340.721 Epidemiologic Inference in Public Health I

PRE-Activity Questions:
Surveillance Systems

The Activities provide experience in applying epidemiologic methods, interpreting findings, and drawing inferences. Activities will be discussed during the LiveTalks. Students are expected to work with their assigned Course Group prior to the start of each LiveTalk.

Prior to each Activity, students are to complete the corresponding set of PRE-Activity Questions. Each set of PRE-Activity Questions consists of 10 graded multiple choice questions. The graded multiple choice questions are to be completed via CoursePlus by the date and time listed in CoursePlus. PRE-Activity Questions prepare you for a productive and collaborative experience during the Activities.

Expectations for the PRE-Activity Questions

1. *Individually, read and attempt to answer all PRE-Activity Questions.*
2. *"Meet" or communicate with fellow students discuss challenging concepts, questions and compare answers. You may refer to their course materials and are strongly encouraged to collaborate with fellow students to complete the PRE-Activity Questions.*
3. *PRE-Activity Questions are due to Courseplus by the date listed on the syllabus. Although group collaboration is encouraged to complete the PRE-Activity Questions, each student must individually submit the PRE-Activity Questions.* ***Without exception, no credit will be given for submitting the PRE-Activity Questions after the due date****. The lowest PRE-Activity grade will be dropped when calculating the overall course grade.*

Motivation
The purpose of this part of the assignment is to analyze different types of surveillance systems. You will review surveillance systems for two diseases (influenza and diabetes) and determine the strengths and limitations of both systems.

This Activity corresponds to:
Lecture: Sources of Epidemiologic Data
Readings: Gordis text (5th ed) Chapter 3

Concepts Covered:

- Purpose of surveillance system
- Case definition
- Event registration
- Process and analysis of an event
- Dissemination of information about an event
- Use of information

Learning Objectives:

- Explain the purpose of the surveillance system
- Determine an appropriate case definition
- Examine surveillance data
- Examine registration of an event in the system
- Compare the analysis of an event among different systems
- Identify strengths and weakness of the surveillance system in terms of information use

Influenza Surveillance

Reference: Frost, WH. The Epidemiology of Influenza. *JAMA*, 73: 313-318, August 2, 1919 and *Public Health Reports*, 34:1823-1836, August 15, 1919.

In his 1919 article, Wade Hampton Frost (first Professor and Chair of Epidemiology at Johns Hopkins) described the epidemiology of influenza, despite a lack of specific records from influenza epidemics. Without such records, Frost asserted, "statistics of mortality from the group comprising influenza and all forms of pneumonia afforded the nearest approximation to a record of influenza." These same statistics are still used by the CDC to characterize influenza epidemics in the United States. The following is a table from the 1919 paper, detailing mortality rates from influenza and pneumonia from 1910 to 1918 in three cities.

TABLE 2. ANNUAL DEATH RATES PER 100,000 OF POPULATION FROM INFLUENZA AND PNEUMONIA (ALL FORMS) BY MONTHS FOR THE YEARS 1910–1918, INCLUSIVE, IN NEW YORK, SAN FRANCISCO, AND CLEVELAND

Years	Total	Months											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
NEW YORK CITY													
1910....	229.3	327.8	300.2	343.3	303.5	225.4	162.1	125.5	108.0	126.9	154.7	211.6	365.9
1911....	217.7	321.3	325.5	359.0	338.7	237.2	137.2	115.8	97.2	107.6	145.0	195.0	240.8
1912....	198.6	266.5	294.5	287.9	254.6	238.3	153.5	112.3	99.0	94.9	157.8	178.5	251.6
1913....	199.7	265.0	353.0	342.2	242.7	225.1	158.9	113.5	101.9	100.6	118.4	172.9	213.3
1914....	184.3	247.3	293.0	319.4	241.8	211.1	131.6	92.5	86.1	88.1	110.0	162.9	234.3
1915....	202.7	253.7	232.2	325.4	344.5	212.1	172.0	103.2	89.2	90.8	120.4	167.1	324.4
1916....	189.7	402.5	261.7	252.0	210.9	194.6	133.1	113.7	100.5	87.7	116.4	154.0	242.1
1917....	191.9	417.9	316.3	237.3	221.2	202.4	122.8	72.6	78.4	89.5	127.6	185.5	237.7
1918....	636.4	348.4	339.0	548.0	432.1	201.4	105.4	81.3	71.8	136.2	3,516.0	1,259.6	549.8
SAN FRANCISCO													
1910....	128.6	199.9	134.0	168.9	148.2	132.3	101.6	109.8	112.6	87.3	118.2	110.5	118.2
1911....	135.7	207.3	150.0	135.6	68.6	91.2	150.0	88.5	83.0	135.0	132.7	144.0	270.9
1912....	126.0	236.3	191.6	182.0	131.9	86.9	47.7	51.6	67.9	92.6	84.2	137.5	198.3
1913....	139.6	261.7	192.1	194.9	143.5	122.8	91.0	66.8	72.1	99.3	125.5	110.4	194.9
1914....	122.6	191.7	130.8	178.5	132.9	107.6	84.1	78.8	63.0	103.1	70.9	97.7	231.0
1915....	133.2	214.6	137.4	118.8	125.4	113.6	101.4	90.4	111.0	138.7	116.2	117.4	211.8
1916....	133.2	243.9	165.6	162.6	144.3	101.6	84.0	88.9	71.1	76.1	88.9	144.3	221.0
1917....	127.5	210.0	185.4	130.0	121.4	125.0	72.3	80.0	77.5	118.8	100.0	144.6	167.5
1918....	713.0	231.3	204.3	278.1	310.2	152.6	139.8	78.7	73.8	117.0	3,534.0	2,069.8	1,331.0
CLEVELAND													
1910....	136.3	198.3	180.0	223.0	213.5	148.3	107.9	54.2	48.2	51.8	85.6	138.0	190.0
1911....	106.5	174.3	165.9	164.1	155.0	103.4	77.5	40.5	50.6	67.1	81.0	109.0	93.2
1912....	114.6	163.6	141.2	159.7	142.7	126.2	91.7	55.2	75.0	30.6	88.8	110.1	185.4
1913....	131.9	179.8	205.1	217.5	152.5	147.4	107.5	68.1	60.6	74.3	115.3	130.9	128.6
1914....	117.2	160.1	175.2	197.0	201.8	139.9	53.3	51.6	46.3	59.0	66.4	116.0	143.7
1915....	162.7	166.5	333.1	252.6	201.8	109.3	77.4	55.5	78.8	59.2	121.8	170.2	336.8
1916....	198.5	545.0	209.2	263.8	266.9	211.2	86.6	57.6	82.1	75.7	153.6	175.0	242.9
1917....	210.9	344.0	386.0	415.0	233.8	208.0	145.8	90.2	66.4	72.1	160.0	152.9	267.0
1918....	557.0	161.3	178.5	190.4	366.3	142.6	60.0	62.5	43.5	48.0	1,812.0	2,135.0	1,376.0

Data for years 1910–1916 compiled from Mortality Statistics, Bureau of the Census, for those years.
Data for 1917 from tables prepared for publication in 1917 Mortality Statistics; advance sheets furnished by the Bureau of the Census.
Data for 1918 from special reports rendered to Director of the Census by city registrars.
Populations used are Bureau of the Census mid-year estimates.

Question 1

What is the cause-specific mortality rate from influenza and pneumonia (all forms) in New York City in September 1910?

a. 87.3 per 100,000 population
b. 126.9 per 100,000 population
c. 136.2 per 100,000 population
d. 229.3 per 100,000 population

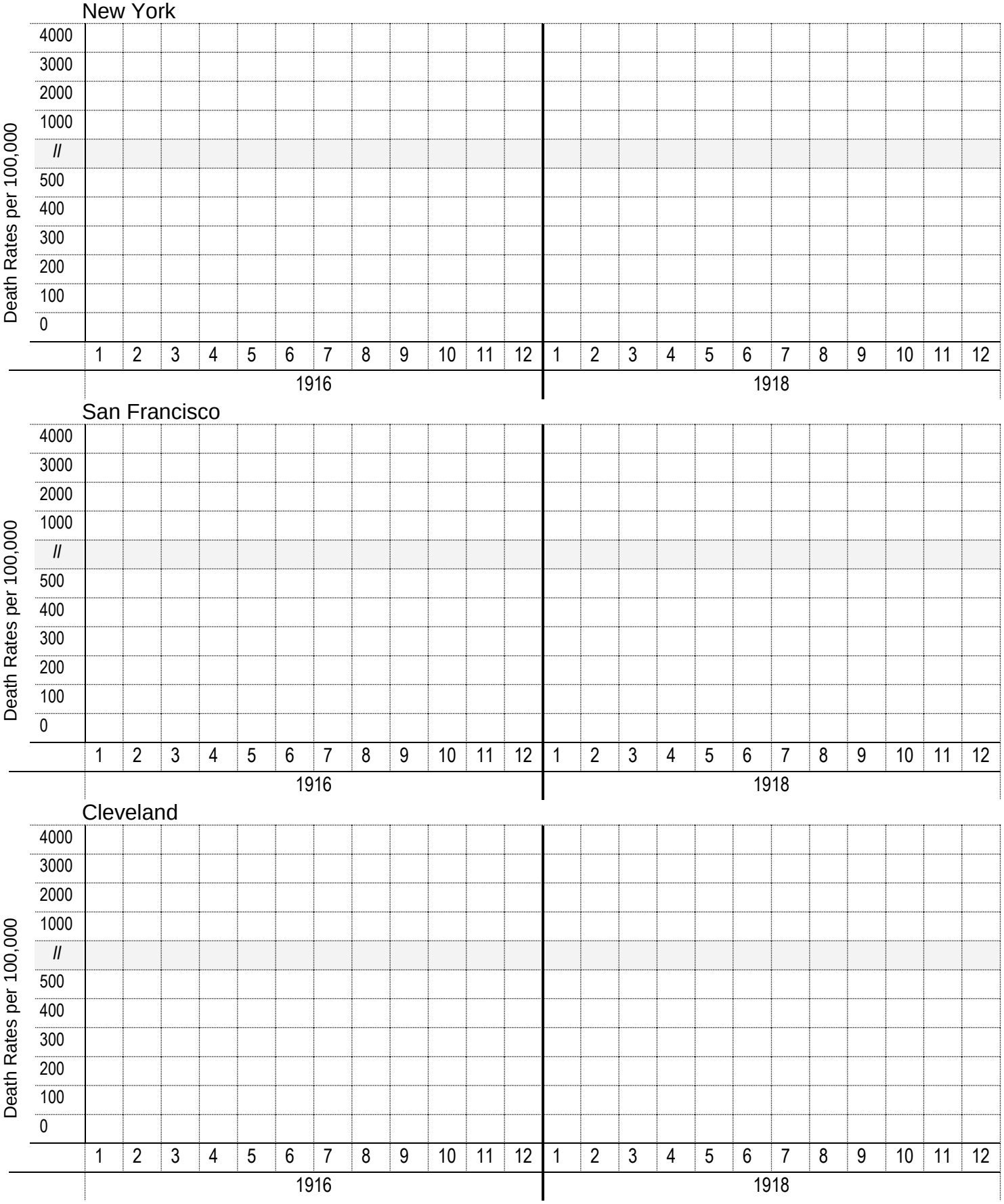
Question 2

Examine the data in Frost's Table 2. Across all data, what are the trends by season and by year?

a. Generally stable mortality rates throughout the year. Mortality rates increased dramatically in all 3 cities in 1918.
b. Generally lower mortality rates from November through March. San Francisco and New York had stable mortality in the years leading up to and including 1918.
c. Generally higher mortality rates from October through May. San Francisco and New York had stable mortality in the years leading up to and including 1918.
d. Generally higher mortality rates from October through May. Mortality rates increased dramatically in all 3 cities in 1918.

Plot the data for each city by month in 1916 and 1918 on the graphs provided on the following page.

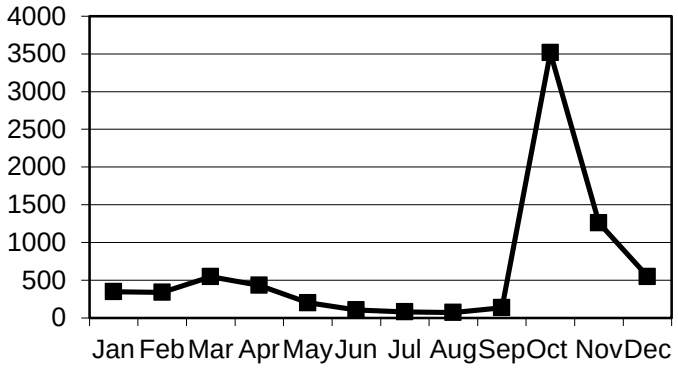
Annual Death Rates Per 100,000 Population From Influenza and Pneumonia (All Forms) By Months In 1916 and 1918 in New York, San Francisco and Cleveland



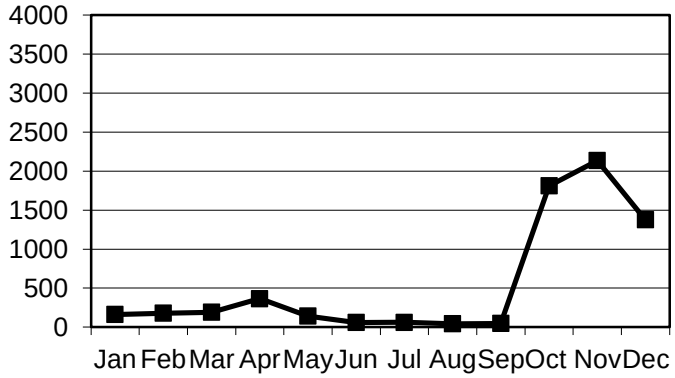
Question 3

Which of the following graphs shows the annual mortality rates per 100,000 population from influenza and pneumonia (all forms) by month in Cleveland in 1918?

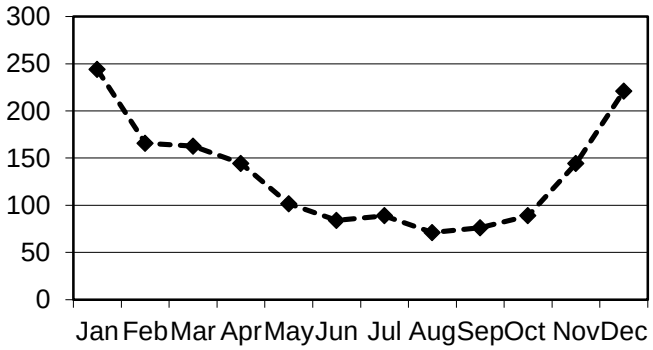
a. Graph 1:



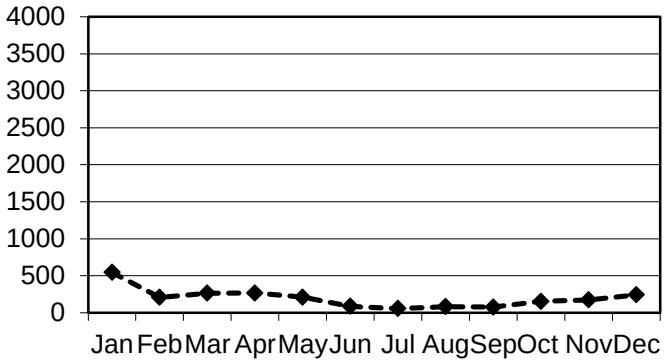
b. Graph 2:



c. Graph 3:



d. Graph 4:



Question 4

The mortality rate ratio comparing the mortality rate in September *1918* in New York City to the mortality rate in September *1916* in New York City is 136.2 / 87.7=1.55. Using the information provided in Frost's Table 2, complete the table below by calculating the *rate ratios* by month for the three cities *comparing 1918 to 1916*.

City	September	October	November	December
New York	1.55	**i.) ?**	8.18	2.27
San Francisco	1.54	39.75	**ii.) ?**	6.02
Cleveland	0.63	11.80	12.2	**iii.) ?**

What are the mortality rate ratios for i.) New York in October, ii.) San Francisco in November, and iii.) Cleveland in December? The units for all answer choices are "per 100,000 population".

a. i.) 9.5; ii.) 39.8; iii.) 29.8
b. i.) 30.2; ii.) 14.3; iii.) 5.7
c. i.) 38.8; ii.) 30.2; iii.) 39.8
d. i.) 39.8; ii.) 15.4; iii.) 6.6

Question 5

The mortality rate *difference* comparing the mortality rate in September *1916* in New York City to the mortality rate in September *1918* in New York City is 136.2 – 87.7=48.5. Using the information provided in Frost's Table 2, calculate the *mortality rate differences comparing 1918 to 1916* for i.) New York in October, ii.) San Francisco in November and iii.) Cleveland in December.

a. i.) 116; ii.) 144; iii.) 243
b. i.) 2966; ii.) 2203; iii.) 436
c. i.) 3400; ii.) 1926; iii.) 1133
d. i.) 3516; ii.) 2070; iii.) 1376

Question 6

Most rapid influenza tests are >70% sensitive for detecting influenza and >90% specific compared with virus culture. The tests are most useful when there is known influenza activity in the community and when they are performed on patients who have signs and symptoms consistent with influenza (e.g., fever, cough, sore throat, muscle aches, headache, and malaise).

Calculate the *positive predictive value* of the rapid influenza test with a prevalence of 5% influenza-like illness in a community in the non-flu season and also for a prevalence of 90% during the flu season. Assume 70% sensitivity and 90% specificity of the rapid influenza test.

a. 5% Prevalence: PPV = 27%; 90% Prevalence: PPV = 98%
b. 5% Prevalence: PPV = 98%; 90% Prevalence: PPV = 27%
c. 5% Prevalence: PPV = 27%; 90% Prevalence: PPV = 28%
d. 5% Prevalence: PPV = 91%; 90% Prevalence: PPV = 98%

Special Case: Avian Influenza

Avian Influenza ("bird flu") is an infection caused by avian influenza viruses that occurs naturally among birds. Wild birds worldwide carry the viruses in their intestines, but usually do not get sick from them. Bird flu is very contagious and can make some domesticated birds very sick and even kill them.

Bird flu viruses do not usually infect humans, but several cases of human infection with bird flu viruses have occurred since 1997. Symptoms of bird flu in humans have ranged from typical flu-like symptoms (fever, cough, sore throat and muscle aches) to eye infections, pneumonia, severe respiratory diseases (such as acute respiratory distress), and other severe and life-threatening complications. The symptoms of bird flu may depend on which virus caused the infection.

It is believed that most cases of bird flu infection in humans have resulted from contact with infected poultry or contaminated surfaces.

During an outbreak of bird flu among domesticated chicken, ducks, and turkeys, there is a possible risk to people who have contact with infected birds or surfaces that have been contaminated with excretions from infected birds. The current outbreak of avian influenza A (H5N1) among poultry in Asia is an example of a bird flu outbreak that has caused human infections and deaths.

Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO[1] (As of 28 June 2005)

Date of onset	Viet Nam		Thailand		Cambodia		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Dec 26, 2003-Mar 10, 2004	23	16	12	8	0	0	35	24
Jul 19, 2004-Oct 08, 2004	4	4	5	4	0	0	9	8
Dec 16, 2004 - to June 2005	60	18	0	0	4	4	64	22
Total	87	38	17	12	4	4	108	54

Notes
Total number of cases includes number of deaths.
WHO reports only laboratory-confirmed cases.

Question 7
Given the data from the WHO, what is the case-fatality for avian influenza in Vietnam from Dec 2003 through June 2005?

a. 26%
b. 44%
c. 50%
d. 70%

[1] http://www.who.int/csr/disease/avian_influenza/country/cases_table_2005_06_28/en/print.html

Obesity and Diabetes Surveillance

The National Health Interview Survey (NHIS) is a multi-purpose health survey conducted by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), and is the principal source of information on the health of the civilian, noninstitutionalized, household population of the United States. The NHIS has been conducted continuously since its beginning in 1957. Public use microdata files are released on an annual basis. The U.S. Census Bureau, under a contractual agreement, is the data collection agent for the National Health Interview Survey. NHIS data are collected through a personal household interview by Census interviewers. Nationally, the NHIS uses about 400 interviewers, trained and directed by health survey supervisors in the 12 U.S. Census Bureau Regional Offices.[2]

About the same time as personal health behaviors received wider recognition in relation to chronic disease morbidity and mortality, telephone surveys emerged as an acceptable method for determining the prevalence of many health risk behaviors among populations. As a result, surveys were developed and conducted to monitor state-level prevalence of the major behavioral risks among adults associated with premature morbidity and mortality. The basic philosophy was to collect data on actual behaviors, rather than on attitudes or knowledge, that would be especially useful for planning, initiating, supporting, and evaluating health promotion and disease prevention programs.

In 1984, The Centers for Disease Control and Prevention (CDC) established the Behavioral Risk Factor Surveillance System (BRFSS), and 15 states participated in monthly data collection. The BRFSS, administered and supported by the Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, CDC, is an ongoing data collection program. By 1994, all states, the District of Columbia, and three territories were participating in the BRFSS.

Obesity

During the past 20 years, obesity among adults has risen significantly in the United States. The latest data from the National Center for Health Statistics show that 30 percent of U.S. adults 20 years of age and older - over 60 million people - are obese. This increase is not limited to adults. The percentage of young people who are overweight has more than tripled since 1980. Among children and teens aged 6-19 years, 16 percent (over 9 million young people) are considered overweight.[3]

These increasing rates raise concern because of their implications for Americans' health. Being overweight or obese increases the risk of many diseases and health conditions, including the following:

[2] CDC. NHIS. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2003/srvydesc.pdf

[3] CDC. Division of Nutrition and Physical Activity, National Center for Chronic Disease Prevention and Health Promotion. Available at: http://www.cdc.gov/nccdphp/dnpa/obesity/

- Hypertension
- Dyslipidemia (for example, high total cholesterol or high levels of triglycerides)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis
- Sleep apnea and respiratory problems
- Some cancers (endometrial, breast, and colon)

Diabetes

Diabetes is a disease in which blood glucose levels are above normal. Diabetes can cause serious health complications including heart disease, blindness, kidney failure, and lower-extremity amputations and is the sixth leading cause of death in the United States. Type 1 diabetes, which was previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, may account for 5% to 10% of all diagnosed cases of diabetes. Type 2 diabetes, which was previously called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, may account for about 90% to 95% of all diagnosed cases of diabetes. Gestational diabetes is a type of diabetes that only affects pregnant women.

Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes.[4]

The following question was used by the 2004 BRFSS to determine diabetes prevalence:

Have you ever been told by a doctor that you have diabetes?[5] (102)

If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"
If Respondent says pre-diabetes or borderline diabetes, use response code 4.

1 Yes
2 Yes, but female told only during pregnancy
3 No
4 No, pre-diabetes or borderline diabetes
7 Don't know / Not sure
9 Refused

[4] CDC. National Center for Chronic Disease Prevention and Health Promotion. Available at: http://www.cdc.gov/diabetes/faq/basics.htm
[5] BRFSS 2004 Questionnaire. Available at: http://www.cdc.gov/brfss/questionnaires/pdf-ques/2004brfss.pdf

The following question was used by the 2004 NHIS to determine diabetes prevalence:

Females: Other than during pregnancy, have you EVER been told by a doctor or health professional that you have diabetes or sugar diabetes?

Males: Have you EVER been told by a doctor or health professional that you have diabetes or sugar diabetes?

1 Yes
2 No
3 Borderline
7 Refused
9 Don't know

The following questions were used by the 2004 BRFSS to determine obesity prevalence:

About how much do you weigh without shoes? (126–129)

Note: If respondent answers in metrics, put "9" in column 126. Round fractions up.

__ __ __ __ Weight pounds
7 7 7 7 Don't know / Not sure
9 9 9 9 Refused

About how tall are you without shoes? (130–133)

Note: If respondent answers in metrics, put "9" in column 130. Round fractions down.

__/__ __ Height
ft / inches
7 7 7 Don't know / Not sure
9 9 9 Refused

Question 8

Body mass index (BMI, a measure of obesity) is calculated as weight divided by height^2 (kg/m^2). Clinical cutpoints for BMI are: <18.5 kg/m^2, Underweight; 18.5-24.9 kg/m^2, Normal weight; 25.0-29.9 kg/m^2, Overweight; and ≥ 30 kg/m^2, Obese.

Compared to their true weight and height, it has been well documented that people tend to report a lower weight and a taller height. How would the sensitivity and specificity of the BRFSS question for measuring obesity compare to a gold standard BMI measurement?

a. Sensitivity will be lower and specificity will be lower
b. Sensitivity will be lower and specificity will be higher
c. Sensitivity will be higher and specificity will be lower
d. Sensitivity will be higher and specificity will be higher

Table 1: Diabetes and Obesity Prevalence in the NHIS and BRFSS

Year	Diabetes Prevalence (NHIS)[6]	Diabetes Prevalence (BRFSS)[7]	Obesity Prevalence (BRFSS)[8]
1990	2.7	-	11.6
1991	2.8	-	12.6
1992	3.0	-	12.6
1993	3.0	-	13.7
1994	3.2	-	14.4
1995	3.1	4.4	15.8
1996	3.2	4.5	16.8
1997	3.8	4.8	16.6
1998	3.9	5.4	18.3
1999	4.1	5.6	19.7
2000	4.4	6.1	20.1
2001	4.7	6.5	21.0
2002	4.8	6.7	22.1

- No data available on BRFSS website

[6] http://www.cdc.gov/diabetes/statistics/prev/national/tableage.htm

[7] http://apps.nccd.cdc.gov/brfss/index.asp

[8] http://apps.nccd.cdc.gov/brfss/Trends/trendchart.asp?qkey=10010&state=US

Question 9

Calculate the ratio of prevalence in 2002 to prevalence in 1995 for each column.

a. Diabetes (NHIS): 1.55; Diabetes (BRFSS): 1.52; Obesity (BRFSS): 1.40
b. Diabetes (NHIS): 1.52; Diabetes (BRFSS): 1.55; Obesity (BRFSS): 1.40
c. Diabetes (NHIS): 1.40; Diabetes (BRFSS): 1.52; Obesity (BRFSS): 1.55
d. Diabetes (NHIS): 1.55; Diabetes (BRFSS): 1.40; Obesity (BRFSS): 1.52

Question 10

Using data from the Table and the answer to Question 9, what is the relative change of diabetes compared to obesity?

a. Diabetes prevalence is increasing *less* rapidly than obesity prevalence.
b. Diabetes prevalence is increasing *more* rapidly than obesity prevalence.
c. Diabetes prevalence is decreasing *less* rapidly than obesity prevalence.
d. Diabetes prevalence is decreasing *more* rapidly than obesity prevalence.