to test them. The development of new measurement techniques, in turn, influences the direction and scope of the research agenda. Nowhere is this more true than for the epidemiology of alcohol use and abuse. Therefore, measurement tools will provide a framework for the much of the present material.

Slide 2



**An ecological model for the epidemiology of alcohol disorders:**

In many respects, alcohol can be considered the causal agent in alcohol psychiatric disorders because it must be present for alcoholism to occur. However, the fact that most drinkers do not become alcoholics indicates that it is a necessary, but not sufficient cause. Suitable conditions of the host and environment must also be present for disease to develop, and the concept that a number of factors influence the occurrence of disease is referred to as multiple causation or multi-factorial causation. In the past, particularly in the context of the epidemiology of infectious disease, a triangle has been used to illustrate relations between three factors that contribute to the occurrence of disease, the agent or proximal cause of the disease, the host, and the environment. Increasingly, with the study of chronic and mental disorders having a complex, multi-factorial etiology, many epidemiologists have come to prefer models in which the agent is considered part of the total environment. This de-emphasizes the role of the agent and stresses the multiplicity of interactions between the host and the environment.

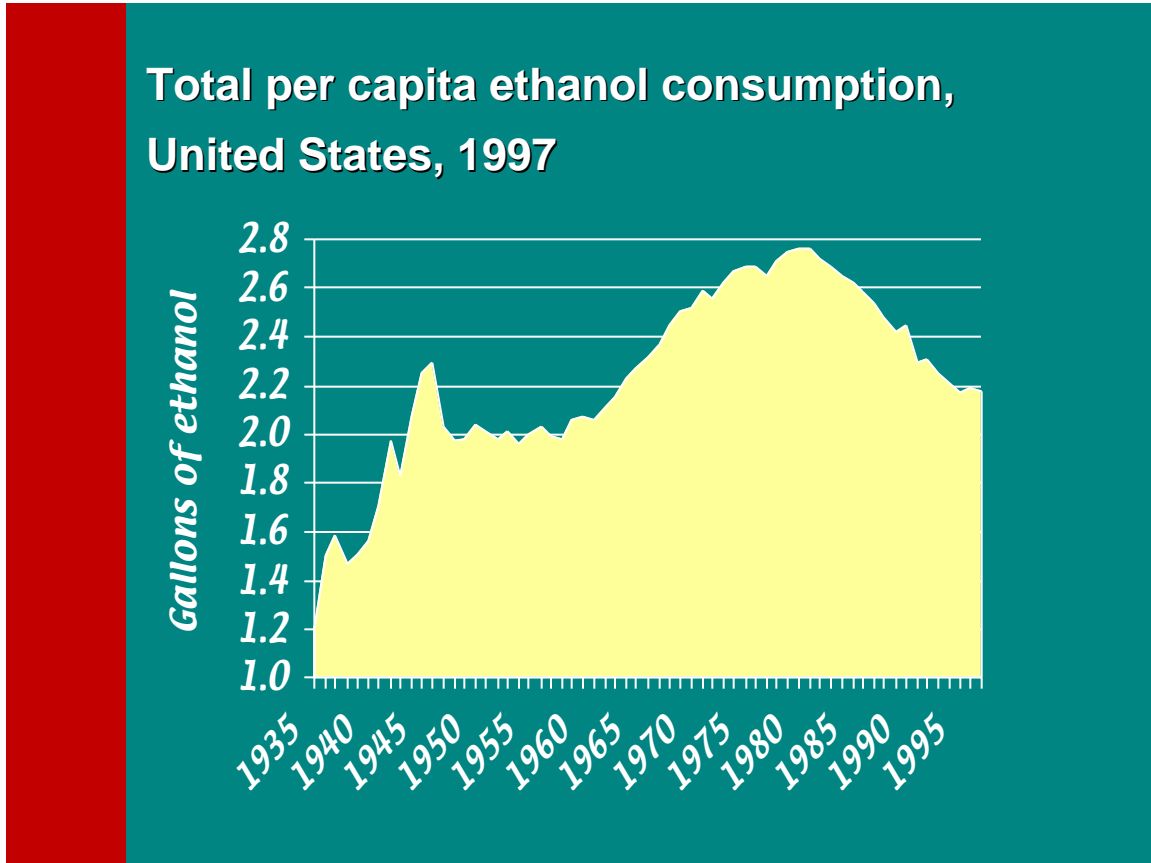
**Wheel model illustrating an ecological model of alcoholism**

Here, a few of the factors thought to influence the incidence of alcohol disorders and alcohol-related problems are fit into the framework of the wheel model of disease. The wheel model depicts the human host with his genetic makeup at its core; the surrounding environment is divided into three sectors: biologic, social, and physical. A definitive model for alcoholism has not yet been developed, and this figure is simply

## Epidemiology of Alcohol (Russell)

meant to illustrate some of the many ways in which host attributes and environmental conditions can interact to increase or decrease the likelihood that a given alcohol exposure will occur and that it will be associated with a given consequence. Other lectures in this series will provide a more detailed look at relations between many of the factors illustrated here. The wheel provides a conceptual framework for thinking about how this information all contributes to understanding the distribution of alcohol use and alcohol-related problems.

## Slide 3

**Alcohol Consumption**

**Per capita consumption.** Alcohol use is measured at the population level in terms of per capita consumption. Its calculation is based on the total amount of alcohol consumed in the United States, estimated on the basis of alcohol sales in each State as determined from tax receipts, sales in State-controlled stores, and/or reports from beverage industry sources. These overall statistics do not include estimates of home production, illegal production, breakage, or untaxed alcohol brought in by tourists. Apparent per capita consumption is determined by dividing total alcohol, derived from sales, by the total population aged 14 years or older. The term "apparent" is used because these estimates artificially attribute average consumption to all persons in this population, regardless of their actual consumption. Per capita consumption is expressed in gallons of pure alcohol calculated by multiplying total gallons of each beverage type by a conversion factor (0.045 for beer, 0.129 for wine, and 0.414 for spirits), which represents the average alcohol content of each beverage, and summing over all three beverages. Per capital consumption is often used to track historical trends, as illustrated above, and to compare alcohol intakes in various countries or regions.

**Historical Evolution/Trends**

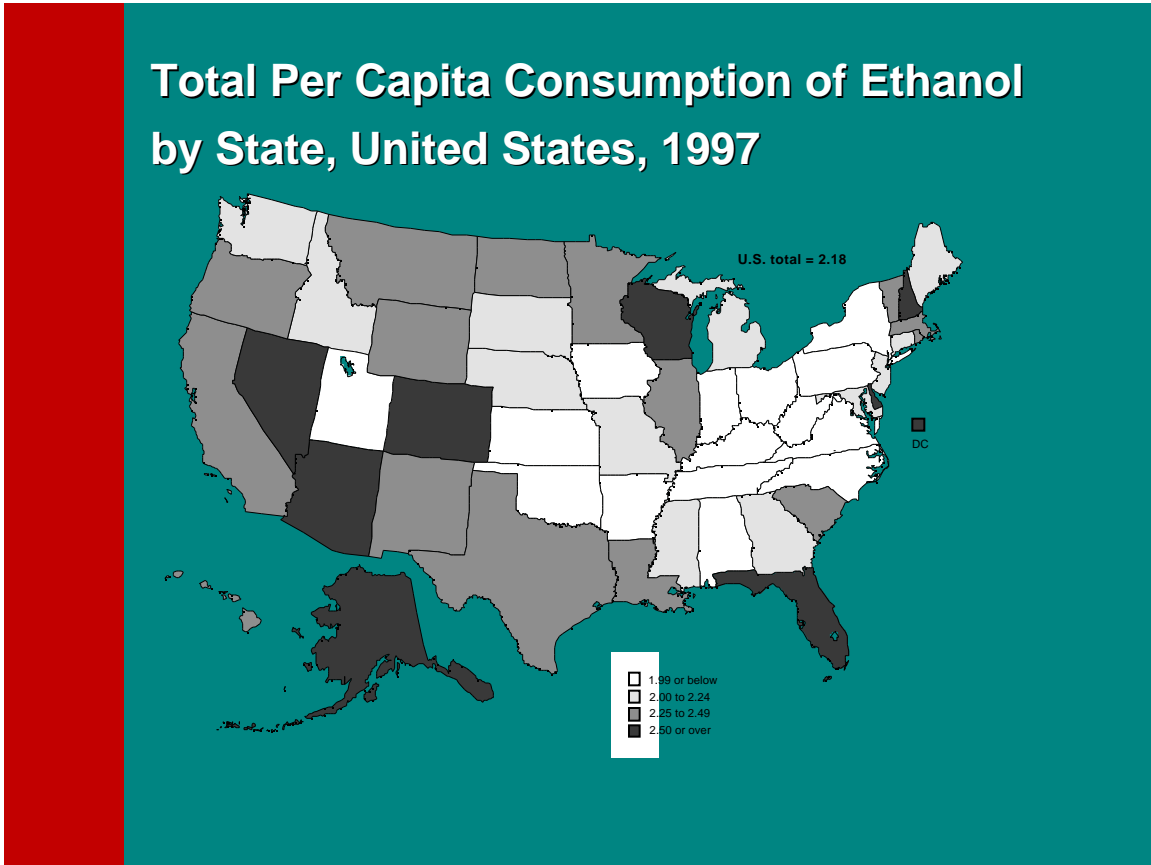
Alcohol use is widespread throughout the world and has been throughout history. In many developed western societies there have been cycles in which social approval of drinking alcohol led to gradually increasing use until alcohol-related problems became so

## Epidemiology of Alcohol (Russell)

pervasive and serious that they provoked a backlash. The most dramatic U.S. backlash resulted in the passage of the Volstead Act, instituting Prohibition in 1919. Illegal activity to circumvent the law led to its being revoked in 1933. Alcohol use took a big jump after World War II and then gradually increased throughout the 1950s and 60s, peaking in the 1970s. Current trends toward lower alcohol intakes have been influenced by societal reactions to high mortality and morbidity rates related to drunk driving, as evidenced by the formation of activist groups such as Mothers Against Drunk Driving, and by increased recognition of the negative effects of excessive drinking on health and social functioning.

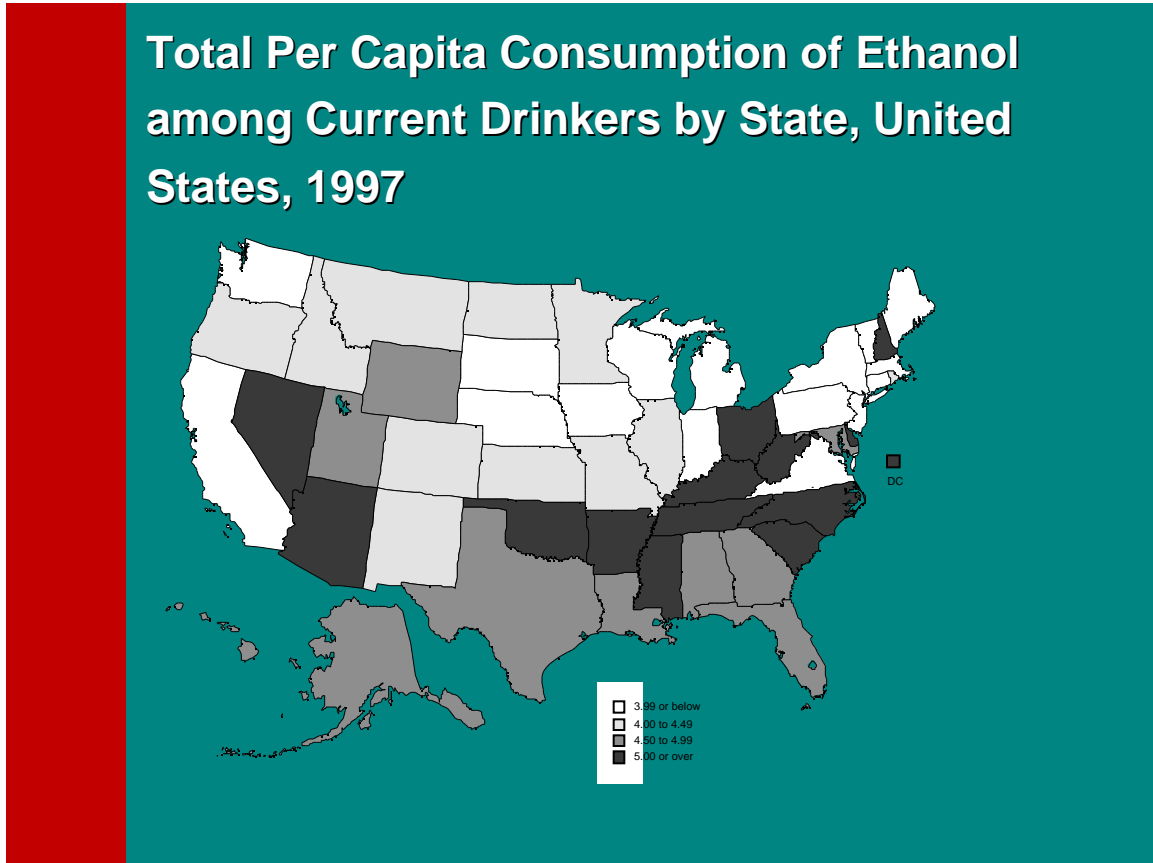
Source: Nephew, T.M., Williams, G.D., Stinson, F.S., Nguyen, K., Dufour, M.C., Apparent per capita alcohol consumption: National, State, and Regional trends, 1977-1997, NIAAA Surveillance Report #51, December, 1999.

Slide 4



**State data on per capita alcohol consumption:** It is of interest to note that there is regional variability in per capita alcohol consumption. In general, alcohol consumption is highest in the West. It used to be lowest in the South and Midwest, with the Northeast somewhat higher, but since 1990, there has been little difference between these three regions in per capita consumption. As illustrated here, the highest totals are for New Hampshire, the District of Columbia, Nevada, Delaware, and Wisconsin. Per capita consumption in some of these areas, like Nevada and the District of Columbia, is inflated because they sell a lot of alcohol to people from out of the area. However, some states have populations that drink a lot—for example, Milwaukee, Wisconsin, is known as a center for brewing beer. Many of the states with low per capita consumption are in the South, Alabama, Arkansas, North Carolina, Virginia, and West Virginia; however, others, such as New York, Pennsylvania, and Ohio are in the north central part of the country.

Slide 5



**Per capita consumption among drinkers by State:** As noted earlier, apparent per capita consumption assumes that everyone over the age of 14 is a drinker; however, this is clearly not the case. In recent years the CDC has coordinated a Behavioral Risk Factor Surveillance System (BRFSS), in which the States conduct telephone surveys of individuals ages 18 and over. The survey includes questions on alcohol consumption in the previous month. These data provide information on the proportion of the population in each State that drank no alcohol. These people can be subtracted from the total census figures to give an estimate of average consumption among drinkers only. There are several caveats to keep in mind regarding these estimates: State samples may have large standard errors; the survey does not include persons between 14 and 18, some of whom drink; and persons who abstained during the last month may be infrequent drinkers or heavy drinkers who did not drink because they were ill or for some other reason. Nonetheless, the data provide a reasonable approximation of abstention rates in States for which data are available. Abstention rates ranged from a high of 71.7 percent in Utah to a low of 29.8 percent in Wisconsin.

When abstention is taken into consideration, yielding estimates of per capita consumption among drinkers, Wisconsin is no longer at the top of the list. The most striking effect is that several states in the South with historically low levels of per capita consumption can be seen to have high per capita intakes among their drinkers. Some of

## Epidemiology of Alcohol (Russell)

these States are in what is called the “Bible Belt” with relatively high membership in churches that actively campaign against drinking alcohol, in some cases resulting in the passage of laws restricting access to alcohol, so-called “Dry” states or counties. Failure to take high abstention rates into account in these States underestimates the extent to which heavy drinking may be a problem among people who drink in spite of a general population tendency to abstain.

Slide 6

## Quantity-Frequency

- **Frequency: Drinking days/year.**
  - How often did you have a drink containing alcohol, that is beer, wine or liquor?
- **Quantity: Drinks per Drinking Day**
  - About how many drinks would you have on average on a typical day when you drank?
- **Volume: (Drinking days/year X Drinks per drinking day)/days in a year = Drinks per day**

**Surveys of alcohol use.** Although per capita consumption provides an overall estimate of alcohol consumed in the U.S., survey data are needed to link consumption data with factors such as sociodemographic correlates and alcohol consequences at the individual level. Although other methods have been proposed to obtain self-reports of alcohol intake, most U.S. surveys have included quantity-frequency (QF) questions asking respondents how often they drink and how many drinks they usually have when they consume alcohol. Quantity-Frequency (QF) questions are often introduced by defining a standard drink as a 12-oz. can or bottle of beer, a 5 oz. glass of wine, or a drink containing 1.5 oz. of liquor.

Within this general framework, there is considerable variability in the way QF questions are formulated. Sometimes they are repeated for specific alcoholic beverages, wine, beer, and liquor; or respondents may be given the option of defining their own drink size. Questions on usual QF may be supplemented by additional QF questions on times when respondents drink more than usual. However they are asked, the resulting data are routinely used to estimate **volume** of alcohol consumption, ounces of ethanol consumed per day, by multiplying drinking days in a year X drinks per drinking day X ounces of ethanol in a drink and dividing by days in a year. Ethanol in a drink is estimated by applying conversion factors based on the amount of ethanol in an ounce of the average beer (.045), wine (.121), or liquor (.409) to the ounces in a drink of each beverage. There is approximately 0.5 oz. ethanol in a standard drink in the United States,

equivalent to about 12 grams of ethanol, or 15 ml., but this varies somewhat in other countries.

**Issues important in evaluating data and designing studies relating alcohol consumption to health:**

**Analysis.** Although the practice of using volume as a measure of alcohol consumption in epidemiological studies of health outcomes is widespread and convenient, it has been criticized because it obscures differences in drinking pattern. Thus, individuals having two drinks seven days a week would have the same volume measure as a person having 14 drinks every Saturday night, but the health implications of these two patterns of drinking are likely to differ. For example, animal models of prenatal alcohol exposure demonstrate that binge drinking is more harmful to the fetus than the same amount of alcohol consumed in small amounts over a longer period of time. Volume measures are particularly problematic when investigating health consequences associated with alcohol consumption in countries such as the United States, in which daily drinking is relatively infrequent. Under these circumstances, health outcomes are correlated with a statistical artifact that does not correspond well to actual drinking patterns of the study population, providing a poor basis for the development of guidelines for moderate drinking that are consistent with good health. The development of methods to assess and analyze drinking patterns in the United States is an active area of research in alcohol epidemiology.

Slide 7

## Graduated QF

Think of all kinds of alcoholic beverages combined, that is, any combination of cans of beer, glasses of wine, or drinks containing liquor of any kind.

*During the past 12 months, what is the largest number of drinks on a single day?*

- Was it 24 or more drinks on a single day?
- 12 to 23 drinks on a single day?
- 8-11?
- 5-7?
- 3-4?
- 1-2?
- No drinks

*Start with largest amount drunk; ask frequency of consuming successively lower amounts per day.*

- Daily or nearly every day
- 3 or 4 times a week
- Once or twice a week
- 2 or 3 times a month
- Once a month
- 11-3 times in the past year
- Twice in the past year
- Once in the past year
- Never

**Assessing variability in alcohol consumption.** Standard QF data are limited in that they provide little information on variability in drinking patterns. To get at this dimension of drinking, respondents may be asked QF questions about times when they drink more than usual, or times when they had specific, relatively large amounts to drink, such as five or more drinks at a time, 5 to 8 drinks, 9 to 11, or 12 or more at a time, or how frequently they get intoxicated. One method for assessing variability is to take the “graduated quantity-frequency” approach. In this approach, the interviewer begins by determining the highest number of drinks the respondents drinks, and asks how often they drink that number of drinks. The interviewer then goes down the quantity scale, asking how often smaller and smaller numbers of drinks are consumed. For example, if a person says the most he ever drinks is six drinks, the interviewer would ask how often he has six drinks, how often has 4 or 5 drinks (but not six), how often he has 2 or 3 drinks (but no more than 3), and how often he has one and only one drink. This is a fairly challenging cognitive task, and respondents sometimes report that they drank more than 365 days in a year, an indication that they either did not understand the questions, or that they had difficulty calculating the number of days they drank the different quantities they were asked about.

Slide 8

## Drinking Pattern Questionnaire--DPQ

1. On Fridays during a typical month, how often did you drink - every Friday, three Fridays, two Fridays, one Friday, or hardly ever on Fridays?
2. How many drinks would you usually have on a Friday?
3. Repeat for Saturday, Sunday, and weekdays.
4. Were there days when you had more than your usual in the past 12 months?
5. If yes, what did you typically drink and how often.?
6. Proportion of time you drank with a meal, while snacking, or without eating anything.
7. Did you ever drink enough to get drunk or very high, that is, your speech was slurred or you were unsteady on your feet?
8. If yes, how often did you drink enough to get drunk or very high?

In our own recent work, we use the Drinking Patterns Questionnaire, or DPQ, in which we ask QF questions for different days of the week, for example, “How often do you drink on Fridays and how many drinks do you usually have on a Friday when you drink?” These questions are repeated for Saturdays, Sundays, weekdays, and times when respondents drink more than usual, plus asking how often they get intoxicated. The same questions are repeated over lifetime drinking intervals in the Cognitive Lifetime Drinking History (CLDH). For most people, this adds a useful framework to help them remember their alcohol consumption and a way to report intakes that vary predictably over the period of a week.

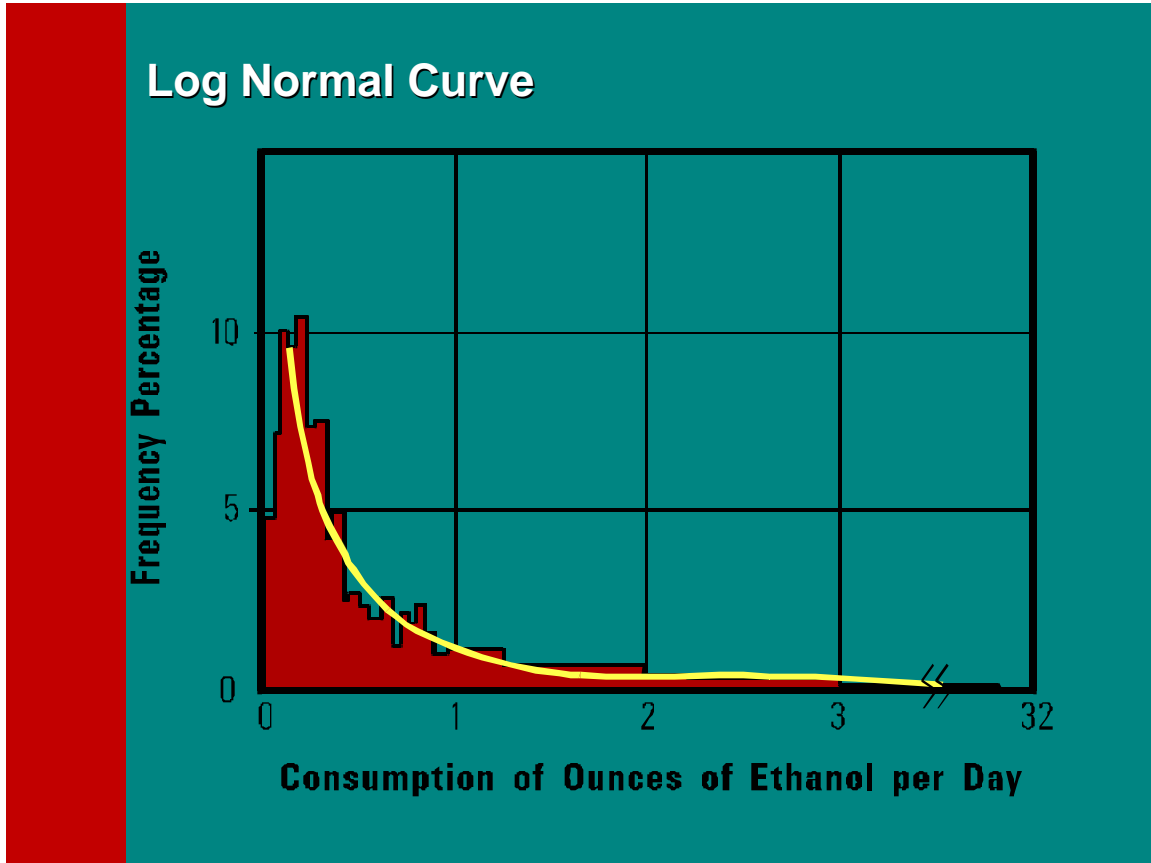
Almost all the available data on alcohol consumption and health is based on current alcohol intake. Given the importance of lifetime patterns of drinking in understanding the relation of alcohol to chronic health and mental disorders, more epidemiological research on long-term effects of alcohol is badly needed.

Obviously, extra questions to assess variability and long-term effects add to the time it takes to assess alcohol consumption. This issue is mentioned here because the relation of alcohol consumption to health is complex, and better measures are needed to fully understand it. There is consensus that heavy alcohol use increases risk for a number of chronic health conditions and causes others, but a number of epidemiological studies suggest that there is not a simple linear relation between alcohol consumption and health.

Rather, some level of light or moderate drinking may actually improve health among drinkers who do not have any contraindications for alcohol use. Accordingly, the relation between alcohol consumption may be J-shaped, or U-shaped. To determine the consumption patterns associated with optimal health and the factors that influence them requires greater attention to measurement of alcohol drinking than has been given in many of the studies currently in the literature. The limited data available suggest that variability plays an important role in determining the relationship between alcohol consumption and health.

**Validity of self-reports of alcohol consumption.** Another concern regarding survey data is that people may not report their alcohol intakes accurately. Evidence that respondents underestimate their consumption has been provided by studies comparing the amount of alcohol sold in a given region with the amount estimated to have been consumed based on survey data; self-reported alcohol consumption accounted for only 40 to 60 percent of the alcohol sold (for reviews, see Midanik, 1982; Midanik, 1988). Some of this underestimation may be attributable to the fact that heavier drinkers in the population are not included, e.g., the homeless, college students, institutionalized individuals, or are underrepresented in survey data. Some may be attributable to the fact that respondents forget or are reluctant to admit all they drink. If all drinkers underestimated their intakes to the same extent, correlational studies of alcohol intake would still be valid because drinkers would be ranked accurately according to their consumption; however, investigation of this point has yielded inconclusive results. Some researchers have reported fairly good agreement between self-reports and independent assessments of alcohol intake, whereas others found that heavier drinkers and drinkers with problems underestimated their intakes more than light drinkers. Despite lingering concerns, alcohol survey researchers have continued to rely on self-report data. They have been forced to do so by the lack of practical alternatives, but they have also been encouraged by studies demonstrating that the validity of self-report data can be maximized by employing good assessment techniques. Moreover, Midanik (1989) has pointed out that self-reports provide valuable psychological information (e.g., on how individuals perceive their drinking patterns), and they should not be evaluated solely on the basis of their accuracy.

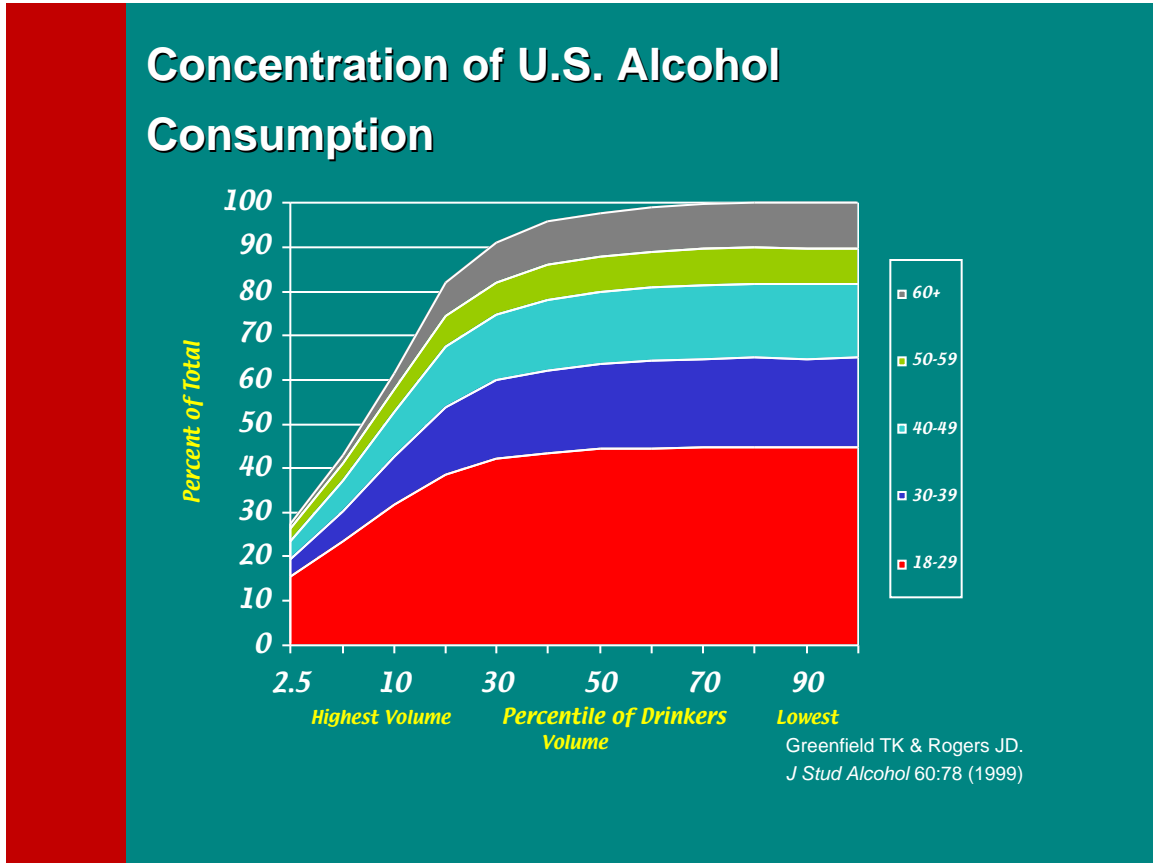
## Slide 9



#### General overview of alcohol consumption—implications for prevention policy.

At any given time, approximately 1/3 of the U.S. population abstains; 1/3 are light, infrequent drinkers; and 1/3 are moderate or heavy drinkers. A plot of the volume drunk against the proportion of the population reporting this volume closely resembles a distribution that can be characterized as a log normal curve, and, indeed, a log normal curve fits the distribution of drinking volumes in many populations. This observation led a Frenchman named Ledermann in the 1950s to develop a formula which was based on the theory that alcohol consumption in a population fit a log normal curve, and the shape of the curve was determined by the average intake of absolute alcohol in liters of the drinking population. Ledermann's theory was relevant to alcohol policy makers because it predicted the number of people likely to be drinking at alcoholic levels. Moreover, it suggested that the number of people drinking at alcoholic levels could be decreased by policies that lowered the average intake of alcohol in all drinkers, for example, by increasing cost, reducing the number of sales outlets, restricting hours during which alcohol is sold, and raising the age limit for buying alcohol. This is sometimes characterized as a "public health" model of prevention, in which alcohol consumption is viewed as a problem, and reducing consumption is the goal. An alternative view is suggested by another representation of survey data on consumption—see slide 10.

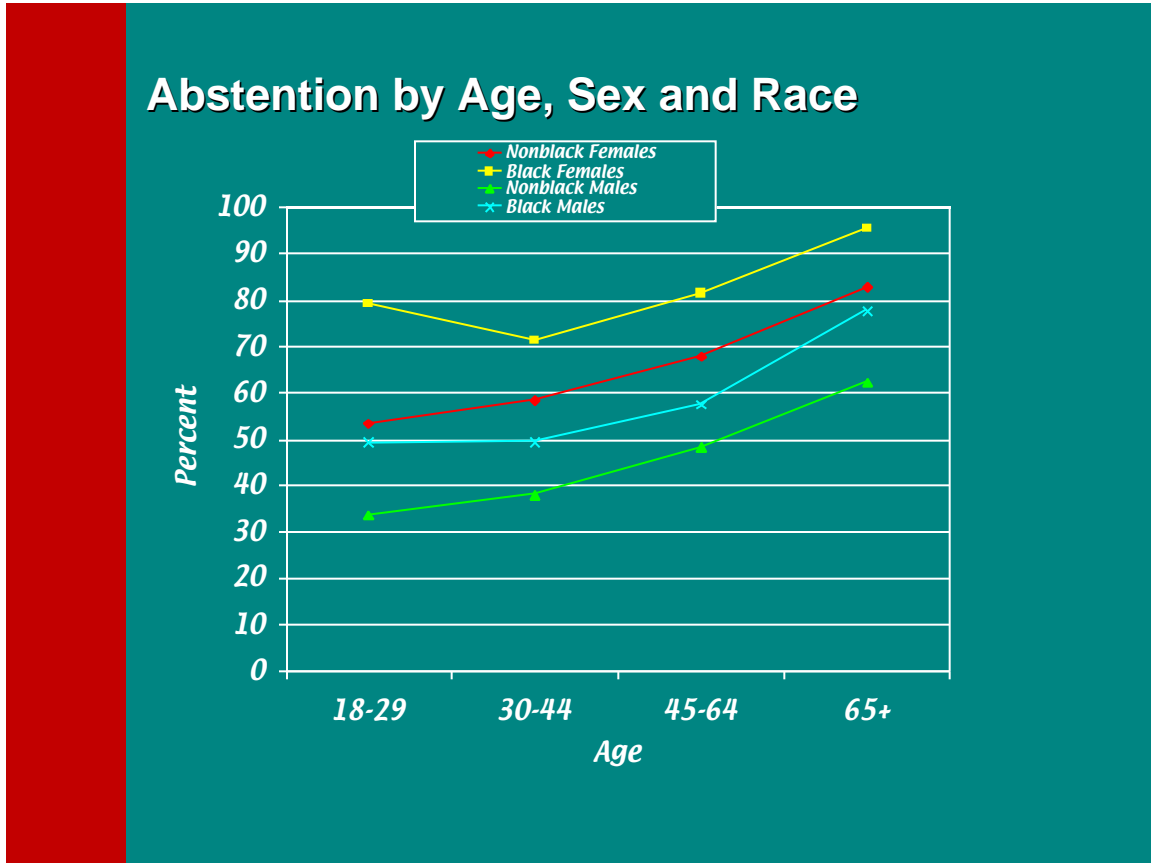
Slide 10



These data illustrate the fact that the top 2.5 percentile of drinkers consume over 25% of the nation’s total self-reported alcohol consumption; the top 5 percentile consume over 40%, and the top 20 percentile consume over 85% .

The fact that a relatively few very heavy drinkers account for most of the alcohol consumption has led some policy consultants to support a “medical model” of alcohol prevention. This approach holds drinkers responsible for their intakes and focuses prevention efforts on heavy drinkers.

## Slide 11

**Host and environmental determinants of consumption.**

**Abstinence by age, sex, and race.** These data come from the 1992 National Longitudinal Alcohol Epidemiologic Survey, NLAES. NLAES was conducted by the Bureau of the Census under the auspices of the National Institute on Alcohol Abuse and Alcoholism in respondents, 18 years or older, in the contiguous United States and the District of Columbia. This survey included over 42,000 respondents, enough to yield stable estimates for Blacks, as well as Whites. Studies of racial differences in alcohol use and abuse have lagged behind studies of gender effects because most surveys included too few members of a given minority group for separate analysis; however, this is not a problem in NLAES because of its large sample size.

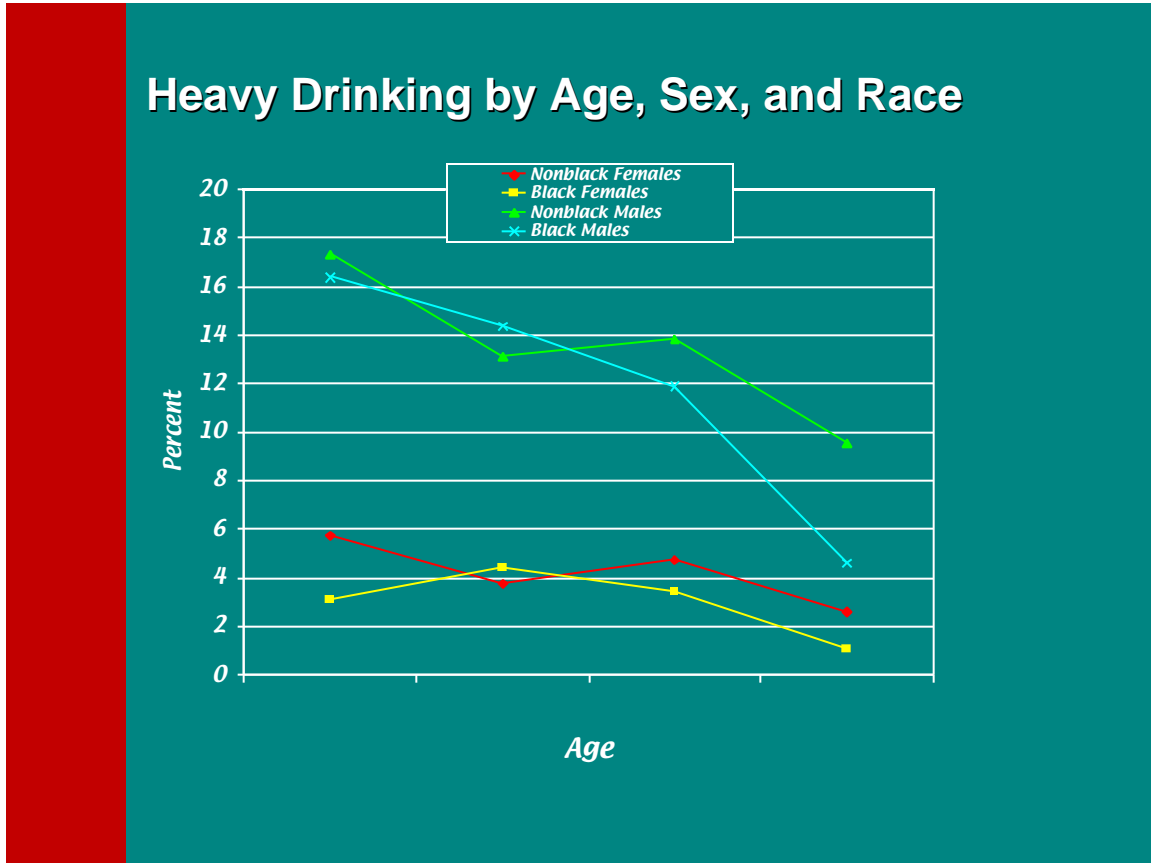
These rates are substantially higher than those based on surveys in which abstinence was defined as not having any alcohol in the 12 months prior to interview. because abstinence was defined more broadly in NLAES, i.e., as having fewer than 12 drinks in the previous 12 months. This definition of abstinence would include individuals who never had anything to drink in their lifetimes, former drinkers, individuals who are light, infrequent drinkers, and people who may binge once a year. Correlates of these differences in lifetime and current patterns of drinking are likely to differ, and coming to a better understanding of abstinence is another active area of epidemiological research.

## Epidemiology of Alcohol (Russell)

**Gender and Race:** These data are consistent with findings from other surveys in demonstrating that abstention is more prevalent among Blacks than Nonblacks, as well as being more prevalent among women than men. Almost 80 percent of Black women abstain compared to 64 percent of Nonblack women, and 54 percent of Black men abstain compared to only 43 percent of Nonblack men.

**Age:** Abstention tends to increase with age. It has been postulated that older individuals in the U.S. may drink less because they were influenced by Prohibition, a cohort effect. However, the tendency for the amount drunk per drinking occasion to decrease with age has been observed in 15 countries, suggesting that biological factors play an important role. Possible reasons for drinking less as people grow older include chronic health problems aggravated by drinking, the potential for alcohol to interact with medications being taken, an increased vulnerability to alcohol's effects, and changes in body composition. The body fat compartment increases with age, and the proportion of body water decreases. This means that the same amount of alcohol will tend to produce higher blood alcohol levels in an older person compared to a younger person of the same weight and sex. Social isolation and loss of income may also encourage abstinence.

## Slide 12



**Heavy drinking:** These data are also from the 1992 National Longitudinal Alcohol Epidemiologic Survey. Heavy drinking is defined as consuming an average volume of 1.00 or more ounces of ethanol per day. Estimates of volume are based on beverage-specific QF questions on the usual and the largest number of drinks, letting respondents define drink size. One ounce of ethanol is equal to about two standard drinks, where a standard drink is equal to a 12 ounce beer; a 4 or 5 ounce glass of wine; or a drink containing one ounce of liquor. As one would expect, there tends to be an inverse relation between abstention and heavy drinking.

**Gender, Race, and Age:** The influence of gender on alcohol use and abuse is powerful and consistent. In every society that has been studied, men drink more than women, and men's drinking leads to more social problems than women's drinking. The consistency of this finding suggests a biological influence, as will be discussed later; however, variability in the ratio of men's drinking to women's across cultures indicates the potential of sociocultural factors to interact with biological factors. Race is not related to the prevalence of heavier drinking, and heavy drinking decreases with age, especially among males.

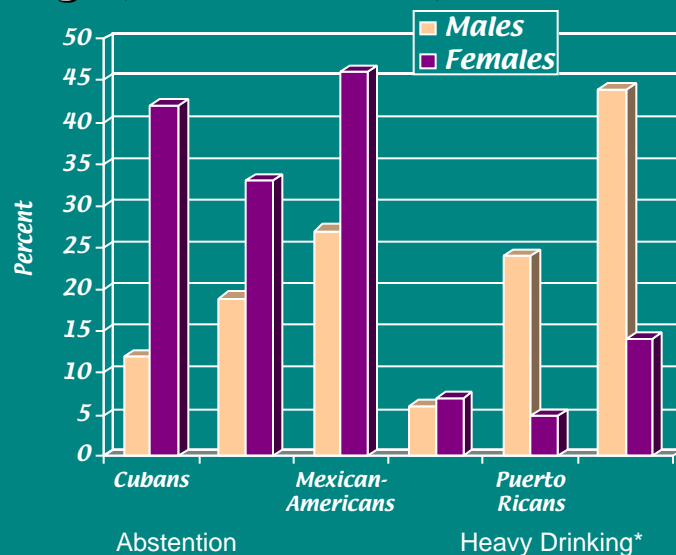
In summary, Blacks are more likely to abstain than Whites; however, the proportion drinking heavily and experiencing alcohol-related problems tends to be more similar. As we shall see later, there is evidence to indicate that alcohol-related health

## Epidemiology of Alcohol (Russell)

problems among Blacks are more prevalent and more severe. It has been suggested that alcohol effects on health may be potentiated in Blacks by adverse conditions associated with poverty and a greater tendency for Blacks to maintain heavier drinking patterns through middle-age.

## Slide 13

## Hispanics, Abstinence and Heavy Drinking by Gender and Country of Origin, United States, 1984.



\*Drinks at least once a week and has five or more at a sitting at least once a year.

**Hispanics.** Hispanics were oversampled in the 1984 National Alcohol Survey, and this data source continues to provide much useful information about their alcohol consumption and alcohol-related problems. Abstinence and heavy drinking rates are illustrated above for Cubans, Puerto Ricans, and Mexican-Americans for men and women. All three groups showed the familiar pattern that men are less likely than women to abstain and more likely to drink heavily. Cuban men were least likely to abstain or to drink heavily, and they had few alcohol-related problems. Gender differences in abstinence were greatest among Cuban Americans. Mexican-American men and women had bimodal drinking patterns, with the highest rates of abstinence and the highest rates of heavy drinking. Puerto Rican and other Latin American men were intermediate on these alcohol measures. There is a tendency for alcohol-related problems among Hispanic men to remain high through their 20's and 30's, rather than decreasing during the 30's as they do among non-Hispanic white men.

Source: 1984 American Drinking Survey, reported by Caetano, R. Alcohol use among Hispanic groups in the United States. *British Journal of Drug and Alcohol Abuse*(14): 293-308, 1988.

Migration studies are important in epidemiology because they afford an opportunity to study the effect of a changing environment on lifestyles/health habits and to investigate the relation of these changes to changes in morbidity and mortality. The experience of migrating from Mexico to the United States has a striking effect on rates of

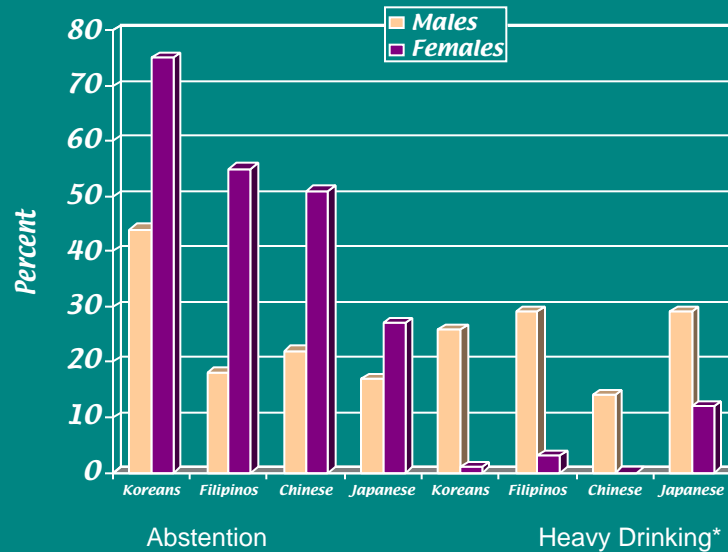
abstention and heavy drinking, especially among women. Seventy-one percent of women born in Mexico abstain compared to only 22 percent of first-generation Mexican-American women. Abstention among men born in Mexico is 18 percent compared to 17 percent among first-generation Mexican-American men. Heavy drinking increases for both first generation Mexican-American men and women, compared to those born in Mexico. For women it increases from 4 percent to 10 percent, and for men it increases from 42 to 54 percent. As noted by Caetano, it is tempting to attribute these increases to the stress of adapting to a new culture. However, changes may also simply reflect the process of adopting the drinking patterns of the new culture. For example, women in the United States are more likely to drink than women in Mexico, and it is reasonable to suppose that Mexican-American women born here would be more likely to drink.

Despite the fact that their alcohol consumption increased, Mexican-American men reported fewer alcohol-related problems than Mexican men. Among both male and female Mexican-Americans, acculturation was associated with more liberal norms about alcohol consumption. It also seemed to be linked to a more neutral view of alcohol, with less support both for positive and negative aspects of alcohol use. Finally, little support was found for the belief that heavy drinking by Hispanic men in the United States is related to the need to demonstrate their male prowess, "machismo," defined as the idea that "a real man can hold his liquor."

**Native Americans.** The limited data on alcohol available for Native Americans tends to focus on high rates of alcoholism seen in some tribes, without appreciating the fact that the federal government recognizes over 300 different tribes, many of which drink moderately with few problems. It has been postulated that some tribes' maladaptive drinking patterns were learned from fur traders and military men who introduced alcohol to the Native Americans as they spread across the United States. These patterns have been perpetuated by dislocations and poverty that many tribes have suffered since then. Some tribal differences in drinking patterns have been attributed to differences in their traditional life styles. Tribes having an independent hunting tradition were found to be more likely to drink in public, whereas farming tribes, who stayed in the same place in a highly structured society were more apt to drink in private. Efforts to reduce problems by laws forbidding the sale of alcoholic beverages on reservations have led, in some cases, to residents driving long distances to purchase and consume alcohol. High rates of drunken driving and fatal accidents occur when they try to make it home. Some tribes are turning to traditional cultural values to fight high rates of alcohol problems.

## Slide 14

## Asian-Americans: Abstention and Heavy Drinking by Gender and Country of Origin, Los Angeles, 1980s.



\*Drinks at least once a week and has five or more at a sitting at least once a year.

**Asians.** Some years ago, there was a general impression that many Asians were protected from the adverse effects of heavy drinking by the fact that they metabolized acetaldehyde more slowly than usual. Acetaldehyde is a highly toxic metabolite of alcohol, and if it builds up in the blood stream, it produces a flushing syndrome, rapid heartbeat, and other uncomfortable symptoms. To some extent this provides an effective deterrence to drinking. However, recent studies have revealed substantial differences in men's drinking patterns between Chinese, Japanese, Koreans, Filipinos, and other Asian groups.

One of the largest studies of Asian drinking in the United States was conducted in Los Angeles. With the exception of the Japanese, most of the respondents in this sample were adult immigrants to the United States, so their drinking patterns reflect those of their countries of origin. The highest rates of abstention were seen among Korean men and women. Japanese men and women had the lowest rates of abstention and Filipinos and Chinese were intermediate. Korean, Filipino, and Japanese men all had rates of heavy drinking similar to that of men in the general US population, whereas Chinese men were less likely to drink heavily. Hardly any Asian-American women drank heavily, except for Japanese women, and they tended to have been born in the United States.

Source: Kitano, H.H.L. & Chi, I., Asian Americans and Alcohol: The Chinese, Japanese, Koreans, and Filipinos in Los Angeles. In Alcohol Use among U.S. Ethnic Minorities,

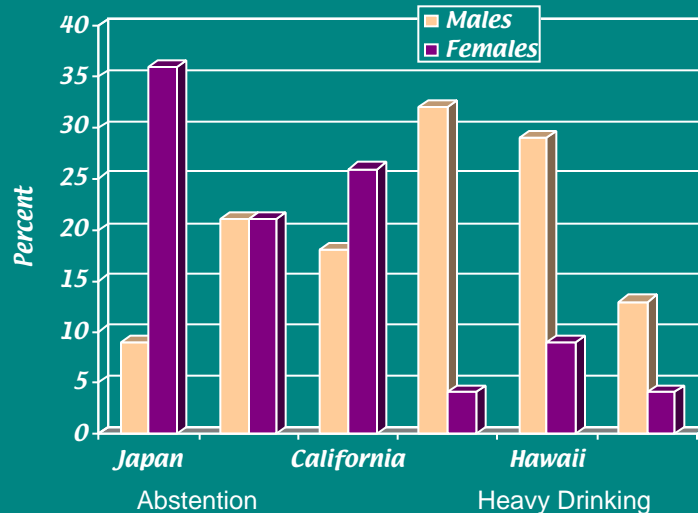
## Epidemiology of Alcohol (Russell)

edited by Spiegler et al., NIAAA Research Monograph 18, DHHS Publication No. (ADM)89-1435, pp. 373-382, 1989.

Studies done in South Korea found an extremely high lifetime prevalence of alcoholism, 43%. (Helzer et al., 1990, ECA DIS). This is consistent with the fact that Koreans are known as the “Irish of the Orient” because of men’s heavy alcohol use. Male socializing in the context of jobs and business relations makes it very important to drink and to keep up with the alcohol consumption of friends. This pattern of drinking is also prominent in Japan, and it may account for the fact that rates of heavy drinking have sharply increased in Japan over the past 20 years.

## Slide 15

## Drinking Patterns of Japanese in Japan, Japanese-Americans in Hawaii, and Japanese-Americans in Santa Clara, California, 1988.



Another migration study, the Joint Japan/U.S. Epidemiologic Project was conducted in the mid-1980s to survey drinking patterns among Japanese in Japan, Japanese Americans living in Hawaii, and Japanese Americans living in Santa Clara, California. These data, taken together with data from the Los Angeles study suggest that among Japanese descendants in the United States, women move away from abstinence into light or moderate drinking. Whereas, men show a slight tendency to adopt abstinence and light drinking when living in the United States.

**Summary of ethnic drinking:** When reviewing the literature on ethnic differences in women's and men's drinking, it is important to keep in mind that number of factors that significant influence alcohol consumption are often ignored in these studies. These factors include socioeconomic and regional differences in the distribution of racial or ethnic groups being compared; differences related to acculturation among immigrant groups; national or tribal differences between individuals having backgrounds often categorized simply as Asian, Hispanic, or Native American; and genetic differences in the enzymes that metabolize alcohol.

Slide 16

## Definition of Alcohol Abuse and Dependence

- Alcohol Abuse: a person's maladaptive alcohol use causes clinically important distress or impairment, as shown in a single 12-month period by one or more of the following:
  - failure to carry out major obligations at work, home, or school because of repeated alcohol use,
  - repeated use of alcohol even when it is physically dangerous to do so,
  - repeated experience of legal problems, or
  - continued use of alcohol despite knowing that it has caused or worsened social or interpersonal problems.

### Alcohol Abuse and Alcohol Dependence

Survey data on alcohol abuse and dependence, such as those available from NLAES, are generally based on items developed to assess diagnostic criteria developed and published by the American Psychiatric Association, most recently revised in 1994.. Respondents are classified as having abused alcohol in their lifetimes if they report one or more of the following experiences in single 12-month period: failure to carry out major obligations at work, home, or school because of repeated alcohol use, repeated use of alcohol even when it is physically dangerous to do so, repeated experience of legal problems, or continued use of alcohol despite knowing that it has caused or worsened social or interpersonal problems. If they reported these experiences in the 12-month period prior to interview, they are classified as having a current diagnosis.

Slide 17

## Definition of Alcohol Abuse and Dependence

- Alcohol Dependence: a person's maladaptive pattern of alcohol use leads to clinically important distress or impairment, as shown in a single 12-month period by three or more of the following:
  - tolerance;
  - withdrawal;
  - amount or duration of use often greater than intended;
  - repeatedly trying without success to control or reduce alcohol use;
  - spending much time using alcohol, recovering from its effects, or trying to obtain it;
  - reducing or abandoning important work, social, or leisure activities because of alcohol use; or
  - continuing to use alcohol, despite knowing that it has probably caused ongoing physical or psychological problems.

Similarly, respondents are classified as dependent on alcohol (lifetime or current) if they report three or more of the following experiences (in any 12-month period and/or in the past 12 months): tolerance; withdrawal; amount or duration of use often greater than intended; repeatedly trying without success to control or reduce alcohol use; spending much time using alcohol, recovering from its effects, or trying to obtain it; reducing or abandoning important work, social, or leisure activities because of alcohol use; or continuing to use alcohol, despite knowing that it has probably caused ongoing physical or psychological problems.

Slide 18

## Jellinek's Phases of Alcoholism Based on 2000+ Male Members of Alcoholics Anonymous

- Prepathogenic Period
  - Prealcoholic Symptomatic Phase
- Pathogenic Period
  - Prodromal Phase—onset of blackouts
  - Crucial Phase—onset of loss of control
  - Chronic Phase—onset of prolonged intoxications

Early studies of alcoholism focused almost exclusively on patients who were in alcohol treatment programs or self-help groups. The most famous was Jellinek's natural history of alcoholism, based on study of over 2000 male members of Alcoholics Anonymous. He characterized alcoholism as a disease that progresses through well-defined phases, each with symptoms that develop in the majority of individuals in an additive, orderly fashion. In the pre-alcoholic symptomatic phase, drinking is associated with rewarding relief from tension or stress. This increases from occasional relief drinking to constant relief drinking. It is accompanied by the development of tolerance to alcohol's effects, defined as needing more alcohol to achieve the same effects experienced when drinking first started, or experiencing less of an effect when you drink the same amount. The prodromal phase is marked by the onset of blackouts, periods of amnesia not connected with loss of consciousness. An increased need for alcohol is coupled with guilt feelings and attempts to hide the need for alcohol. The crucial phase is characterized by loss of control, as evidenced by the inability to abstain from drinking or the inability to stop once started, despite the fact that the use of alcohol is creating serious health, social or economic problems. Finally, in the Chronic Phase, the alcoholic is intoxicated for several days at a time and can no longer cope with the problems his drinking is creating.

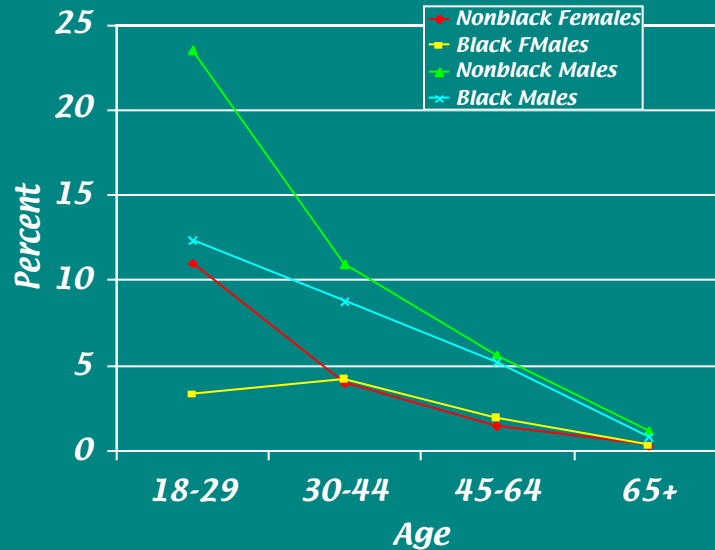
The fact that this history is based only on male members of AA limits its generalizability. There are several ways in which AA membership might bias a study of

the natural history of alcoholism. It seems likely that the AA format of sharing one's alcohol history influences members' recollection of their own experiences, especially when alcohol use itself has affected memory. It is also possible that personal and environmental characteristics may influence both the way in which alcoholism develops and the likelihood of becoming an AA member, or the way in which alcoholism develops may itself play a role in determining whether or not a person joins AA. Finally, the AA model of alcoholism is influenced by the obvious, but often overlooked fact that all of Jellinek's subjects were in the latter stages of alcoholism. These data suggest that people in the early and middle stages of alcoholism will inevitably progress to the later stages.

It wasn't until people began to conduct alcohol surveys in community samples/samples of the general household population that a different picture of alcohol-related problems began to emerge. The first national drinking survey was conducted in 1965 by members of the Social Research Group, now represented by the Berkeley Alcohol Research Group, which continues conducting periodic follow-up surveys to this day. This and other population-based research uncovered the fact that men with alcohol-related problems in the general population differed from alcoholics in treatment in several important ways: they were younger, and their alcohol problems tended to occur more often as isolated events instead of in clusters typical of older respondents. More importantly, longitudinal studies showed that younger men with problems at Time 1 were less likely to still have problems when interviewed later in time than older men. These data were interpreted as indicating that some individuals in the population who appear to be drinking alcoholically, particularly young men, appear to be passing through a phase in their drinking careers that is permitted by societal tolerance of their heavy drinking and periodic intoxication. As they mature and are expected to take on the responsibility of wage-earner, marriage, and parenthood, they recognize the need to moderate their drinking and do so voluntarily. The contrast between these individuals who mature out of alcoholic drinking and Jellinek's AA members who reported being unable to do so, led Robin Room, in 1977, to coin the phrase, "the two worlds of alcoholism," to refer to their differences.

Slide 19

## NLAES Data on Alcohol Abuse and Dependence by Age, Race, & Sex



**Alcohol Abuse and Dependence:** The ability to estimate the prevalence of psychiatric disorders in U.S. population samples is a relatively recent development. The landmark study in this area was the Epidemiologic Catchment Area (ECA) Study conducted in the early 1980's. It employed a highly structured interview that could be administered by lay interviewers to assess criteria for the diagnosis of psychiatric disorders, including alcohol abuse and alcohol dependence. The interview was the National Institute of Mental Health Diagnostic Interview Schedule (DIS), developed by researchers at Washington University, and it has been updated periodically to keep consistent with changes in the diagnostic criteria endorsed by the American Psychiatric Association. The World Health Organization also has been active in formulating definitions of alcoholism, set out in their publications of the International Classification of Diseases. Structured diagnostic interviews other than the DIS have also been developed to assess alcohol abuse and dependence. Illustrated here are data from NLAES based on the Alcohol Use and Di

**Gender, Race, and Age:** Consistent with their heavier alcohol consumption, males have higher rates of alcohol abuse and dependence at every age, although rates are universally low over age 65. Nonblack males and females have significantly higher rates of alcohol abuse and dependence between the ages of 18 and 29. However, by the ages of 30 to 44, there is little difference in the prevalence of alcohol disorders related to race.

## Epidemiology of Alcohol (Russell)

In several community surveys of alcohol consumption, an interaction between age and race has been observed. Nonblacks are more likely than Blacks to drink and drink heavily at younger ages and then decrease their alcohol consumption. In contrast, younger Blacks are less likely to use or abuse alcohol, but middle-aged and older Blacks are more likely than Nonblacks to initiate or maintain patterns of heavy drinking. This is illustrated in NLAES by data on the proportion of the population who reported having five or more drinks a day at least weekly in the past 12 months for both men and women (not shown here) and by data on the prevalence of alcohol abuse and/or dependence in women.

Slide 20

## “Two Worlds of Alcoholism” 1992 National Longitudinal Alcohol Epidemiology Survey (NLAES)

- Only 10% of the U.S. adult population currently abusing or dependent on alcohol had received any treatment in the 12 months prior to interview.
- Only 28% of individuals with a past diagnosis of alcohol dependence reported ever having any kind of alcohol treatment.
- 75% of the people who recovered from a previous alcohol disorder did so without having received any treatment, often termed “natural recovery.”

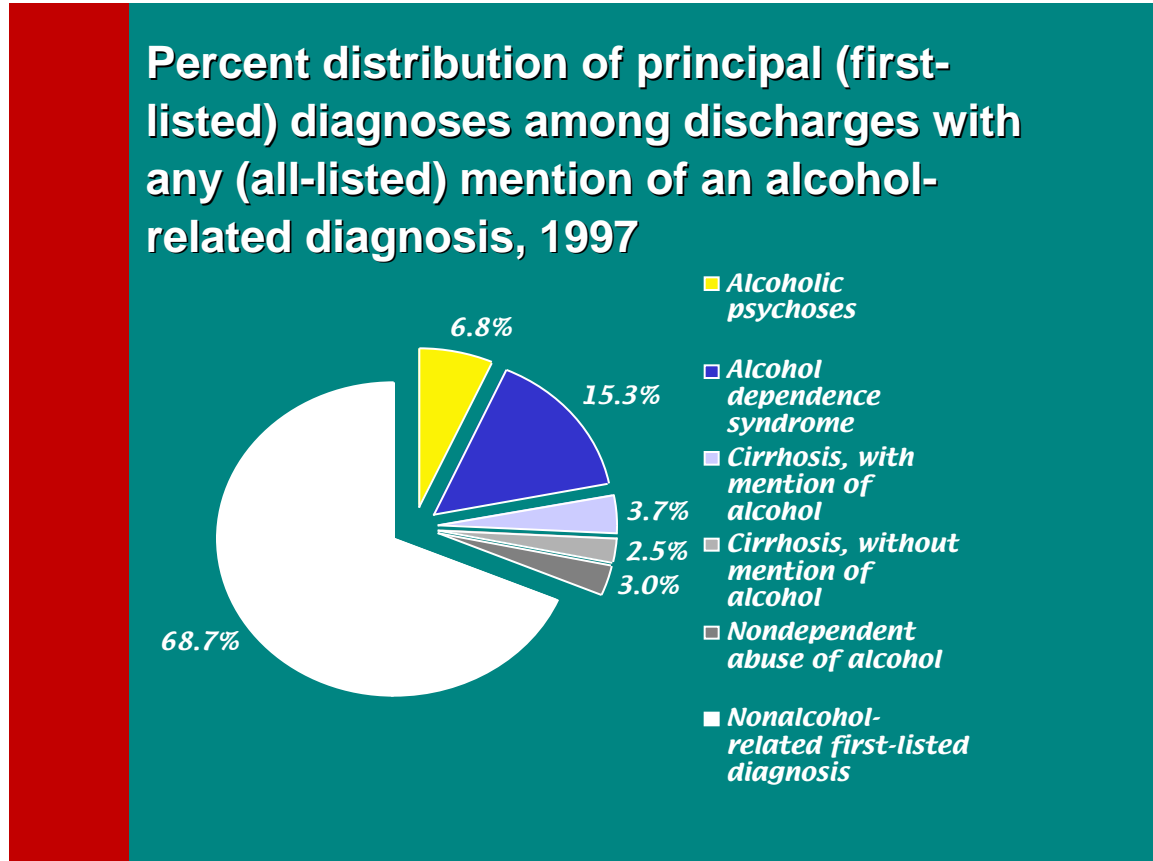
**Link between population-based and treatment-based data on alcohol abuse and dependence.** Despite increases in treatment resources during the 1980s, data from NLAES indicate that only 28 percent of individuals with a past diagnosis of alcohol dependence reported ever having had any kind of alcohol treatment, and only 10 percent currently abusing or dependent on alcohol had received any treatment in the 12 months prior to interview.

The continuing gap between the numbers of people meeting diagnostic criteria for an alcohol disorder and the numbers getting alcohol treatment raises important public health and policy questions, and it underlines the importance of learning more about alcoholics who do and do not enter treatment. National U.S. and Canadian surveys of alcohol use and abuse found that between 75 and 78 percent of the people who had recovered from a previous alcohol disorder did so without having received any treatment, often termed natural recovery. The high prevalence of natural recoveries has stimulated research on this hard-to-access population. In addition to community surveys, much of the available information comes from in-depth, focused interviews with convenience samples recruited via advertisements or by word-of-mouth snowball sampling. These data sources have their limitations. Regional community surveys with relatively small sample sizes tend not to identify enough alcoholics to provide useful information on factors associated with natural recovery, whereas the larger, national surveys are limited in the scope of the assessments that can be included given the cost of interviewing such a

## Epidemiology of Alcohol (Russell)

large number of respondents. Detailed information on adequate numbers of naturally recovered alcoholics is provided by studies of convenience samples, but it is not appropriate to extrapolate from populations who volunteer to participate in a research study to populations who do not volunteer.

## Slide 21

**Alcohol-related Morbidity and Mortality**

**Vital Statistics on morbidity and mortality.** One does not have to be dependent on alcohol to suffer alcohol-related morbidity or mortality. Even isolated episodes of intoxication can result in traffic crashes or falls that lead to serious injury or death. Vital statistics that capture routinely reported health consequences of hazardous drinking provide an economical method of monitoring trends in the prevalence of such alcohol-related problems. Through their Alcohol Epidemiologic Data System, NIAAA's Division of Biometry and Epidemiology regularly produces surveillance reports on U.S. trends in alcohol-related morbidity and mortality. Copies of these reports can be ordered through the NIAAA website by clicking on publications and surveillance reports.

**Morbidity:** The National Hospital Discharge Survey (1999) provides data on alcohol-related morbidity from 1979 to 1997. These data are based on national samples of hospital discharge episodes compiled by the National Center of Health Statistics. Census data are used to compute population rates. Data are presented for hospital discharges with principal mention or any mention of specific diagnoses for chronic diseases resulting from alcohol abuse, such as alcoholic cirrhosis of the liver. Data on average length of hospital stay are also included. Overall, the data show few significant changes over the 19-year period. It is important to note that diseases or injuries indirectly attributable to alcohol are not taken into consideration, underestimating the

## Epidemiology of Alcohol (Russell)

total effect of alcohol on hospitalization in the U.S. To properly interpret the data one has to keep in mind that:

- The same person might have been hospitalized—and discharged—more than once; therefore, these data do not reflect the prevalence of alcohol-related diagnoses among individual patients.
- NHDS data are based on a sample, and are subject to sampling error.
- Up to seven different diagnoses can be coded for each hospital discharge record. The diagnosis listed first may be arbitrary, and it is important to include all-listed diagnoses, some of which are discovered during the course of the hospitalization.
- When doing trend analysis with these data, one needs to be aware of changes in recording and sampling that have taken place over the years.
- The data are based on persons age 15 years and older.

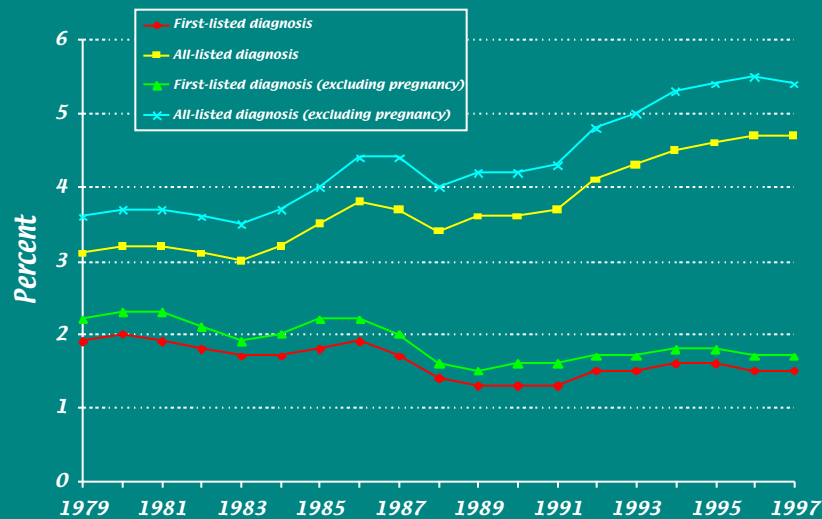
In 1997 the National Hospital Discharge Survey estimated that there were approximately 28.6 million discharge episodes for persons age 15 and over from short-stay hospitals. Of these episodes, approximately 1.3 million, or 4.7 percent, had an all-listed alcohol-related diagnosis.

The data in the pie chart illustrate how important it is to consider all diagnoses when estimating the extent to which alcohol-related diagnoses are associated with short-term hospital discharges. Over two-thirds of alcohol-related morbidity episodes in 1997 did not appear as a first-listed diagnosis. Of the first-listed alcohol-related diagnoses, about 50% were alcohol dependence syndrome and about 20% were nondependent abuse of alcohol; about 20% were alcoholic psychoses; and almost 10% were cirrhosis.

Source: Whitmore, C.C., Stinson, F.S., Dufour, M.C., Trends in Alcohol-Related Morbidity among Short-Stay Community Hospital Discharges, United States, 1979-1997, NIAAA Surveillance Report #50, December, 1999.

## Slide 22

### Trends in percent of discharges with principal (first-listed) or any (all-listed) mention of an alcohol-related diagnosis among all discharges, 1979-97



**Trends in percentages of first-listed and all-listed alcohol-related diagnoses from 1979 to 1997:** There are two pairs of lines plotted in this figure. The top pair of lines represent all-listed diagnoses, and the bottom pair represent first-listed diagnoses. The bottom line in each pair represents alcohol-related diagnoses expressed as a percentage all hospital discharges, including discharges related to pregnancies and deliveries; the top line represents percentages based on hospital discharges excluding those related to pregnancies and deliveries. In a typical year, approximately 12 to 13 percent of all hospital discharges are for conditions based on pregnancy. Because pregnancy is not an illness, conditions related to pregnancy and childbirth are excluded in assessing alcohol-related morbidity. This has the effect of increasing the percentages of alcohol-related diagnoses, but it does not change the pattern of trends over time.

In each of the years between 1979 and 1997, there has been a notable difference between first-listed and all listed percentages, indicating that substantial alcohol-related morbidity was reported among patients hospitalized for other reasons. There has been relatively little change over this period in the percentage of first-listed alcohol-related hospital discharges; however, the proportion of hospital discharges with any mention of alcohol has grown over time. Thus, hidden alcohol-related morbidity has grown steadily from 39 percent in 1979 to 69 percent in 1997. It cannot be determined from these data whether the increase is due to more alcohol-related morbidity among hospital patients, or

## Epidemiology of Alcohol (Russell)

whether it is a consequence of a greater awareness among physicians of alcohol-related morbidity and/or a greater willingness to record such diagnoses in medical records.

## Slide 23

## The influence of alcohol on morbidity and mortality: Alcohol-Attributable Fractions (AAF)

	AAF	Age
Causes of death directly attributable to alcohol	1.0	$\geq 15$
Diseases indirectly attributable to alcohol		
Cancer of the esophagus	0.75	$\geq 35$
Acute pancreatitis	0.42	$\geq 35$
Injuries and adverse effects indirectly attributable to alcohol		
Motor vehicle traffic and non-traffic deaths	0.42	$> 0$
Suicide and self-inflicted injury	0.28	$\geq 15$
Homicide and injury purposefully inflicted by others	0.46	$\geq 15$

Source: Stinson, F.S., and DeBakey, S.F., Alcohol-related mortality in the United States, 1979-1988, *Brit. J. Addict.* 87:777-783, 1992.

**Alcohol-attributable Fractions.** To correct for these underestimates, literature reviews have been conducted to identify disease or injury diagnoses causally linked to alcohol use/misuse, and estimates have been made of the proportions of deaths from these diagnoses that could be attributed to alcohol use, (i.e., alcohol-attributable fractions, or AAFs). The alcohol-attributable fraction is based on a formula which takes into consideration the prevalence rates of a condition in abstainers and drinkers, and the relative risk for drinkers relative to abstainers. In some cases the amount drunk is taken into consideration. Clinical case series and analytical epidemiological studies have been employed to estimate alcohol-attributable fractions for chronic diseases, and injury surveillance studies that reported alcohol involvement were used to estimate alcohol-attributable fractions for injuries. The overall impact of alcohol on mortality is estimated by applying the alcohol-attributable fractions to population estimates for the appropriate age group and summing over causes of death both directly and indirectly attributable to alcohol.

In the present example, causes of death directly attributable to alcohol, such as alcoholic cirrhosis, have an alcohol-attributable fraction of 1.0, indicating that all such deaths can be attributed to alcohol. Diseases indirectly attributable to alcohol have an alcohol-attributable fraction of less than 1.0. If alcohol consumption makes a strong contribution to death, as in the case of cancer of the esophagus, the fraction tends to be

## Epidemiology of Alcohol (Russell)

higher. In the study from which these data are taken, age is also taken into consideration when summing over causes of death. For example, a person of any age could be killed in an automobile crash caused by a drunk driver, but years of exposure are required for someone to die of some of the chronic diseases indirectly attributable to alcohol. In these cases, the alcohol-attributable fractions are applied only to deaths among people who are old enough for alcohol to have influenced their condition.

Eric Single and his colleagues recently used this approach to estimate morbidity and mortality attributable to alcohol, tobacco, and illicit drug use in Canada. They concluded that alcohol use contributed to 3% of total mortality; 6% of total years of potential life lost, 2% of hospitalizations, and 3% of total hospitalization days due to any cause in Canada for 1992. This approach has been criticized because it assumes that all differences in disease rates between users and non-users of alcohol are causal in nature, and it does not take into consideration any possible protective effect of alcohol on morbidity and mortality related to coronary heart disease or stroke. However, Single et al. noted that the lives saved by alcohol occurred in older people, whereas the excess deaths occurred in younger people. Also, the number of hospitalizations estimated to have been averted by alcohol use was much lower than those caused by alcohol.

## Slide 24

## Alcohol-Related Mortality, Death Rates and Premature Mortality by Years of Potential Life Lost (YPLL), 1980.

	Percent of YPLL	Percent of Deaths
Accidents, adverse effects	26.8	5.2
Suicides, homicides	14.0	2.5
Chronic liver disease, cirrhosis	3.0	1.7
Malignant neoplasms (CA)	18.0	21.9
Diseases of heart (CHD)	16.4	37.5
Cerebrovascular disease (CVD)	2.8	8.3

In 1982 CDC published a landmark study in which the concept of premature mortality was introduced for the first time. Premature mortality was calculated by subtracting the age at which death occurred from 65. This measure gives greater weight to deaths that occur in young people. This concept is important in evaluating the impact of alcohol-related mortality on society because many of the deaths caused by alcohol occur in young people. For example, in 1980, heart disease, cancer, and cerebrovascular disease accounted for 67.0 percent of all deaths in the United States; and motor-vehicle and other accidents, suicide, and homicide accounted for 8.1 percent. In terms of age at the time of death, the relative importance of causes of death changes remarkably. Motor vehicle accidents, suicide, and homicide accounted for 40.8 percent of the years of life lost prematurely; and heart disease, cancer, and cerebrovascular disease accounted for 37.2%. As indicated in Slide 23, the alcohol-attributable fractions associated with mortality from accidents tend to be high. Similarly, alcohol consumption is positively associated with suicides and homicides, as well as deaths from chronic liver disease and cirrhosis.

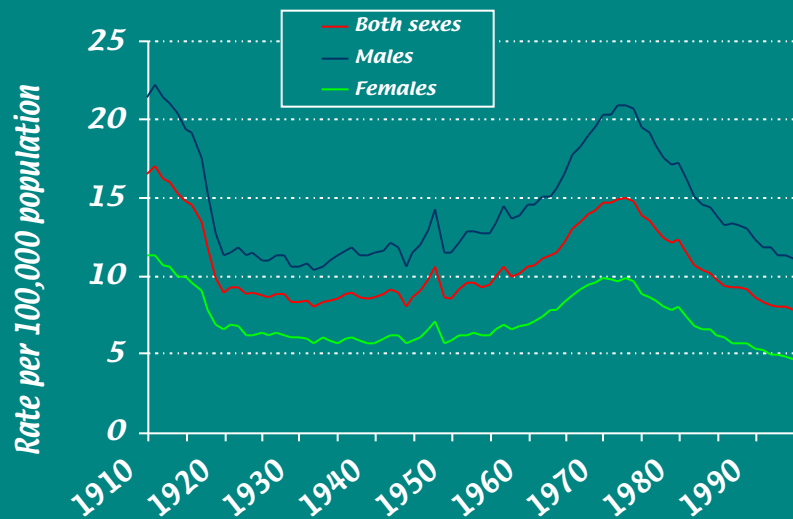
This is a particularly important point when evaluating the impact of public health recommendations regarding the possible protective effects of moderate drinking on coronary heart disease. A decrease in death rates from coronary heart disease will not increase leads of potential life very much because most deaths from heart disease take

## Epidemiology of Alcohol (Russell)

place in individuals who are relatively old. In contrast, increases in alcohol-related mortality tend to have a larger impact on years of potential life lost because these increases affect people at younger ages.

## Slide 25

### Age-adjusted death rates of liver cirrhosis by sex (death registration States, 1910-32, and United States, 1933-96)



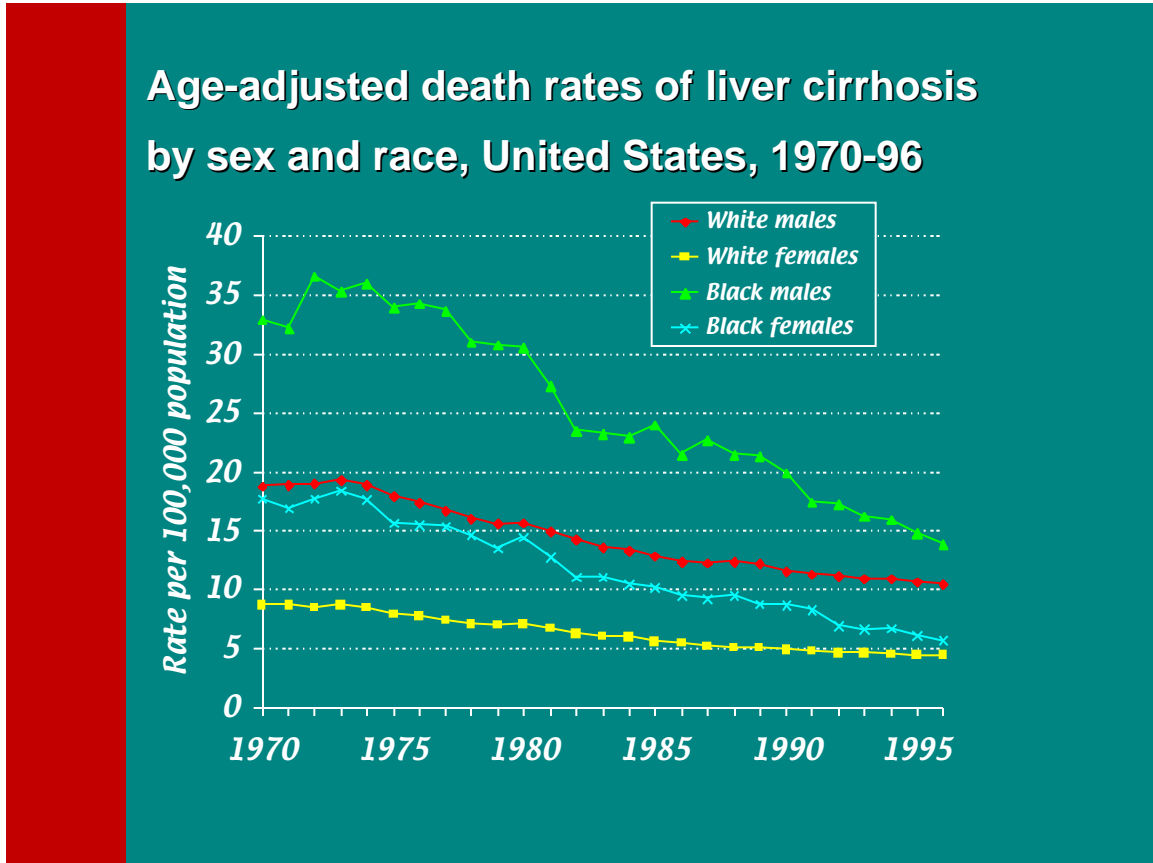
**Age-adjusted death rates of liver cirrhosis by sex from 1910 to 1996:** The average age of the United States population has increased since 1910, and liver cirrhosis mortality increases with age, so it is important to adjust for these population age differences when looking at trends in mortality. This was done by multiplying age-specific death rates for each year to a single, standard population. In this case the standard was the 1940 population, divided into 10-year age intervals. The resulting mortality figures were then summed over the age intervals.

Death rates for liver cirrhosis were consistently about twice as high for males as they were for females over the entire period from 1910 to 1996 (the top line gives mortality rates for males, the bottom one refers to females, and the average is represented by the line in the middle). The highest death rates from cirrhosis occurred from 1910 to 1914, and they decreased to reach an historical low in 1932, partly as a result of the National Prohibition Act of 1920. After the end of Prohibition in 1933, death rates increased steadily until they peaked in 1973 at 14.9 per 100,000 population. Since then, rates have been steadily decreasing, and in 1996 they were at their lowest. For much of the 1970s, cirrhosis was the seventh leading cause of death in the United State. It dropped to eighth place in 1978, to ninth place in 1982, and to eleventh place in 1990. Since 1994 it has been the tenth leading cause of death in the United States.

## Epidemiology of Alcohol (Russell)

Somewhat surprisingly, cirrhosis death rates started dropping in 1973, and per capita alcohol consumption did not start dropping until the 1980s. Several other factors may have contributed to decreases in cirrhosis mortality. Improved availability of treatment for alcoholism reduced the numbers of heavy drinkers in the population, and treatment for cirrhosis itself also improved. There is also increasing recognition that chronic viral infections caused by Hepatitis B and C play an important role in determining cirrhosis death rates among alcoholics.

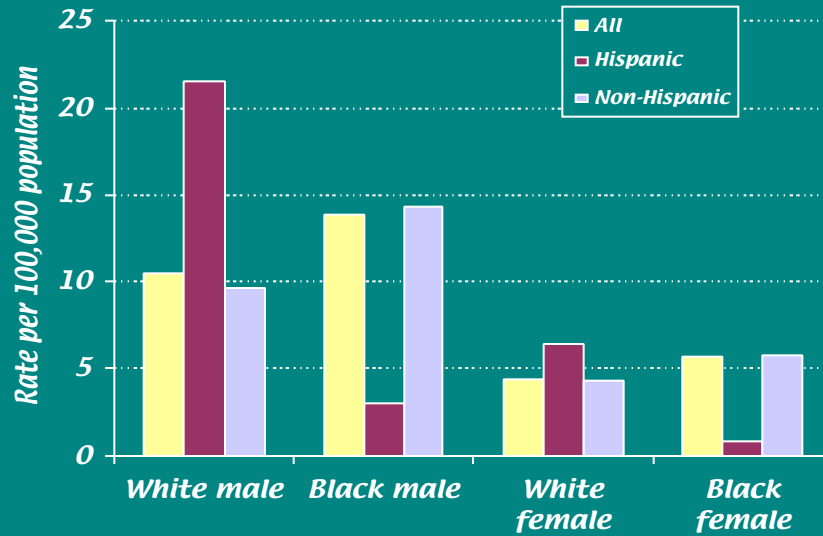
Slide 26



**Age-adjusted death rates of liver cirrhosis by sex and race:** Death rates for blacks are higher than those for whites of the same sex for every year from 1970 through 1996. Rates decreased over this period 67.8 percent for black males, 57.8 percent for white males, 49.4 percent for white females, and 44.1 percent for black females.

Slide 27

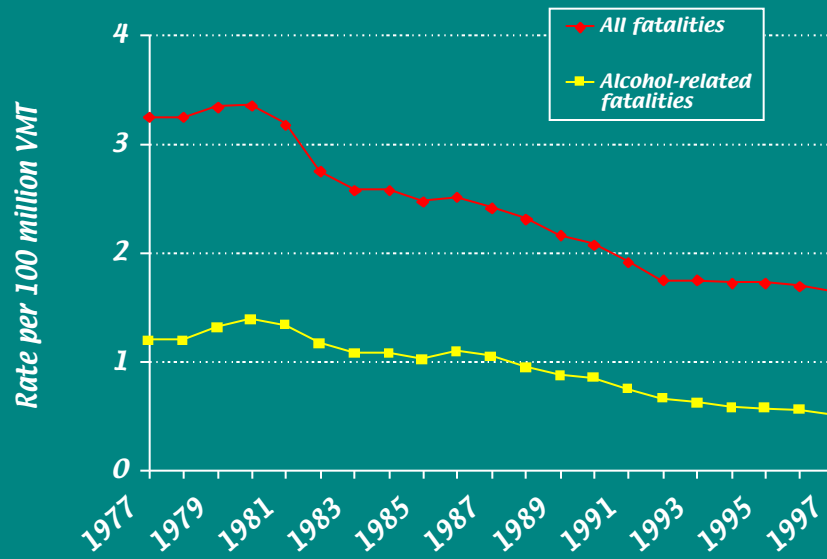
### Age-adjusted death rates of liver cirrhosis by sex, race, and Hispanic origin, United States, 1996



**Age-adjusted death rates of liver cirrhosis by sex, race, and Hispanic origin:** Information on cirrhosis death rates Hispanics became available in 1991 and were published for the first time in NIAAA surveillance reports in 1999. For the most recent year available, 1996, it can be seen that, for both sexes, Hispanic whites had higher death rates from cirrhosis than non-Hispanic whites. The differential was greater for males than females; for white males, Hispanics’ death rates were than twice as high as non-Hispanics. In contrast, Hispanic blacks had cirrhosis death rates that were approximately four times lower than rates for non-Hispanic blacks.

## Slide 28

## Total and alcohol-related traffic fatality rates per 100 million vehicle miles traveled (VMT), United States, 1977-97



**Trends in the rates of traffic crash deaths, 1977 to 1997:** The probability of having or being involved in a traffic accident depends on risk factors that can change over the years. Four risk factors are frequently used to express crude accident rates in the context of changing road environments: rates per 100 million vehicle miles traveled (VMT), per number of people in the population, per number of registered vehicles, or per number of licensed drivers. All these measures show downward trends in both alcohol-related and non-alcohol related traffic crash fatalities from 1977 to 1997. Expressed in terms of fatalities per 100 million vehicle miles traveled, total traffic crash fatalities decreased 50% and alcohol-related traffic crash fatalities decreased 58 percent over this period.

Four possible reasons have been suggested to account for these decreases:

- Safety improvements for both vehicles and roadways along with increased seatbelt use and passive restraint systems.
- Public awareness and activism against DWI have increased—Mothers Against Drunk Driving, etc.
- The minimum legal drinking age increased to 21 years; and legal blood alcohol levels were lowered in many States, especially for youthful drivers.
- Levels of police enforcement and legal consequences of driving while intoxicated have increased.

## References

- American Psychiatric Association (1994). Diagnostic and statistical manual of mental disorders, 4th Edition. Washington, DC: American Psychiatric Association.
- Caetano, R. (1987). Acculturation and drinking patterns among U.S. Hispanics. British Journal of Addiction, *82*, 789-799.
- Centers for Disease Control (1999). Introduction to Table V premature deaths, monthly mortality, and monthly physician contacts - United States. Morbidity and Mortality Weekly Report, *48*, 19-24.
- Dawson, D. A. (1996). Correlates of past-year status among treated and untreated persons with former alcohol dependence: United States, 1992. Alcoholism: Clinical and Experimental Research, *20*, 771-779.
- Gilbert, M. J. & Collins, R. L. (1997). Gender, stress, coping, and alcohol use. In R.W.Wilsnack & S. C. Wilsnack (Eds.), Ethnic variation in women's and men's drinking (pp. 357-378). New Brunswick, NJ: Rutgers Center of Alcohol Studies.
- Grant, B. F., Harford, T. C., Dawson, D. A., Chou, P., Dufour, M., & Pickering, R. (1994). Epidemiologic Bulletin No. 35: Prevalence of DSM-IV alcohol abuse and dependence, United States, 1992. Alcohol Health Research World, *18*, 243-248.
- Greenfield, T. K. & Rogers, J. D. (1999). Who drinks most of the alcohol in the U.S.? The policy implications. Journal of Studies on Alcohol, *60*, 78-89.
- Helzer, J. E., Canino, G. J., Yeh, E., Bland, R. C., Lee, C. K., Hwu, H. G., & Newman, S. (1990). Alcoholism-North America and Asia. Alcoholism: Clinical and Experimental Research, *47*, 313-319.
- Kitano, H. H. L. & Chi, I. (1989). Asian Americans and alcohol: The Chinese, Japanese, Koreans, and Filipinos in Los Angeles. In D.L.Spiegler, D. A. Tate, S. S. Aitken, & C. M. Christian (Eds.), NIAAA research monograph 18. Alcohol use among U.S. ethnic minorities (pp. 373-382). (DHHS Publication No. ADM 89-1435). Washington, DC: U.S. Government Printing Office.
- Kitano, H. H. L., Chi, I., Rhee, S., Law, C. K., & Lubben, J. E. (1992). Norms and alcohol consumption: Japanese in Japan, Hawaii and California. Journal of Studies on Alcohol, *53*, 33-39.
- Midanik, L. (1982). The validity of self-reported alcohol consumption and alcohol problems: A literature review. British Journal of Addiction, *77*, 357-382.
- Midanik, L. T. (1989). Perspectives on the validity of self-reported alcohol use. British Journal of Addiction, *84*, 1419-1423.

## Epidemiology of Alcohol (Russell)

National Institute on Alcohol Abuse and Alcoholism (1997). Ninth Special Report to the U.S. Congress on Alcohol and Health (NIH Publication No. 97-4017). Bethesda, MD: National Institutes of Health.

National Institute on Alcohol Abuse and Alcoholism (2000). Tenth Special Report to the U.S. Congress on Alcohol and Health (NIH Publication No. 00-1583). Bethesda, MD: National Institutes of Health.

Nephew, T. M., Williams, G. D., Stinson, F. S., Nguyen, K., & Dufour, M. C. (1999). Apparent per capita alcohol consumption: National, state, and regional trends, 1977-97 (Surveillance Report #51). Bethesda, MD: NIAAA.

Room, R. (1991). Measuring alcohol consumption in the U.S.: Methods and rationales. In W.B.Clark & M. E. Hilton (Eds.), Alcohol in America: Drinking practices and problems (pp. 26-50). Albany: State University of New York Press.

Rothman, K. J. & Greenland, S. (1998). Modern epidemiology. (Second ed.) Philadelphia: Lippincott-Raven Publishers.

Russell, M. (1986). The epidemiology of alcoholism. In N.J.Estes & M. E. Heinemann (Eds.), Alcoholism: Development, consequences, and interventions (3 ed., pp. 31-52). St. Louis, MO: C.V. Mosby Company.

Russell, M., Marshall, J. R., Trevisan, M., Freudenheim, J., Chan, A. W. K., Markovic, N., Vana, J. E., & Priore, R. L. (1997). Test-retest reliability of the Cognitive Lifetime Drinking History. American Journal of Epidemiology, 146, 975-981.

Russell, M., Testa, M., & Wilsnack, S. (2000). Alcohol use and abuse. In M.B.Goldman & M. C. Hatch (Eds.), Women and health (pp. 589-598). San Diego: Academic Press.

Saadatmand, F., Stinson, F. S., Grant, B. F., & Dufour, M. C. (1999). Liver cirrhosis mortality in the United States, 1970-96 (Surveillance Report #52). Bethesda, MD: NIAAA.

Single, E., Robson, L., Rehm, J., & Xi, X. (1999). Morbidity and mortality attributable to alcohol, tobacco, and illicit drug use in Canada. American Journal of Public Health, 89, 385-390.

Stinson, F. S. & DeBakey, S. F. (1992). Alcohol-related mortality in the United States, 1979-1988. British Journal of Addiction, 87, 777-783.

Watson, A. L. & Sher, K. J. (1998). Resolution of alcohol problems without treatment: Methodological issues and future directions of natural recovery research. Clin Psychol Sci Prac, 5, 1-18.

## Epidemiology of Alcohol (Russell)

Whitmore, C. C., Stinson, F. S., & Dufour, M. C. (1999). Trends in alcohol-related morbidity among short-stay community hospital discharges, United States, 1979-1997 (Surveillance Report #50). Bethesda, MD: NIAAA.

Yi, H., Stinson, F. S., Williams, G. D., & Bertolucci, D. (1999). Trends in alcohol-related fatal traffic crashes, United States, 1975-97 (Surveillance Report #49). Bethesda, MD: NIAAA.