

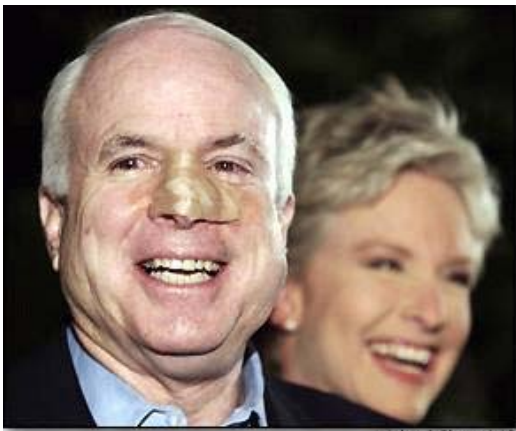
Skin Cancer Epidemiology and Prevention*
A *Disease Detectives* Exercise from the
Centers for Disease Control and Prevention



Part I

(Recommended time: 15 minutes)

Read the following media reports and then proceed to the exercise that follows.



Sen. McCain Leaves Hospital After Surgery

(Quoted from AP — Last updated: February 06, 2002 12:42 PM ET)

PHOENIX (Reuters) — Republican Sen. John McCain was released from a Phoenix hospital Wednesday, emerging cancer-free from his latest bout with a deadly form of skin disease, a spokeswoman said.

McCain, Arizona's senior senator and a former presidential candidate, was given a clean bill of health after an overnight stay at the Mayo Clinic Hospital to treat an early melanoma on the left side of his nose, said Nancy Ives, a McCain spokeswoman.

"He was in good spirits and was joking with staff," Ives told Reuters. "He plans to take it easy for the rest of the week before returning to Washington." McCain, 65, left the hospital with a gauze bandage on his face and would have some stitches for about one week, she said. His activities are not restricted.

* This exercise was originally developed for the *Disease Detectives* event in the 2002 National Science Olympiad held at the University of Delaware in Newark, Delaware. Winners of the event were from Harriton High School in Rosemont, Pennsylvania.

**Skin Cancer Epidemiology and Prevention
Part I**



Doctors took about an hour Tuesday covering the scar left when the tumor was removed the previous day during outpatient surgery. A pathology report confirmed the melanoma discovered during a checkup on Jan. 17 had been totally removed, she said. It was the third time the fair-skinned McCain has been diagnosed with skin cancer, but Ives said the new tumor was not related to any melanoma he had previously. McCain had surgery to remove melanomas from his left temple and left arm after his 2000 campaign for the Republican presidential nomination, which he lost to then-Texas Gov. George W. Bush. He also had a melanoma removed in 1993.

Melanomas are the most deadly form of skin cancer, affecting more than 53,000 Americans and killing more than 7,000 annually. Doctors consider early detection a key, catching it before the cancer invades the skin deeply. People who have had them are cautioned to watch for lesions that have uneven or irregular borders and contain multiple shades of brown or black.

* * * * *

**Maureen Reagan Dies — Former President's
Daughter Loses Battle With Skin Cancer**
(abcnews.com; August 8, 2001)



(Alex Wong/Getty Images)

Maureen Reagan, daughter of former President Ronald Reagan, is shown at a March 21 press conference in Washington, D.C.

Skin Cancer Epidemiology and Prevention Part I



* * * * *

It is early February 2002, and news media around the country are reporting that Senator John McCain has been diagnosed with a recurring melanoma. Successful surgery follows, but the report has come on the heels of the death from melanoma of former President Reagan's daughter, Maureen Reagan.

These high-profile cases focus attention on skin cancer, and you, as Chief Disease Detective for the State of Delaware, are asked to prepare a briefing for the governor on the problem nationally and in your state, and how to prevent it.

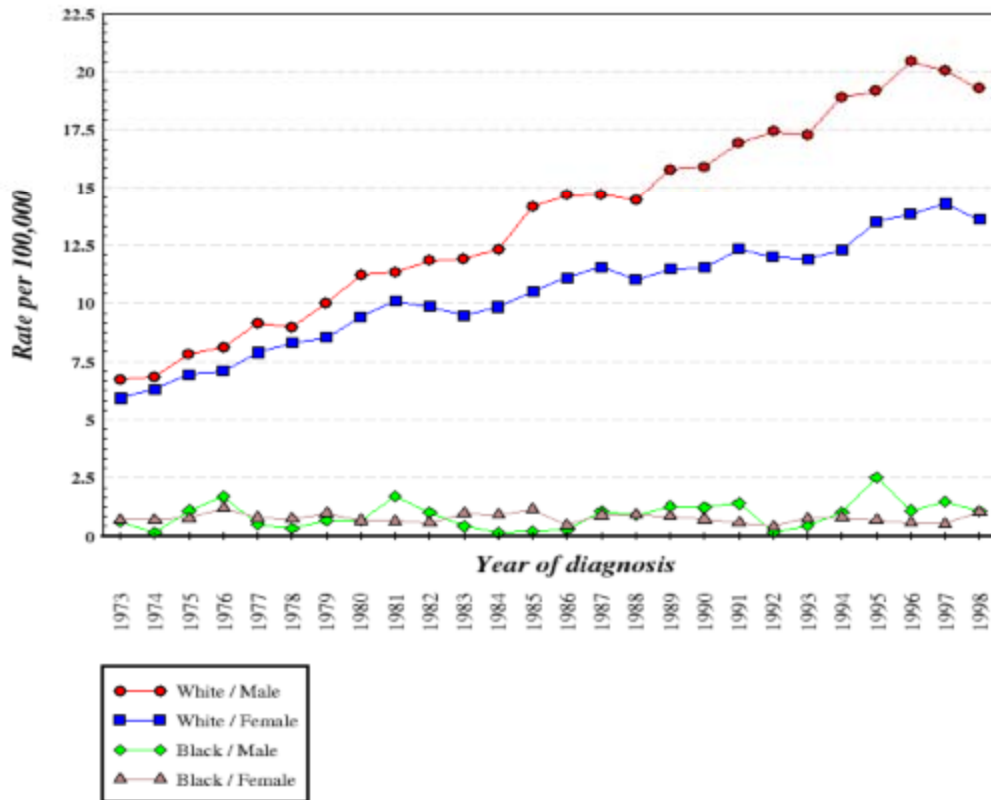
A quick search of the data tells you that in 2001 doctors diagnosed approximately 51,400 new cases of melanoma, and about 7,800 people died of the disease. You locate data indicating that the incidence of melanoma has been on the rise since the early 1970s.

The Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute collects and publishes cancer incidence and survival data from registries covering approximately 14% of the U.S. population. Using the SEER data in the table on the next page, answer the questions that follow.

Skin Cancer Epidemiology and Prevention
Part I



Figure 1. Age-adjusted incidence of melanoma by race and gender; SEER data, 1973–1998.
(Source: National Cancer Institute)



**Skin Cancer Epidemiology and Prevention
Part I**



✎ 5. The rates in Figure 1 are age-adjusted. (1) Define “age adjustment” and (2) explain why Disease Detectives would use age-adjusted rates.

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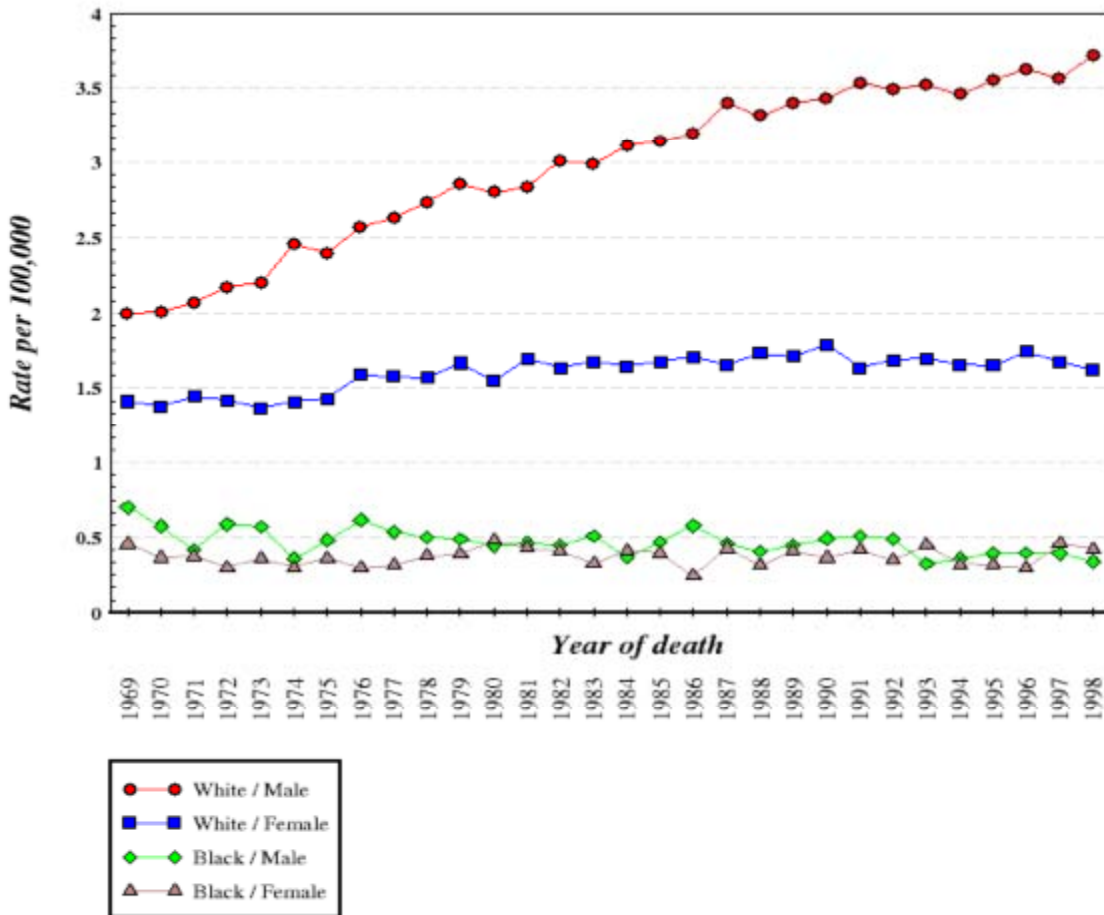
Part II

(Recommended time: 10 minutes)

In addition to examining incidence, Disease Detectives may use data on mortality (death) from melanoma. The table below presents this type of data for 1969-1998.

Figure 2. Age-adjusted melanoma mortality rates by race and gender, 1969–1998.

(Source: National Center for Health Statistics, CDC)



**Skin Cancer Epidemiology and Prevention
Part II**



✎ 6. Define “mortality rate.”

✎ 7. Referring to Figure 2, give the 1998 mortality rates for the following groups:

Black Men	_____
White Women	_____
Black Men	_____
Black Women	_____

✎ 8. Note the difference in mortality rates between white men and white women. Give two possible reasons for this difference.

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Part III

(Recommended time: 5 minutes)

Your interpretation of Figures 1 and 2 underscores the magnitude of the problem among white men in the U.S. You decide to examine the data further and come upon a map from the National Cancer Institute of U.S. melanoma mortality rates for white men from 1970-1994.

Figure 3.

(Note to web developer: please insert figure at <http://www.dceg.cancer.gov/cgi-bin/atlas/mapview2?direct=melswm70>)

**Skin Cancer Epidemiology and Prevention
Part III**



✎ 9. Using the map (Figure 3), list two geographic areas with high melanoma death rates.

✎ 10. Referring to Figure 3, give two possible reasons for higher mortality in the places that you listed in the Question 9.

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Part IV

(Recommended time: 5 minutes)

The governor wants to know how Delaware’s melanoma mortality rate compares with that of other states. While preparing for the meeting, you come upon a figure ranking melanoma mortality for white men aged 20–49, by state, during 1970-1994

Figure 4. Melanoma mortality for white men aged 20-49, by state — United States, 1970-1994.

(Note to web developer: Please insert graph at

http://cas.popchart.com/cancer?v=f&c=ACC&rg=WM&o=g&fc=c&site=nci&ac=1&si=0&sort=m&bar=0&t=7094&a=0&l=state_sea To get the correct version of the graph, select the age (20-49), race and sex (White male), time period (1970-1994), and condition (Melanoma of skin).

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Part V

(Recommended time: 15 minutes)

In your meeting with the governor, you want to be able to present the major risk factors for skin cancer so you can discuss how Delaware can bring its skin cancer mortality rate down.

You know that the major preventable cause of skin cancer is exposure to ultraviolet (UV) radiation from the sun over many years. To determine which behaviors of people put them at risk for sun exposure, you find an excellent resource, the Youth Risk Behavior Survey (YRBS). The survey collects data on important health-related behaviors, such as smoking and exercise, among young people. Data from the YRBS are used at the national, state, and local levels for a variety of public health programs.

Students complete the self-administered YRBS questionnaire in their classrooms during a regular class period, recording their responses directly on a computer-scanned answer sheet. The students' parents' permission is obtained before the survey. For the first time, in 1999, the national YRBS asked students about sunscreen use.

Table 1, on the next page, includes findings on sunscreen use from a sample of 15,439 U.S. high school students. Students were asked, "How often do you wear sunscreen or sun block with an SPF of 15 or higher when you are outside for more than one hour on a sunny day?" Possible multiple-choice responses included "never," "rarely," "sometimes," "most of the time," or "always."

Table 1. Prevalence of sunscreen use¹ among U.S. high school students, by demographic characteristics — Youth Risk Behavior Survey, 1999.²

Demographic Characteristics	N³	Never (%)	Rarely (%)	Sometimes (%)	Most of the time or always (%)
Total	15,349	35.9	29.3	21.4	13.3
Age (years)					
≤14	1,308	30.5	26.1	25.9	17.5
15	3,378	35.2	29.1	22.1	13.7
16	988	35.3	29.8	21.2	13.7
17	4,013	36.6	30.4	21.1	11.9
≥18	2,631	41.0	29.1	18.3	11.6
Sex					
Female	7,828	29.8	28.4	23.8	18.1
Male	7,445	42.0	30.3	19.1	8.6
Race or Ethnicity					
White	5,407	25.0	32.5	26.0	16.5
Black	4,283	74.1	13.7	7.4	4.8
Hispanic or Latino	4,106	43.2	28.4	17.6	10.8
Grade					
9	3,786	37.0	27.5	21.0	14.6
10	3,787	34.2	29.5	22.8	13.6
11	3,885	35.8	30.1	21.7	12.5
12	3,823	36.6	30.7	20.3	12.4

(Source: Hall HI, Jones SE, Saraiya M. Correlates of Sunscreen Use. Journal of School Health)

¹Wear sunscreen or sun block with an SPF of 15 or higher when outside for more than one hour on a sunny day.

² Prevalence estimates based on weighted data.

³ Unweighted numbers. Numbers may not add to total because of missing information.

✎ 13. Give two reasons why Disease Detectives would be interested in monitoring the sunscreen use of high school students?

✎ 14. Define “prevalence” as used in Table 1.

✎ 15. Using Table 1, determine the prevalence for frequent (“most of the time” or “always”) sunscreen use.

**Skin Cancer Epidemiology and Prevention
Part V**



✎ 16. Use the data in Table 1 to identify three characteristics of a hypothetical student who is least likely to use sunscreen.

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Part VI

(Recommended time: 10 minutes)

The data in Table 2 show what percentage of students who reported practicing the health-related behaviors listed there also reported wearing sunscreen. For example, 10.7% of the students who reported “never or rarely” wearing a bicycle helmet also said that they wore sunscreen either “most of the time” or “always.”

Table 2. Prevalence of frequent use of sunscreen¹ among U.S. high school students, by other health-related behaviors — Youth Risk Behavior Survey, 1999.

Health Related Behaviors	Frequent Sunscreen Use (%) (Note: N = 15,349)
Bicycle helmet use²	
Never or rarely	10.7
Sometimes, most of the time, or always	25.7
Seat belt use	
Never or rarely	8.4
Sometimes, most of the time, or always	14.3
Alcohol impairment and vehicle use³	
0 times	15.3
1 or more times	9.7
Weapon carrying⁴	
0 times	14.2
1 or more times	9.5
Cigarette smoking⁴	
0 days	14.5
1 or more days	11.2

Continued Next Page

¹ Used sunscreen most of the time or always.

² Among students who rode a bicycle during the 12 months preceding the survey.

³ During the 30 days preceding the survey, drove after drinking alcohol or rode with a driver who had been drinking.

⁴ During the 30 days preceding the survey.

Table 2, cont'd. Prevalence of frequent use of sunscreen* among U.S. high school students, by other health-related behaviors — Youth Risk Behavior Survey, 1999.

Health Related Behaviors	Frequent Sunscreen Use (%) (Note: N = 15,349)
Alcohol Use⁴	
0 days	15.1
1 or more days	11.6
Marijuana use⁴	
0 days	14.4
1 or more days	10.1
Sexual activity⁵	
Yes	9.4
No	15.2
Body mass index⁶	
Overweight	9.4
At risk for being overweight	11.1
Neither overweight nor at risk	14.0
Fruit and vegetable consumption⁷	
Yes	17.8
No	12.0
Physical activity⁸	
Both vigorous and moderate	16.9
Vigorous only	12.8
Moderate only	10.9
Neither vigorous nor moderate	11.9

(Source: Hall HI, Jones SE, Saraiya M. Correlates of Sunscreen Use. Journal of School Health)

⁵ Had sexual intercourse during the 3 months preceding the survey.

⁶ Body Mass Index (kg/m²) categorized as overweight (at least 95th percentile), at risk for being overweight (at least 85th but <95th percentile), and neither overweight nor at risk for overweight (<85th percentile).

⁷ Had eaten at least 5 servings/day of 100% fruit juice, fruit, green salad, potatoes (excluding french fries, fried potatoes, or potato chips), carrots, or other vegetables during the 7 days preceding the survey.

⁸ *Vigorous physical activity*: activities that caused sweating and hard breathing for at least 20 minutes on at least 3 of the 7 days preceding the survey. *Moderate physical activity*: activities that did not cause sweating and hard breathing for at least 30 minutes on at least 5 of the 7 days preceding the survey.

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Answer Key

✎ 1. Give the definition of “incidence rate.”

Answer (3 points — 1 each for explanation of numerator, denominator, and time)

Incidence rate is a measure of the frequency with which a health problem or health event (such as a new injury or case of illness) occurs in a population. In calculating incidence, the numerator is the number of new cases occurring in the population during a given period of time, and the denominator is the total population at risk during that time.

✎ 2. For some subgroups, the incidence rates appear to have increased overall in the past 20 years. Give two reasons for this apparent increase.

Answer (2 points — 1 for each valid reason)

Factors that could contribute to the rise in rates include

- increased exposure to UV radiation as a result of more people being exposed to the sun (**Note:** This is the most important reason.);
- ozone depletion;
- heightened awareness among health care providers;
- increased reporting (improved surveillance); and
- people living longer — increased survival.

✎ 3. Referring to Figure 1, give the 1998 incidence rate for the following groups:

Answer (8 points — 2 for each rate. Estimates are acceptable; however, units must be cited. Take off 1 point for each rate without units.)

White Men 19.3 per 100,000 persons

White Women 13.6 per 100,000 persons

* This exercise was originally developed for the *Disease Detectives* event in the 2002 National Science Olympiad held at the University of Delaware in Newark, Delaware. Winners of the event were from Harriton High School in Rosemont, Pennsylvania.

Skin Cancer Epidemiology and Prevention Answer Key



Black Men 1.1 per 100,000 persons

Black Women 1.0 per 100,000 persons

4. Give two possible reasons for the observed large differences in incidence rates between races.

Answer (2 points — 1 for each valid reason)

- Racial and ethnic differences in observed rates are mostly due to skin color, which is determined by the amount of melanin produced by skin cells called melanocytes. Melanin also protects the skin from damage by UV radiation. Although darkly pigmented people (e.g., African-Americans, Asians, Hispanics) develop skin cancer on sun-exposed sites at lower rates than lightly pigmented people, UV exposure still increases their risk of skin cancer.
- Different cultures may have different prevention behaviors.
- Exposure may tend to be longer and more intense in some cultures than in others.
- Diagnosis may be more difficult when skin is highly pigmented.

5. The rates in Figure 1 are age-adjusted. (1) Define “age adjustment” and (2) explain why Disease Detectives would use age-adjusted rates.

Answer (2 points — 1 for each part of the answer)

Age adjustment is a statistical technique that uses the age distribution of a standard, or reference, population to adjust crude rates. Or, if actual methods for age adjustment are given: multiplication of an observed age-specific rate in each of two comparison groups by a standard population.

Age-adjustment eliminates the effect of age on the data being compared, thus allowing Disease Detectives to compare incidence rates for different subgroups which otherwise may have different age distributions.

6. Define “mortality rate.”

Answer (3 points — 1 for each of the key elements)

Mortality rate is the rate of occurrence of death in a defined population during a specified time interval. (**Note:** The student’s answer should contain such key words as “deaths,” “population at risk,” and “over time.”)

7. Referring to Figure 2, give the 1998 mortality rates for the following groups:

Answer (8 points — 2 for each rate. Estimates are acceptable; however, units must be cited. Take off 1 point for each rate without units.)

White Men 3.7 deaths per 100,000 persons

White Women 1.6 deaths per 100,000 persons

Black Men 0.3 deaths per 100,000 persons

Black Women 0.4 deaths per 100,000 persons

8. Note the difference in mortality rates between white men and white women. Give two possible reasons for this difference.

Answer (2 points — 1 for each valid reason)

Several explanations are possible for the higher rate among white men:

- White women may be more aware than white men of skin cancer risk and, therefore, may have protected their skin better in childhood and adulthood.
- Diagnosis may take place at a later stage for white men than for white women.
- Genetic determinants may differ between white men and women.
- Health care workers may be more responsive to suspicious lesions in women and, therefore, have greater tendency to biopsy or excise tissue from women.
- Men may have a higher prevalence of exposure because of occupational patterns.

9. Using the map (Figure 3), list two geographic areas with high melanoma death rates.

Answer (2 points — 1 for each correct area)

Coastal, Southeast, West, and Texas. A north-south differential was seen among white men with lower rates in the North and higher rates in the southeastern and south-central regions.

10. Referring to Figure 3, give two possible reasons for higher mortality in the places that you listed in the Question 9.

Answer (2 points — 1 for each valid reason)

- Recreational exposure may be different for coastal areas (e.g., beach exposure).
- Occupational exposure may be higher in Texas.

Skin Cancer Epidemiology and Prevention Answer Key



- Personal awareness of risk (and therefore preventive behaviors) may differ as a function of regional prevention programs.
- General gradient by latitude that may reflect intensity of exposure, with some exceptions. (**Note:** The map is for white men only, so “differences in skin color/pigmentation” is not a valid answer.)
- Differences due to health care availability.

11. Using Figure 4, give the five states with the highest mortality rates for white men?

Answer (5 points — one for each correct state)

Delaware
Mississippi
Tennessee
South Carolina
Georgia

12. Give two reasons why melanoma mortality rates might be higher for white men in Delaware than for men in neighboring states and some states in the south.

Answer (2 points — 1 for each valid reason)

White men in Delaware might be

- genetically predisposed to have fair skin or other traits that make them more susceptible to skin cancer;
- more likely to engage in behaviors that put them at increased risk of melanoma (e.g., repeated exposure);
- less likely to use protective measures;
- less likely to receive health care that adequately addresses skin cancer.

13. Give two reasons why Disease Detectives would be interested in monitoring the sunscreen use of high school students?

Answer (2 points — 1 for each valid reason)

Overexposure to the sun as a child or teenager is an important factor in the development of skin cancer later in life. Because they are making their own behavioral decisions, teenagers should be especially encouraged to take precautions against skin cancer. Monitoring their sunscreen use helps scientists

- target programs toward subgroups that have the riskiest behavior;
- see if and how risky health behaviors are related;

Skin Cancer Epidemiology and Prevention Answer Key



- start up, monitor, and improve policies and programs to reduce unprotected UV exposure among youth.

14. Define “prevalence” as used in Table 1.

Answer (3 points — 1 each for indication of numerator, denominator, and time)

Prevalence as used in Table 1 is the rate, or proportion, of people in a population at a given time who have a certain disease, chronic condition, injury, or attribute. We can calculate prevalence at a particular point in time (point prevalence) or during a specified period of time (period prevalence).

15. Using Table 1, determine the prevalence for frequent (“most of the time” or “always”) sunscreen use.

Answer (2 points)

13.3% of students reported frequent sunscreen use when they are outside for more than one hour on a sunny day.

16. Use the data in Table 1 to identify three characteristics of a hypothetical student who is least likely to use sunscreen.

Answer (3 points — 1 for each characteristic)

Give credit for

- “Older” or “age \geq 18” (no credit for grade)
- Black
- Male

17. Use the data in Table 2 to identify three behaviors with which sunscreen use is positively associated.

Answer (3 points — 1 for each correct behavior)

Teens who reported using sunscreen were also likely to report

- not carrying a weapon
- wearing a bike helmet
- wearing a seat belt
- not driving after drinking
- not smoking
- not drinking

Skin Cancer Epidemiology and Prevention Answer Key



- not using marijuana
- not being sexually active
- being neither overweight nor at risk of being overweight
- eating more than 5 servings of fruits and vegetables per day
- being vigorously and moderately physically active

18. Using sunscreen is one way to reduce ultraviolet (UV) exposure. Other sun-safety measures include wearing hats and long-sleeved clothing and limiting time spent in the sun during midday. List three ways to encourage students to adopt any of these behaviors.

Answer (3 points — 1 for each valid strategy)

- Introduce sun-safety education into curriculum.
- Encourage environmental changes such as planting trees, building shade structure.
- Encourage policies that will encourage you to play inside when it is sunny.
- Encourage policies that facilitate preventive measures, e.g., wearing hats outdoors.
- Encourage parents and teachers to practice sun-safe behavior themselves.

19. List two limitations to the YRBS that you noted while using the data to study sun protective practices.

Answer (2 points — 1 for each correct limitation)

- Data is self-reported.
- Use cannot be confirmed or validated.
- Generalizability of the results is limited because the survey includes only kids in schools and in regular classrooms.
- Reporting or information bias is possible (e.g., students may give answers they believed the teacher or interviewer want to hear).
- Some of the terms in the survey are ambiguous (e.g., “sometimes” or “rarely”).
- The study has a very short observational period (30 days before the survey).