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Insights on Cholera Epidemiology

CHOLERA (etiologic agent: toxin producing *Vibrio cholerae* O1 and O139) is the disease most closely associated with the development of the field of epidemiology.

John Snow, MD, a physician who served during the London cholera epidemic of 1831-1832, in 1849 published a small pamphlet *On the Mode of Communication of Cholera* where he proposed that the "cholera poison" reproduced in the human body and was spread through the contamination of food or water. This theory was opposed to the more commonly accepted idea that cholera, like all diseases, was transmitted through inhalation of contaminated vapors. Unfortunately, at the time Snow had no way to prove his theory. Then in 1854 cholera again affected London and it was Snow's observations and investigations that led to the removal of the Broad Street Pump handle which caused a severe neighborhood outbreak of cholera to end (a simple solution to a complex problem). This time he was able to establish a causal link between cholera transmission and exposure to contaminated water supplies. Snow's techniques and reasoning paved the way for other epidemiologists and many consider him the father of epidemiology and the Broad Street Pump is often used as the icon for the field of epidemiology.

Cholera is no longer a significant public health issue in the US, with no major outbreak in more than 100 years. Yet the disease continues to be contracted both in the US and when citizens travel abroad. Between 1996 and 2005, 29 cases of toxin producing *V cholerae* O1 were contracted in the US – 7 were from eating Gulf Coast seafood, 13 with consumption of seafood from areas other than the Gulf Coast, and 9 exposures were undetermined. Thirteen cases occurred in states outside of the Gulf Coast. Two cases occurred in Louisiana following hurricane Katrina last year (*MMWR* 55:31-32, 2006).

In addition to the 29 cases that were acquired within the US, 35 cases were acquired as the result of travel to for-

eign countries. The Centers for Disease Control and Prevention (CDC) advises that travelers observe food safety recommendations, including not drinking untreated water and not eating poorly cooked or raw seafood, when visiting countries reporting cholera (consult CDC's Yellow Book www.cdc.gov/travel/yb/index.htm). CDC feels that vaccination against cholera is of questionable benefit for US citizens traveling abroad. In fact, the only cholera vaccine licensed for sale in this country has been discontinued by Wyeth Ayerst. Currently, no country or territory requires vaccination against cholera as a condition for entry, although some local authorities may still require proof of vaccination.

The above notwithstanding, cholera remains a serious threat to public health across the world. In fact, it is in its 7th recognized pandemic since 1817. The current pandemic began in 1961 when the disease spread from Indonesia through most of Asia into Eastern Europe and Africa, and from North Africa to the Iberian Peninsula. In 1991, an extensive epidemic began in Peru and spread to neighboring countries in the Western Hemisphere. Currently, a major cholera outbreak is underway in Angola (www.msf.org) with more than 38,897 cases and 1,437 deaths (case fatality rate of 3.6%) as of the 23rd of May (www.who.int/csr/don/en/). In endemic regions, such as South Asia, cholera is seasonal; with explosive outbreaks occurring once or twice a year depending on the region. Outbreaks can be associated with floods or drought.

The disease is caused by toxin producing strains of *V cholerae* O-group 1 and O-group 139. Toxin production is conferred by infection of the bacteria by certain bacteriophages, such as CTX (*Molecular Cell* 19:1-8, 2005). Without these infections, *V cholerae* does not produce toxin. Meanwhile, other bacteriophages in the water can help reduce the risk of an outbreak by limiting the size of the bacterial population (*Proc Natl Acad Sci USA* 102:1702-1707, 2005).

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Two features of cholera outbreaks are puzzling, their almost simultaneous appearance in distinct areas (suggesting an environmental trigger) and their explosive nature. The dynamics between the bacteria and their bacteriophages are key to understanding the geographic epidemiology of the disease. As for the explosiveness of the disease, it has been proposed that hyperinfectious *V cholerae* derive from passage through the human gut and these bacteria have a competitive advantage for <18 hours over organisms living in the environment. The infectious dose of water harboring hyperinfectious organisms is 700 times smaller than that of environmental

toxin producing strains of *V cholerae* (*PLoS Med* 3:e7, 2006). This means that any public health action to reduce direct transmission of cholera will have a large impact on the rate of disease spread. In other words, any measure that delays fecal-oral transmission, even the simple act of washing hands before a meal, would have a stronger than previously expected impact on cholera transmission (again, simple solutions to complex problems). Thus, public health strategies based on increasing hygiene standards would be effective, even if more permanent improvements, such as proper sewage treatment, were impossible (*PLoS Med* 3:e42, 2006).

Fatherhood

ON THE 31ST OF MAY, CDC issued a comprehensive report on fertility, contraception, and fatherhood indicators among men 15-44 years of age in the US (www.cdc.gov/nchs). The data were from the National Survey of Family Growth conducted in 2002. This is the latest survey of this type, and, for the first time, this large-scale, nationwide survey included men. Whenever appropriate, the findings for men and women are contrasted. Men's and women's reproductive experiences vary significantly, and often sharply, by characteristics such as education, income, and Hispanic origin and race. Highlights of the findings included the following.

Teen fathers - Among non-Hispanic black fathers, 25% fathered their first child before they were 20 years old; 19% of Hispanic fathers also became fathers as teenagers, and 11% of non-Hispanic white men became fathers while they were teens.

Non-marital childbearing - About one-half of the men without a high school education have fathered a child outside of marriage compared with about 6% among

college graduates.

Child support – About three-quarters of the 28 million men who have children (under age 19) live with those children. Among fathers who live apart from their children, 85% of fathers with higher incomes contributed to their children's support on a regular basis, compared with 64% of fathers with income below the poverty level.

Marriage and divorce - A third of men marry by age 25; almost two-thirds marry by age 30. Among women, one-half are married by the time they are 25 and three-quarters by age 30. Overall, men marry later in life than women. The average woman marries a man 2 years older than she. One-half of the men who married as teenagers were divorced or separated within 10 years, compared with 17% of men who married when 26 y old or older.

Sexual activity - Men who did not live with both parents at age 14 were more likely to have had sexual intercourse during the teenage years (<20 y old) compared with those who lived with both parents at age 14.

Food Allergens and Food Labels

FOOD ALLERGIES AND FOOD INTOLERANCES are not the same. Food intolerance is defined as an adverse food-induced reaction that does not involve the immune system, eg lactose intolerance. A food allergy, on the other hand, involves an immune system response.

The most common response to a food allergen is the production of immunoglobulin E (IgE) antibodies. When these antibodies react with the allergen, histamines and other chemicals (mediators) can cause hives, asthma or other symptoms of an allergic reaction, the most danger-

ous of which is anaphylaxis.

The Food and Drug Administration (FDA) estimates that approximately 11 million Americans (including 2 million school aged children) suffer from food allergies, with 6.5 million allergic to seafood and 3 million allergic to peanuts or tree nuts. Approximately 30,000 persons require emergency room treatment and 150 die each year because of allergic reactions to food.

As of the 1st of January, the FDA requires food labels to clearly state if food products contain any ingredients with protein derived from the 8 major allergenic foods: milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat, and soybeans. These 8 major food allergens account for 90% of all documented food allergic reactions.

The new law is a provision of the Food Allergen Labeling and Consumer Protection Act of 2004, which mandates that manufacturers identify in plain English the presence of ingredients that contain protein powder from the list of allergenic foods or to say “contains” followed by the name of the source of the food allergen after or adjacent to the list of ingredients. The FDA believes this labeling law will be especially helpful to children who must learn to recognize the presence of substances they must avoid. For example, if a product contains the milk-derived protein “casein,” the product’s label will have to use the term “milk” in addition to the term “casein” so that consumers with milk allergies can clearly understand the presence of an allergen they are to avoid.

The operative word is “contains.” If a “contains” statement is used on a food label, the statement must include the names of the food sources of all major food allergens used as ingredients in the packaged food.

Potpouri

TINEA CAPITIS is a common infection, particularly among young children in urban regions, and is easily passed person-to-person (*Cutis* 77:93-99, 2006). The infection often is seen in a form with mild scaling and little hair loss, a result of the prominence of *Trichophyton tonsurans* (the most frequent cause of tinea capitis in the US). *T tonsurans* does not fluoresce under Wood light, unlike the common tinea capitis-causing fungal organ-

The new law does not require food manufacturers or retailers to re-label or remove products from grocery or supermarket shelves that do not reflect the additional allergen labeling as long as the products were labeled prior to the law’s effective date. Thus, consumers may encounter different labels on the same product, depending on the date of labeling.

What the law does not address is cross-contact contamination which, for example, can occur inadvertently when products that contain allergens and products that do not contain allergens are produced in the same facility. Cross-contact also may occur during customary practices associated with growing and harvesting crops, as well as from the use of shared storage, transportation or production equipment.

This law applies to all packaged foods sold in the US that are regulated under the Food, Drug and Cosmetic Act, including both domestically manufactured and imported foods. Raw agricultural commodities such as fruits and vegetables are not affected. Meat, poultry and egg producers receive guidance from the US Department of Agriculture which requires producers to indicate 12 groups of potential allergens by reference to the source allergen if they are used as an ingredient at any level in pre-packed foods, including alcoholic beverages. The list of potential allergenic ingredients and associated products include: cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk and dairy products, nuts and nut products, celery, mustard and products thereof, sesame seeds and sulphur dioxide and sulfites at concentrations of more than 10 mg/kg or 10 mg/l expressed as SO₂.

(Source: DeSorbo MA. Allergens: a potential kiss of death. April/May 2006 issue of Food Quality. www.foodquality.com)

isms seen in Europe and many other countries, which emit a green fluorescence. However, *T tonsurans*, like other fungi, also may less often produce an intense inflammatory reaction, which is suggestive of an acute bacterial infection.

T tonsurans is a relatively new organism in Europe and is reaching epidemic proportions in some areas of England according to the British Skin Foundation (<http://>

news.bbc.co.uk/go/pr/fr/-/1/hi/health/4972880.stm).

EVERYONE THINKS ABOUT life expectancy from birth, but how many years can a person expect to live once they are a certain age? The table below shows data for three key stages in life in 2003 for US residents and a more detailed table can be found at www.cdc.gov/nchs/data/nvsr/nvsr54/nvsr54_14.pdf.

	Birth	65 y	85 y
All males	74.8	16.8	6.0
All female	80.1	19.8	7.2
White male	75.3	16.9	5.9
White female	80.5	19.8	7.1
Black male	69.0	14.9	6.4
Black female	76.1	18.5	7.8

IN APRIL, the Missouri Department of Health and Senior Services released updated diabetes data (www.dhss.mo.gov/ASPsDiabetes/Main.php?cnty=521). Between 1999 and 2003, 5,212 hospital admissions occurred among Kansas City residents for which diabetes was the principal diagnosis and 50,919 admissions were it was either the principal or secondary diagnosis. For the admissions with diabetes as the principal diagnosis, the rate of age-adjusted admissions per 10,000 population for blacks was 2.86 times that for whites (41.7 and 14.6, respectively). These rates were similar to statewide rates of 13.3 for whites and 41.9 for blacks. For emergency department visits in 2003 with diabetes as the principal diagnosis, the black:white disparity ratio in age-adjusted rates per 1,000 population was 5.4 (6.5 blacks, 1.2 whites). The rate for whites was similar to that for whites statewide (1.1) while the rate for blacks was 1.4 times higher than the statewide rate for blacks (4.6).

In 2003, admissions with diabetes as the principal diagnosis resulted in 5,440 days of care provided with hospital charges of \$17,952,226. There were 2,385 days of care provided to whites with hospital charges of \$8,004,154 and 2,759 days of care provided to blacks with hospital charges of \$9,127,338. For the 1,272 emergency department visits in 2003 the hospital charges were \$1,489,210 (363 visits by whites and \$450,466 in charges; 825 visits by blacks and \$943,639 in charges).

In addition to the above, there were 2,831 admissions

with a diabetes related lower extremity condition listed as the principal diagnosis, and 705 individuals (304 of whom were white and 325 black) underwent lower extremity amputation as a result of their diabetes. The age-adjusted amputation rate for blacks (5.9 per 10,000 population) was nearly three times that for whites (rate of 2.0). The amputation rate of whites was similar to the statewide rate of 2.1 for whites while that for blacks was approximately 11% lower than the statewide rate for blacks (6.6).

Between 2000 and 2004, 276 Kansas City women with insulin dependent diabetes and 1,164 with other diabetes gave birth (rates of 7.5 and 31.6 per 1,000 live births, respectively). Among women with insulin dependent diabetes, 170 were white (rate 7.8) and 87 black (rate 6.8). The black:white disparity ratio was 0.87. Both of these rates were lower than the comparable statewide rates of 9.4 and 10.0, respectively. Among women with other diabetes, 671 were white (rate 30.6) and 408 black (rate 32.1). The black:white disparity ratio was 1.05. Both of these rates were higher than the comparable statewide rates of 27.1 and 28.5, respectively.

THE LUNG CANCER death rate is not higher in female than in male never smokers and there is little evidence of it having increased over time in the absence of smoking (*J Natl Cancer Institute* 98:691-699, 2006). The age-standardized lung cancer death rates among never-smoking men and women were 17.1 and 14.7 per 100,000 person-years, respectively. Lung cancer mortality was higher among black women than in white women.

IN MAY, a 16 y old boy in Houston died from rabies acquired from a bat. The boy had taken a nap and woke up to find a bat flying in his bedroom. That bat was captured with a towel and released. Subsequently, the boy became symptomatic for rabies and died. Although the bat from his bedroom was not tested, rabid bats were found in the neighborhood following his death.

TWENTY-EIGHT POINT FOUR PERCENT of persons with asthma in Missouri are current smokers and 30% were not advised by their health care provider to quit smoking (*Prev Med* 42:286-290, 2006).

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