

The Unfortunate Nurse: A Case Study of Dengue Fever and Social Policy

by

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BEFORE CLASS

Students should read the journal article, “Nosocomial Acquisition of Dengue,” by Dirk Wagner et al., *Emerging Infectious Diseases*, vol. 10, no. 10, pp. 1872–73, October 2004 (available online at <http://www.cdc.gov/ncidod/EID/vol10no10/03-1037.htm>). This is the article that inspired “The Case of the Unfortunate Nurse.” The event described in the article occurred in Freiburg, Germany, but in a global economy air travel for business and recreation have shrunk our world to a “global village” where infection can spread rapidly.

Notice that the article appears in *Emerging Infectious Diseases*, a journal of the Centers for Disease Control (CDC). The CDC is the agency of the United States government charged with monitoring incidence and patterns of infections in our country. The CDC is keenly aware of dengue infection. Endemic in Latin America and Puerto Rico as well as other parts of the world, dengue infection could one day become more common in the continental U.S.

As you read the article, circle all of the terms that you do not understand. You can find definitions for many of these terms using the Medline Plus Medical Dictionary (<http://www.nlm.nih.gov/medlineplus/mpldictionary.html>) or the textbooks available on the PubMed Entrez Bookshelf (see Resources below). Be prepared with a few definitions, as we will go over some of these new words next time class meets. Also pay special attention to the information given in the figure and the table in the article, but do not be concerned if there is much that you do not understand. Do your best and we will demystify the rest together when we discuss the article in class.

We also will generate a list of questions that require further research if we are to accomplish the project outlines given below:

- Approach a scientific paper without fear, identifying and researching unknown terminology.
- Become familiar with the idea of nosocomial infection (note the title of the pre-class reading).
- Become familiar with the idea of emerging pathogens.
- Explore the complex virus/mosquito vector/host infection strategy of dengue virus.
- Become familiar with the following techniques: EIA (ELISA), differential cell counts, and RT-PCR (first introduced in the pre-class reading).
- Explore the idea of “agenda” in science and ethics and politics in public policy-making.
- Learn to communicate information with special attention to the intended outcome and the intended audience.

Resources

Note: Asterisked items 1 and 6 are *required reading* for the case study. You may pick and choose from the rest of the list as desired. Don't be afraid to look further than this list. All Internet addresses were active as of May 5, 2007.

- *1. Wagner, D., de With, K., Huzly, D., Hufert, F., Weidmann, M., Breisinger, S., Eppinger, S., Kern, W.V., and Tilman, M.B. 2004. Nosocomial acquisition of dengue. *Emerging Infectious Diseases* 10(10):1872–1873; see <http://www.cdc.gov/ncidod/EID/vol10no10/03-1037.htm>.
- *2. Neves-Souza, P., Zeredo, E.L., Zagne, S., Valls-de-Souza, R., Reis, S., Cerqueira, D., Nogueira, R., and Kubelka, C.F. 2005. Inducible nitric oxide synthase (iNOS) expression in monocytes during acute dengue fever in patients and during in vitro infection. *BMC Infectious Diseases* 5:64; see <http://www.biomedcentral.com/1471-2334/5/64>.

- *3. Dengue and Dengue Hemorrhagic Fever: Information for Health Care Practitioners, <http://www.cdc.gov/ncidod/dvbid/dengue/dengue-hcp.htm>. Contains good diagrams/slides and other information about the dengue virus, the mosquito vector, and the infectious strategy of the virus.
- *4. Better Environmental Management for Control of Dengue, World Health Initiative, <http://www.who.int/heli/risks/vectors/denguecontrol/en/index.html>.
- *5. Blood Groups and Red Cell Antigens, NCBI, <http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=rbcantigen.chapter.ch1>. Good textbook article on blood and the cells it contains.
- *6. The White Blood Cell and Differential Count. <http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=cm.chapter.4532> In: *Clinical Methods*, 3rd ed., H. Kenneth Walker et al., Butterworths.
- 7. Wikipedia has a good article on white blood cells with photographs that will help you see the morphological differences that allow a trained microscopist to determine leukocyte number, lymphocyte number, neutrophil number, etc.—i.e., to make a “differential count” of white blood cells. See: http://en.wikipedia.org/wiki/White_blood_cell.
- 8. EpiNotes Disease Prevention and Epidemiology Newsletter. South Carolina 2006 List of Reportable Conditions. <http://www.scdhec.gov/health/disease/index.htm>. Look at this to get an idea of what the Reportable Disease forms look like, and where dengue sits on the list. Try to also find sites like this for other southern and southwestern states, which have large Mexican immigrant populations, and Florida, which has large populations of well-traveled retirees.
- 9. Reiter, P., Lathrop, S., Bunning, M., Biggerstaff, B., Singer, D., Tiwari, T. et al. 2003. Texas lifestyle limits transmission of dengue virus. *Emerging Infectious Diseases* 9(1): 86–89. Available at <http://o-www.cdc.gov/mill1.sjlibrary.org/ncidod/eid/vol9no1/02-0220.htm>.
- 10. Medline Plus Medical Dictionary at <http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>.
- 11. PubMed’s Entrez BookShelf, at <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=Books>, is a free, searchable database of on-line college and medical life science textbooks. In the search box at the top of the page, type in your search words (e.g., “ELISA”). Many of the books include downloadable figures, etc., that you can use in your papers and presentations. Just be sure to cite your sources!

Part I—The Unfortunate Nurse

As a class, we are going to act out the scenario below, with students taking the parts of the Narrator, Nancy, Dr. Ghee, and Elaine (Dr. Ghee's nurse).

Narrator: *It is July, and it's sweltering in St. Louis, Missouri. A young woman named Nancy waits nervously in the examining room of a local doctor. There's air conditioning here, but the woman does not look very comfortable. She sighs repeatedly and rubs her neck from time to time. After a brief wait, Elaine, the nurse, enters and takes Nancy's vital signs and updates her chart.*

Elaine: Well, your weight is down a few pounds from your last visit—124 pounds—and it was 128 in, let me see ..., October. It's nothing to worry about of course; 124 pounds is an excellent weight for a young woman your height. Let's see, you're what ..., about 21 years old?

Nancy: I'm 25.

Elaine: Oh, right, of course. Your pulse is normal. Your blood pressure is a little low, but it's within the normal range. You do have a fever though—101.5. How do you feel?

Nancy: I feel awful. I have a headache, and I ache all over.

Elaine: Any nausea?

Nancy: No, not really. But I sure don't feel like eating. I guess that's why I've lost a few pounds. I just feel lousy. But I mean really lousy. It's a couple of days now. I don't get it—it's not flu season, and I had a shot, anyway.

Elaine: Let's see what the doctor says. She'll be right in.

Narrator: *After a short wait, the doctor arrives and the following conversation ensues.*

Dr. Ghee: Hi, Nancy. I haven't seen you for a while. What seems to be the problem today?

Nancy: Well, I got my flu shot last October. All of us got them. But it feels like I have the flu. I have no appetite. I have killer headaches and everything hurts, even my bones! If I stop taking acetaminophen, I get a fever. It's been a few days now.

Dr. Ghee: When you say "all of us," who do you mean ...?

Nancy: All of the nurses on my unit got flu shots—it's required.

Dr. Ghee: Oh, right. You look so young I always think you're still in college. It seems like you were shadowing in this office only last year. But that can't be right. I guess you're a nurse now, right? So, what do you think may be going on?

Narrator: *Nancy hesitates for a moment.*

Nancy: Dr. Ghee, I had a needlestick incident a week or so ago. It was minor, and the patient was HIV negative and she didn't have hepatitis. I didn't think much of it, just cleaned the wound and filled out a report.

Narrator: *Doctor Ghee looks grave.*

Dr. Ghee: Do you know what the patient was hospitalized for, Nancy?

Nancy: She had picked up a case of dengue on vacation abroad. You can't get dengue from a needlestick, can you?

Dr. Ghee: Well, it's possible, although I've never heard of it before. Let's take a more thorough look at you and do some blood work.

Questions

1. How does this story highlight the importance of taking a thorough medical and personal history of a patient? What sorts of questions are important to ask someone who is ill?
2. Why does the doctor want to take a “closer look” at Nancy? What sort of things might she look for?
3. What exactly does “blood work” mean? What kind of tests is the doctor likely to order using the blood and why? What about the urine and/or sputum sample?

Now look over the Figure and Table from the article you read; be sure you understand them and try to interpret the results (see next page). The questions below are intended to guide your understanding of this material.

Further Questions

1. What is a leukocyte? Are leukocytes raised or depleted in Nancy’s blood? What is the usual significance of an elevated leukocyte count? What’s going on with the lymphocytes?
2. An EIA (enzyme-linked-immunosorbent assay, sometimes also called an ELISA) is a frequently used technique that allows medical personnel and researchers to identify and quantitate proteins such as antibodies, antigens, or other immune system chemicals that are present in biological fluids. Antibodies are proteins produced by white blood cells called B cells. They bind in a highly specific “lock and key” fashion to viruses, bacteria, fungi, and to pieces of viruses, bacteria, and fungi. The immune system uses these antibodies almost like handles that aid in clearance of the infecting organisms as well as to tag pathogens and identify them as foreign, which also facilitates clearance and healing. There are several different classes of antibody (or immunoglobulin, as the antibody protein is properly named), including IgM, IgG, IgD, IgA and IgE. IgM is always present on the surface of resting B cells, and is the first class of antibody secreted (released into the fluid portion of the blood) in response to infection. After the immune response matures a bit, with the help of T lymphocytes, the predominant antibody class present switches to IgG. In people who have been previously exposed to a pathogen, memory B cells exist, and these express IgG bound to their cell membranes. Upon stimulation by re-infection, they differentiate into plasma cells that secrete IgG that is directed against the pathogen. In the second set of results, EIA was used to quantify anti-dengue antibodies in Nancy’s blood. What do the results tell you? What new, complementary information is gained from the EIA report?
3. What is the significance of the RT-PCR results?
4. What actions will Dr. Ghee take in treating Nancy?

Note: You may have some trouble answering Question 4. It’s hard to give advice if you don’t have enough background information to make rational decisions. Please list some of the questions that you have about dengue and the related condition known as dengue hemorrhagic fever (DHF). Also list any questions you may have about the techniques or tests used in the journal article.

Homework Assignment

Dr. Ghee also did not know a lot about dengue because it is a disease not often encountered in American doctors’ offices. She went to the Centers for Disease Control (CDC) website and read about the history, immunology, treatment, etc., for dengue. You will also be using this site as a point of departure to prepare PowerPoint presentations answering some of the questions you have generated above.

We will divide up into groups. Each group will use information gained from the Resources in Part I to generate a short PowerPoint presentation on a chosen/assigned topic from the list of questions generated. These will be presented at the next class meeting, and eventually posted on the class website. Each group’s presentation will be graded according to the Presentation Grading Rubric.

In addition, in order to receive credit for this assignment, the group must prepare a one-page summary hand-out for the class and also post the PowerPoint presentation on the class website.

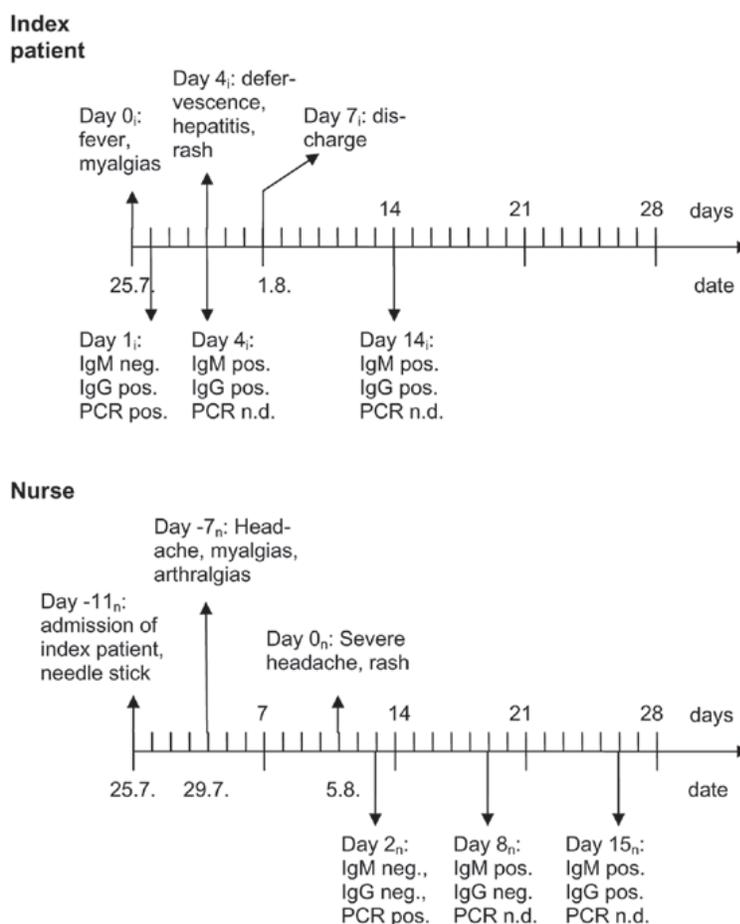
Table

Laboratory data for index patient and health care worker infected with dengue virus*

	Day	Leukocytes (mL)	Lymphocytes (mL)	Thrombocytes (mL)	Dengue IgM EIA	Dengue IgG EIA (U)	Dengue PCR
Index patient	0i	2.000	420	137.000	–	+ (16.4)	+
	4i	1.900	ND	55.000	+	+ (43.0)	–
	14i	5.000	1.650	375.000	+	+ (30.9)	ND
Health care worker	2n	2.600	590	136.000	–	– (2.8)	+
	8n	4.000	1.040	174.000	+	– (5.9)	ND
	15n	4.200	1.190	213.000	+	+ (16.4)	ND
	22n	4.800	1.220	215.000	+	+ (21.7)	ND

*Ig, immunoglobulin; EIA, enzyme immunosorbent assay; PCR, polymerase chain reaction; ND, not done.

Figure



Source: Wagner, D., de With, K., Huzly, D., Hufert, F., Weidmann, M., Breisinger, S., Eppinger, S., Kern, W.V., and Tilman, M.B. 2004. Nosocomial acquisition of dengue. *Emerging Infectious Diseases* 10(10):1872–1873. Retrieved from <http://www.cdc.gov/ncidod/EID/vol10no10/03-1037.htm>.

Part II—Presentations

Each student group will give their presentations. When not presenting, you will be listening to and grading the other groups' presentation using the Presentation Grading Rubric to score each group. The instructor will also score each group using the rubric and make the final assessment grade, taking into consideration the comments of the students. The instructor will share the class comments with each group as well as the final assessment.

It is your job as a member of the “audience” to interact with the presenters, asking questions, etc., as appropriate. At the end of the class session, each student will present a brief outline (about a page) telling what he/she now knows about the facts and background of dengue, and what he/she would still like to learn.

Presentation Grading Rubric

Please evaluate the slide show presentations according to the following rubric.

Title: Have a title, please.

Content: 5 pts

- _____ Students set the topic in context, i.e., explained why this topic is important. (1)
- _____ Students were able to deliver a coherent, detailed explanation for each figure shown. Students gave background material (visually and/or verbally) to help audience understand the presented figures. (2)
- _____ Students did an adequate job of answering questions from the audience. (2)

Organization: 2 pts

- _____ Presentation was organized in a logical, easy-to-follow fashion. (1)
- _____ Presentation had a good balance of visual/verbal material. (1)

Presentation: 3 pts

- _____ Students spoke loudly and clearly. (1)
- _____ Students made eye contact with members of the audience and attempted to engage them; they seemed to care whether they held attention of the audience. (1)
- _____ Talk was neither too long nor too short, and was delivered at an even pace. (Practice your talk and time it; it should be about 15 minutes long.) (1)

In addition, in order to receive credit for this assignment, the group must prepare a one-page summary hand-out for the class and also post the PowerPoint presentation on the class website.

Part III—Dengue in a Social Context / Educating Stakeholders

Before Class

Students should read the January 2003 article “Texas Lifestyle Limits Transmission of Dengue Virus” by P. Reiter et al., *Emerging Infectious Diseases*, vol. 9, no.1, pp. 86–89 (<http://o-www.cdc.gov.mil/ncidod/eid/vol9no1/02-0220.htm>). Again, as you read, circle terms that you do not understand and look up definitions for them using the On-Line Medical Dictionary (<http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>) or other sources. Do your best and we will demystify the rest together in class.

In Class

We will start with a discussion of what we have learned about dengue and what challenges the disease presents to our society.

Questions

1. Legal immigrants typically are tested for certain diseases. Obviously, people entering illegally undergo no such screening. What concerns might that cause in light of recent immigration trends in the United States? What would immigration watch-dog groups say about the cost to society of dengue? Can you think of other examples of medical issues that become entangled in political considerations?
2. From what you have read and the information we have presented in class on the incidence and epidemiology of dengue and on dengue surveillance, do you think we are in much danger of a serious dengue epidemic locally?
3. Consider the Reiter article that you read before class. Describe the climatologic argument for considering dengue as a limited danger. Describe the “life-style” argument.
4. Optional, food for thought: Earlier in this case study, we saw dengue transmitted by a needlestick. Outside of hospitals, dengue is transmitted from person to person via mosquito bite. Why is it that HIV, another blood-borne virus, can be transmitted by needlestick, but is not transmitted by mosquito bite?
5. Your instructor will give you a table or figure showing the National Institute of Health’s projected funding budget for various diseases for 2007. Look it over. Do you think each allocation is defensible? Explain how politics can sometimes drive research funding decisions.

Homework Assignment

The following writing assignment is designed to demonstrate student mastery of the goals for this case study:

As a take-home project, design (with artwork and text) three short (no more than two sides of a page each!) educational brochures on dengue—one appropriate for primary care physicians, a second intended to encourage recently graduated researchers to pursue research in this field, and a third that is appropriate for laypeople who maintain homes or plan to travel into areas where dengue is endemic. Begin sketching your plans in class. Some information may be common to all three brochures and some will be quite different. Your instructor is available for consultation.

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