The rate of infectious disease outbreaks and the number of unique illnesses causing them is increasing around the globe, according to a new Brown University analysis of more than 12,000 outbreaks affecting 44 million people worldwide over the last 33 years.

**Talking points**

- My background…
- Globalization / ID
- Bugs / Antibiotic resistance
- Saving Lives in the Shadows of Healthcare
  - Hygiene Specialists
  - Public Health
  - Medical Laboratory
- Our call to action – concluding thoughts

**Who am I to talk to you?**

- Education & credentials
- Career
  - DSHS / CDC
  - Texas State University – CLS Program
  - ACC
- Research
- Mission / Passion

**Globalization & Infectious Diseases**

- Several human activities that characterize the Anthropocene account for the increases in NTDs.
- See figure to facilitate the emergence of two of the most devastating NTDs in 2014 and 2015—Ebola and Zika virus infections, respectively.
- Likewise, as well as other high-disease-burden NTDs such as the cutaneous and visceral forms of leishmaniasis and schistosomiasis.

**Globalization & Infectious Diseases**

- For consideration…
  - “While we advance through a geological epoch that increasingly reflects human intervention on a massive scale, we might expect to see the continued expansion of epidemic neglected tropical diseases (NTDs), as we have recently seen for Zika and Ebola viral infections.”

**Learning Objectives**

1. Discuss the factors associated with the globalization of infectious diseases.
2. Correlate the local and global issue of antibiotic resistance with globalization.
3. Discuss the different professionals who are often overlooked in the fight against HAI and antibiotic resistance.
Poverty is front and center. NTDs are most common in the setting of poverty while simultaneously helping to perpetuate poverty through their long-standing negative effects on maternal and child health and human productivity and labor.

Yet another feature of Zika, leishmaniasis, Chagas disease, and other NTDs is their propensity to strike the poorest people who live in the wealthiest group of 20 countries, such as Brazil or Mexico.

Today, most of the world’s NTDs paradoxically occur in the world’s largest economies, but mostly among the disenfranchised poor in those nations.

Poverty and “Blue Marble Health”

The concept of “blue marble health” has been invoked to describe the surprising disease burden of NTDs among the poor living in these countries.

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Globalization & Infectious Diseases

- Global Health Revolution
  - Global life expectancy
    - 1948 – 46 years
    - 1999 – 65 years
    - 2015 – 71 years

- Global health revolution
  - Health care and prevention, communications, agricultural productivity, trade
  - While life expectancy around the world has risen by an average of 10 years in rich nations, the US is lagging behind. It is among the bottom 10 countries…

Science and the “Conquest” of Infectious Disease

- Scientific triumphs: Antibiotics, Vaccines, Sanitation
  - Led scientists 50 years ago to proclaim that “we” would conquer infectious disease by turn of 21st century (1977: Smallpox Zero)
  - Other “conquests” in public health or medicine?

But…hold up!

- Optimism based on false assumptions:
  - Diseases could be geographically isolated / “systematically controlled”
  - Microbes didn’t change / “We’re smarter”

Microbes don’t read the books or play by the rules!

- Since 1973:
  - ~31 Emerging Infectious Diseases (EIDs)
    - HIV/AIDS, Hepatitis C, Lyme Disease, Ebola, Hantavirus, SARS, Zika, etc.
  - ~20 Reemerging Diseases
    - TB, diphtheria, malaria, cholera, yellow fever, etc.
“No microbe in the world is now more than 24 hours away from the gateways of every industrial country.”

“As the HIV disease pandemic surely should have taught us, in the context of infectious diseases, there is nowhere in the world from which we are remote and no one from whom we are disconnected.”

– IOM, 1992

Interdependence: The Shrinking World

• 1 billion people cross international borders each year or 25/second
  – unprecedented vulnerability
  – Threats spread faster, further, and non-linear
• Increased threats of global pandemics
  – Significant risk in resource-poor countries with under funded public and animal health systems

Source: Professor William Powderly, J. William Campbell Professor of Medicine, Director, Institute for Public Health, Health Challenges: The need for Transdisciplinary Science

Increase in global travel and tourism, as predicted in the early 2000’s -WHO.

Microbes don’t read the books or play by the rules!

Global Influences on Health

Demographic and Social Changes

Health

Economic Changes

Environmental and Climate Changes
**Why is the Reemergence of Infectious Disease a Global Issue?**

- Infectious Disease is the leading cause of death globally
- Greatest impact in LDCs (sub-Saharan Africa 50% of deaths from ID globally), exacerbating other problems
- Growing evidence infectious pathogens contribute to other diseases (cancers, heart disease, Alzheimer’s, Parkinson’s, etc.)
- High economic costs: trade disruptions, tourism

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**Factors Leading to Emergence and Reemergence of Infectious Disease**

- I. Microbial Adaptation
  - Genetic mutation and evolution
  - Resistance to antibiotics
  - Resistance to pesticides/disinfectants (e.g., malaria, HAIs)

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**The Bottleneck Effect**

**Factors Leading to Emergence and Reemergence of Infectious Disease**

- II. Human Activity
  - A. Demographics:
    - Population Growth (densities spread disease)
    - Urbanization > rural-urban migration
    - Sudden movements of people > refugees and internally displaced populations

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**The Rise in the Population in the U.S. and Urbanization**

- The U.S. has seen >3X population growth in the past 100 years.
- The percentage of the U.S. population living in urban areas has increased dramatically in the past 100 years

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**Factors Leading to Emergence and Reemergence of Infectious Disease**

- II. Human Activity
  - B. Human Behaviors
    - Multiple sex partners
    - Sex industries
    - Intravenous drug use
    - Misuse of antibiotics
    - Institutions (hospitals, daycare) that incubate
Factors Leading to Emergence and Reemergence of Infectious Disease

II. Human Activity

C. Global Commerce and Travel
- Air Travel since the 1970s (\(^\text{\textsuperscript{+}}\) transmission)
- Movement of People (tourists, migrants, military personnel) spread pathogens to new populations
  - Sometimes naïve populations (low immunity)
- Commerce spreads contaminants across borders via food, plants
- Hitchhiking insects (e.g. Foot and Mouth Disease)

D. Globalization of Food Supplies
- Free trade and comparative advantage
- Limited regulation of food production, preparation, handling and outdated laws
- Cheap animal feed (Mad Cow Disease and new variant -- Creutzfeldt-Jakob)
  - (e.g. human food lobby, animal industry & McDonalds)

E. Economic Development & Environmental Degradation
- Changes in land use > reforestation; encroachment on tropical forests; conversion of grasslands to farms; clearance of rainforests
- Zoonotic diseases (animal > human)
  - e.g. Flu, SARS

F. Climate Change
- Global warming favors mosquitoes, rodents, other insects > spread of malaria in highland areas; spread of subtropical diseases into US
- Ocean algae blooms
- Weather patterns (impact of floods, droughts)

G. Breakdown of Public Health & Medical Laboratory
- Complacency > faith in antibiotics and vaccines undermined spending
- Failure to keep up with new technologies
- National disasters and economic collapses (impact of structural adjustment programs)
- Hidden professions / recognition / understanding
A Case Study > Emergence of Ebola in West Africa -2014

Recent Wars/ Conflict
Distrust in Public Institutions
Behavioral/cultural issues enhancing transmission
Increased urbanization
Population mobility

Inter-species transmission? (fruit bats)

A Case Study - Transmission of Ebola

• Individuals are only infectious if they have symptoms of Ebola.
  – No risk of transmission from people who have been exposed to the virus but are not yet symptomatic.
• Ebola spreads through direct contact with bodily fluids.
  – In the 2014 outbreak, most new cases were occurring among people who have been taking care of sick relatives or who have prepared an infected body for burial.
  – Health care workers are at high risk
  • Need personal protective equipment (PPE) and training to use and decontaminate it.
• The virus can survive on heavily contaminated surfaces, objects contaminated with bodily fluids, e.g., latex glove or a hypodermic needle, may spread the disease.

Best-case scenario
11,000-27,000 cases through Jan.

Worst-case scenario
537,000-1.4 million cases through Jan.

Global Challenges
• Challenges are interdependent: an improvement in one makes it easier to address others; deterioration in one makes it harder to address others.
• Challenges are transnational in nature and trans- institutional in solution.
  – Cannot be addressed by any government or institution acting alone.
  – Need collaborative action among governments, international organizations, corporations, universities, NGOs, and creative individuals.

Ebola – a Global Crisis needing a global large-scale, coordinated humanitarian, social, public health, and medical response

Public Health
• Classic public health measures (case identification, contact tracing and isolation)
• Safe and effective interventions including behavioral changes, developed in collaboration with the affected communities.
• Appreciation of the culture of the societies in the affected countries and redevlopment of local trust in governance.
• Coordination and real-time, open sharing of information across disease disciplines and with all the players involved.

Medical Science
• Development of diagnostic tools, therapies, and vaccines.
• Performance of clinical research in the midst of care.
• Development of an accepted, ethical mechanism for accelerating development and testing such interventions in epidemic situations.
• Qualified PERSONNEL!

Adapted from Farrar and Piot, NEJM 2014
HIV, SARS, MERS, Ebola 2018, Zika, Salmonella, HepA, E. coli, Flu (always), Newcastle…. A new threat……..What next?

• Global vulnerability remains
  - Microbial evolution
  - Opportunities for exposure
  - Human behaviors
• Most countries lack adequate public health infrastructure to cope
• PERSONNEL / FUNDING

Globalization & One Health

- Transdisciplinary science explains but can it anticipate?
  - Better models of prediction
  - Better tools for surveillance
  - Better modes of response
  - Critical role for education
    - Future leaders
    - Current public

#HealthLiteracy and #SciComm are CRITICAL in the new reality of Globalization of infectious disease

Antibiotic Resistance – The Bugs

WHO
- $100 trillion
- 10 million
- 2050
- Healthcare Associated Infections (HAIs)
  - 1 in 25
  - 1/3 sec

Beware of the healthcare setting……and, community settings!

HAIs – examples

- Ten most common pathogens that account for 84% of all HAIs
  1. Coagulase-negative staphylococci (15%)
  2. Staphylococcus aureus (15%)
  3. Enterococcus species (12%)
  4. Candida species (11%)
  5. Escherichia coli (10%)
  6. Pseudomonas aeruginosa (8%)
  7. Klebsiella pneumoniae (6%)
  8. Enterobacter species (5%)
  9. Acinetobacter baumannii (3%)
  10. Klebsiella oxytoca (2%)
HAIs – examples (continued)

- Approximately 16% of HAIs were associated with multidrug-resistant pathogens
  - Methicillin-resistant *Staphylococcus aureus* (8% of HAIs)
  - Vancomycin-resistant Enterococci (VRE) (4%)
  - Carbapenem-resistant *P. aeruginosa* (2%)
  - Extended-spectrum cephalosporin-resitant *K. pneumoniae* (1%)
  - Extended-spectrum cephalosporin-resitant *E. coli* (0.5%)
  - Carbapenem-resistant *A. baumannii, K. pneumoniae, K. oxytoca, E. coli* (0.5%)

Research shows that nearly 75% of patients’ rooms are contaminated with MRSA and 69% with VRE!

~ Contaminated surfaces increase cross-transmission ~


HAIs: Some perspective….

- While Ebola and Zika is on everyone’s mind and concern…..consider these numbers.

- Healthcare Associated Infections (HAIs) are responsible for roughly 200 deaths per DAY
  - Everyday!
  - We need #Perspective

“Clean, does not necessarily mean microbially clean, or sterile!”

HAIs continued

200
Hidden Professions that Save Lives....

- We are behind the scenes like the airport ground crew...
- We are not the pilot, flight attendant, ticket taker
  - People you see….doctor, nurse, pharmacist.
- We are the Healthcare Ground Crew

Hidden Professions that Save Lives....

- Hygiene Specialist
- Public Health Professionals
- Medical Laboratory Professionals
  - Medical Laboratory Technicians (MLT)
  - Medical Laboratory Scientists (MLS)
  - Specialists

Hidden Professions that Save Lives....

- Hygiene Specialists
- #SecretWeapon
- #Multimodal

A secret weapon for preventing HAI

A scientist's message to hospitals trying to rid themselves of healthcare-associated infections

By: Rodney L. Babcock, P.D.

I teach a microbiology class for future nurses, and the subject that day was a rather complex discussion of microbial control. In an aside, I happened to tell my students of what I believe to be an overlooked "secret weapon" in reducing and preventing HAI (healthcare-associated infections) in hospitals: the housekeepers — or more accurately, the environmental services staff. After all, as I often tell my clinical laboratory science students, "What is done not necessarily done medically..."
Hidden Professions that Save Lives….

• Public Health Professionals
• Laboratory
• Epidemiology

Hidden Professions that Save Lives….

• Medical Laboratory Professionals
  – MLS, MLT, specialists
• #Lab4Life
• #WeSaveLivesEveryday

Hidden Professions that Save Lives….

• Challenges
  – Recognition
  – Understanding
  – Dangerously dwindling numbers

Our Call to Action!

• Abx stewardship
• Awareness
• Education
• Communication
References

- https://www.cdc.gov/drugresistance/
- Professor William Powderly, J. William Campbell Professor of Medicine, Director, Institute for Public Health. Health Challenges: The Need for Transdisciplinary Science. PPT
- Review on Antimicrobial Resistance: https://www.review.org/

Questions / Concerns

- THANK YOU!
- #WeSaveLivesEveryday
- #EverydayHeroes
- Make a difference... because...
- For more information: See http://rodrenewalsho.wp.txstate.edu/
- https://www.youtube.com/watch?v=JLKh_WzKwiU