

Antibiotic Resistance in Hospital Settings

Patient dependency characterizes the epidemiology of disease transmission within multiple small wards with rapid patient turnover. Other variables affecting the epidemiology of resistance are the use of antimicrobial agents, introduction of colonized patients, and efficacy of infection-control measures. A Markov chain model originally made for vector-borne diseases was used to elucidate the relative importance of different routes within intensive care units.

Managing Foot-and-Mouth Disease Epidemics

State-of-the-art modeling approaches were used in Britain during the outbreak of 2001 to address such questions as: Were planned control policies sufficient to bring the epidemic under control? What was the optimal intensity of preemptive culling? Would a logistically feasible vaccination program be a more effective control option? This "real-time" use of models, although of help in devising an effective control strategy, also proved controversial.

Developing Smallpox Models as Policy Tools

Although models of infectious diseases have influenced public policy, that process and its results could be improved by regular, direct contact and communication between modelers, policy advisors, and other infectious-disease experts. At the U.S. Department of Health and Human Services, the Secretary's Council on Public Health Preparedness is sponsoring initiatives using various modeling approaches to assess biodefense strategies.

Common themes in this session were: 1) involving substantive experts, thereby ensuring that conceptual frameworks underlying the mathematics are faithful to current understanding of complex natural phenomena, 2) including all possible interventions, which could then be evaluated alone or in various combinations, and 3) identifying inadequacies in available information, for augmentation through further research.

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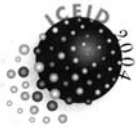
Public Health Workforce Development¹

Until the early 1990s, most of Uganda's public health workforce obtained master's degrees from abroad. The responsibility for health training institutions has been shifting between the Ministry of Health and the Ministry of Education, although it is currently under the Ministry of Health, also the main employer of public health workers. The Ugandan Public Health School Without Walls is an innovative and sustainable model of worker development, conceived in 1994 in partnership with Makerere University, which houses the program; the Ministry of Health; and the development partners, notably, the Rockefeller Foundation, the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO). Up to 145 professionals from medical, biologic, and social sciences have been trained in a 10-year period. The curriculum is flexible and is constantly reviewed and adapted to the local situation. The program is 75% field-based, during which trainees are placed in 15 district training sites under professional working conditions and they also rotate through various Ministry of Health programs, where they get hands-on training. The program emphasizes operational research, dissemination of findings to policymakers, and evidence-based management decisions, features that have translated into marked improvements in the quality of the delivery of health systems in the country. Students participate in both national and international outbreak investigations. Challenges include increasing the numbers of students to match the high demand and increasing the number of learning facilities. Ensuring effective mentorship, appropriate recruitment, career paths for graduates, and sustainability of the program with reduced donor funding are also problems.

Other examples of international public health worker development initiated by WHO and its Communicable Disease Surveillance Response unit for development of training materials in partnership with CDC are the Lyon 2-year training program for laboratory specialists and epidemiologists, Global Outbreak Alert and Response Network, and various internships.

The Council of State and Territorial Epidemiologists (CSTE) conducted an Epidemiology Capacity Assessment survey of all states and territories. As of November 2001, a total of 1,366 persons were employed as epidemiologists in the 44 responding state and territorial health departments; almost half (47.7%) of these epidemiologists were working in infectious disease. The survey found that 42%

¹Presenters: Margaret Lamunu, World Health Organization; Matt Boulton, Michigan Department of Community Health; and Lou Turner, North Carolina Public Health Laboratory.



of all epidemiologists working in state and territorial health department have no formal academic training in that discipline. States reported that approximately 48% of epidemiologists work in infectious diseases (a figure that is close to optimal), but that the rest of the public health disciplines, such as chronic disease, maternal child health, occupational health, oral health, bioterrorism/emergency preparedness, injury, and environmental health, are far below optimal capacity; further, >60% of states epidemiologic funding support comes from federal sources. Most states reported having an insufficient number of epidemiology staff and resources to carry out essential public health services.

In response to the training needs identified by this assessment, CSTE, CDC, and Association of Schools of Public Health developed a 2-year applied epidemiology training fellowship that places trainees in state health departments. CSTE hosted the first national epidemiology workforce summit in January 2004 to identify strategies for building epidemiologic capacity in the U.S. public health system.

Infectious disease testing is one of the core capacities of public health laboratories. Such laboratories play a key role in supporting outbreak investigation and surveillance activities. Public health laboratory staff must meet unique requirements and possess technical skills that require a long learning curve. Staff also need to have the knowledge of public health principals and relevance of their work to public health activities. Special recruitment and retention issues are challenging the public health laboratory workforce, including increasing vacancy rates and an increasing demand for skilled workers in light of the Select Agent Rule. At the same time, technology is changing rapidly, with new tests emerging almost daily. Solutions offered were salary parity with the private sector, innovative training, creation of interest in laboratory sciences, and continuing education. The National Laboratory Training Network has helped by offering courses, and Emerging Infectious Diseases fellowships are also attracting new workers. In 2000, Association of Public Health Laboratories survey of state laboratory directors led to the "Green Book," which forecasts impending vacancies up to 40% in certain public health laboratory areas. This finding led to the development of the Center for Public Health Laboratory Leadership, which offers corrective courses and ventures.

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Methicillin-Resistant *Staphylococcus aureus*¹

Methicillin-resistant *Staphylococcus aureus* (MRSA) is first and foremost a pathogen of healthcare settings. It is the most common pathogen associated with nosocomial infections in the United States, particularly nosocomial pneumonia and surgical site infections. It is also a frequent cause of bloodstream and skin and soft tissue infections. The percentage of *S. aureus* isolates resistant to oxacillin/methicillin in U.S. intensive care units increased from 30% to 40% in the mid-1990s to 57% in 2002.

Data from a recent Duke Infection Control Outreach Network survey indicate that of patients with healthcare-associated MRSA infections, 39% were from nursing homes, 37% had been hospitalized in the previous 90 days, 10% had received home health care, and 10% received dialysis. Data suggest that MRSA bacteremia is associated with an increased likelihood of death, longer hospital stays, and increased cost of hospitalization, when compared with bacteremia levels caused by methicillin-susceptible strains. Increasing resistance to vancomycin among MRSA also complicates therapy, which is already difficult because of multidrug resistance among healthcare-associated MRSA. Because spread of MRSA in healthcare settings is often clonal, hand hygiene and barrier precautions are often effective in interrupting spread. Targeted surveillance for MRSA is also a useful aid for infection control. Data from the Duke network indicate that the spread of MRSA can be curtailed in healthcare settings, given vigilance and adequate funding of infection control activities.

MRSA is now spreading in community settings. Reports from the early 1980s indicate that patients in the community without established risk factors for MRSA (i.e., recent hospitalization, residence in a long-term care facility, or dialysis) sought medical care with MRSA infections. In the late 1990s, four children in Minnesota and North Dakota died from community-associated MRSA

¹Presenters: Keith Kaye, Duke University; Ruth Lynnfield, Minnesota State Department of Health; and Barry Kreiswirth, New York University Public Health Research Institute.