Disease Detectives Investigate West Nile Virus

(Suggested Time: 20 minutes)

Background: In late August 1999, an infectious disease specialist in a New York City hospital called the New York City Health Department to report 2 patients hospitalized with encephalitis (a clinical illness related to an inflammation of the brain tissues and frequently caused by viral infection). The health department contacted other hospitals in the area and identified 6 additional patients with similar illness. Public health surveillance conducted during August and September 1999 identified a total of 62 patients with encephalitis and positive tests for recent West Nile virus. Three of the 62 had only fever and headache and were not hospitalized.

✎**1. Define *Public Health Surveillance*.**

Background: Table 1 below shows the age and sex distributions of the 59 patients who were hospitalized and who had symptoms and positive lab tests for West Nile virus.

Table 1. Number of hospitalized patients with laboratory confirmed West Nile virus infection, New York City Department of Health, August 1 – September 31, 1999.

Age (yrs)	No. Patients (%)	Population At Risk	Calculations
0-19	2 (3)	2,324,081	_____
20-29	1 (2)	1,553,981	_____
30-39	3 (5)	1,549,111	_____
40-49	1 (2)	1,177,190	_____
50-59	9 (15)	867,331	_____
60-69	13 (22)	814,838	_____
70-79	18 (31)	534,785	_____
≥80	12 (20)	281,054	_____
Sex			
Male	31(53)	4,289,988	_____
Female	28(47)	4,812,383	_____

Source: Nash D, Mostashari F, Fine A, et al. 1999 West Nile Outbreak Response Working Group. The outbreak of West Nile virus infection in the New York City area in 1999. *NEJM 2001;344(24):1807-14.*

✎**2. Based on the data in Table 1, for which two age groups was the apparent risk of West Nile virus infection greatest? In the space in Table 1, show each calculation to support your answer and give all units. (Note: units must be given to receive credit.)**

(a)

(b)

✎**3. For which single age group was the apparent risk the least? In the space in Table 1, show a calculation to support your answer and give all units. (Note: units must be given to receive credit.)**

✎**4. Given that mosquitoes transmit this disease, give two explanations for the age distribution.**

(a)

(b)

✎**5. For which gender group is the risk of infection highest? In the table, show your calculations and give all units. (Note: units must be given to receive credit)**

✎**6. For the group you determine to be at greatest risk, give one explanation that might account for the increased risk.**

Background: Next, the investigators collected data for various risk factors for more severe illness, using three measures: muscle weakness, encephalitis, or death. The results are shown below in Table 2.

Table 2. Risk Factors for West Nile virus infection, New York City Department of Health, August 1 – September 31, 1999.

Risk Factor	Relative Risk (95% Confidence Interval)		
	Muscle Weakness	Encephalitis with muscle weakness	Death
Known history of immunosuppression	1.6 (1.0 – 2.6)	1.4 (0.4 – 11.1)	2.1 (0.5 – 8.1)
Coronary artery disease	1.2 (0.5 – 2.6)	1.4 (0.7 – 2.6)	2.0 (0.6 – 6.6)
Hypertension	1.6 (0.9 – 2.5)	1.2 (0.6 – 2.3)	2.1 (0.3 – 12.2)
Diabetes mellitus	1.0 (0.5 – 1.9)	1.3 (0.6 – 2.7)	5.1 (1.5 – 17.3)

Source: Nash D, Mostashari F, Fine A. et al., op cit

✎7. From Table 2, the relative risk of death among people with diabetes mellitus appears to be substantially increased. Explain the quantitative meaning of this relative risk.

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Answer Key

✎**1. Define *Public Health Surveillance*.**

Answer *(5 points, one for each element)*

- Ongoing collection
- Analysis
- Interpretation
- Dissemination
- Action linked to health and risk factor information

✎**2. Based on the data in Table 1, for which two age groups was the apparent risk of West Nile virus infection greatest? In the space in Table 1, show each calculation to support your answer and give all units. (Note: units must be given to receive credit.)**

Answer *(4 points, 1 pt for each correct age group, 1 for each corresponding calculation; must express as # cases/population/2 months, or 1 month)*

Age groups 70-79 and 80+. See table for calculations and units.

Table 1. Number of hospitalized patients with laboratory confirmed West Nile virus infection, New York City Department of Health, August 1 – September 31, 1999.

Age (yrs)	No. Patients (%)	Population At Risk	Calculations Rate/100K/2mo	Calculations Rate/100K/1mo
0-19	2 (3)	2,324,081	**2 ÷ 2,324,081 = 0.09**	**(2 ÷ 2,324,081) ÷ 2 = 0.05**
20-29	1 (2)	1,553,981	**1 ÷ 1,553,981 = 0.06**	**(1 ÷ 1,553,981) ÷ 2 = 0.03**
30-39	3 (5)	1,549,111	**3 ÷ 1,549,111 = 0.19**	**(3 ÷ 1,549,111) ÷ 2 = 0.10**
40-49	1 (2)	1,177,190	**1 ÷ 1,177,190 = 0.08**	**(1 ÷ 1,177,190) ÷ 2 = 0.04**
50-59	9 (15)	867,331	**9 ÷ 867,331 = 1.04**	**(9 ÷ 867,331) ÷ 2 = 0.52**
60-69	13 (22)	814,838	**13 ÷ 814,838 = 1.60**	**(13 ÷ 814,838) ÷ 2 = 0.80**
70-79	18 (31)	534,785	**18 ÷ 534,785 = 3.37**	**(18 ÷ 534,785) ÷ 2 = 1.69**
>80	12 (20)	281,054	**12 ÷ 281,054 = 4.27**	**(12 ÷ 281,054) ÷ 2 = 2.14**
Sex				
Male	31 (53)	4,289,988	**31 ÷ 4,289,988 = 0.72**	**(31 ÷ 4,289,988) ÷ 2 = 0.36**
Female	28 (47)	4,812,383	**28 ÷ 4,812,383 = 0.58**	**(28 ÷ 4,812,383) ÷ 2 = 0.29**

✎**3. For which single age group was the apparent risk the least? In the space in Table 1, show a calculation to support your answer and give all units. (Note: units must be given to receive credit.)**

Answer *(2 points, 1 for each correct age group and 1 for calculation: must express as # cases/population/week, month, or 2 months)*

Age Group 20-29; See table for units.

✎**4. Given that mosquitoes transmit this disease, give two explanations for the age distribution.**

Answer *(2 points, 1 per valid answer)*

- Older people are more likely than other groups to be bitten by mosquitoes: they may be less likely than others to use protective measures, or they may keep windows open for lack of air conditioning.
- Older people are more susceptible than others to infection.
- Older people are more likely than others to seek medical care: they may have severe disease and be hospitalized.

(Note: Students may give reciprocal answer concerning younger people.)

✎**5. For which gender group is the risk of infection highest? In the table, show your calculations and give all units. (Note: units must be given to receive credit)**

Answer *(2 points)*

1 point for group (men) and 1 point for calculation with units.

✎**6. For the group you determine to be at greatest risk, give one explanation that might account for the increased risk.**

Answer *(1 point)*

- They may be outside more.
- They may be less likely to wear mosquito repellent.

✎**7. From Table 2, the relative risk of death among people with diabetes mellitus appears to be substantially increased. Explain the quantitative meaning of this relative risk.**

Answer *(2 points, 1 for quantifying risk elevation and 1 for mentioning reference group)*

The risk of death from West Nile virus infection for people with diabetes is 5 times greater than that for people without diabetes.