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PROSPECTS OF SCIENCE
AND TECHNOLOGY IN
REALIZATION OF THE
MILLENNIUM
DEVELOPMENT GOALS
2008

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SCHOOL OF SCIENCE

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The Challenges and Prospects of science and Technology in Realization of the Millennium development Goals 2008
FOREWORD

It is heartwarming that we have been able to come up with this issue of the Journal of the School of Science. It has not been easy. I consequently appreciate the efforts of all that have contributed to the successful accomplishment of the task of this journal – the Editors; Consulting Editors; our numerous Assessors; Members of the School of Science Journal Committee; and all the contributors to this edition.

It is our aspiration to continue to improve. We therefore welcome constructive criticisms and objective suggestions to this end. The next edition shall be released more promptly with improvement. We have therefore worked towards having increased patronage.

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Abstract
The discovery and use of antibiotics to fight infection brought great relief and joy to mankind. However, in the past two decades the world has been experiencing the presence of diseases that were previously unknown among human beings. These new set of diseases are called emerging diseases. Also experienced is the resurgence of old diseases which were thought to have been conquered. These diseases are called reemerging diseases. The emerging and reemerging of diseases in the society have been attributed to some factors such as close relationship with some animals like cat, changes in human behaviour, use of pesticide and decrease in compliance with vaccination policy. The sensitization of the society on emerging and reemerging infectious disease and the causes will help to control the rate of its presence in the world.

Introduction
Mankind has always being confronted with natural disasters - storm, flood, earthquake, hunger etc and man made disasters such as war, pollution, accident, terrorism etc. Another disaster confronting human beings are diseases such as measles, cholera, malaria, cancer, diabetes, hypertension, typhoid fever, etc. Disease is a condition whereby part or all of an organism's normal function is upset. A disease is usually associated with a particular symptom that helps to define or diagnose it. (Allan and Greenwood, 2001) Disease sometimes referred as a medical condition is further defined as an abnormality of the body or mind that causes discomfort, dysfunction, or distress to the person afflicted or those in contact with the person. A condition that may result in the concerned person who suffers from it not behaving in a way that is natural for his species or his nature. Sometimes disease is used broadly to include injuries, disabilities, disorders, syndromes, infections, symptoms, deviant behaviours, and atypical variations of structure functions (www.wikipedia.org/wiki/diseases).

Disease is broadly grouped into two: infectious and non-infectious diseases. Infectious disease is an illness caused by an organism that enters the body then grow and multiplies in cells, tissue or cavities of the body. Infections can be acute - such as influenza - with the disease occurring in a short duration and being contagious for a short period of time. Infectious diseases can be chronic - such as Hepatitis B and C - with a long duration of communicability due to continual reproduction of the pathogen. The organism that causes infectious diseases is sometimes referred to as pathogenic agent. The pathogenic agents are: virus, bacteria, fungi, protozoa and rickettsia, metazoa/ helminths (parasitic worms). Infectious disease is contagious in nature, it is transmitted from infected person, vector (animal and arthropod), infected water, food and infected innate objects such as clothing, soil, etc to other individuals (Precott, 2007 Insel and Roth, 2004, Lucas and Grill, 2003, Davis and Lederberg, 2000). Non-infectious disease is a disease that cannot be transmitted from diseased person to a non-diseased person. However, pathogenic agents sometimes may play a role in the onset of non-infectious disease, but cannot be transmitted from one person to person. This group of disease could be caused by lifestyle, environment or human-induced factors, genetic, poor nutrition, mental/psychological factors, age and metabolic problems. Some non-infectious diseases are sickle cell anaemia, diabetes, psychosis, hypertension, arthritis, beriberi, cancer (Insel and Roth, 2004, Lucas and Grill, 2003, Davis and Lederberg, 2000).

Human beings had from time been exposed to different types of infectious diseases which had claimed millions of life. For example, in 1347 a ship carried a plague called 'Black Death' which were bubonic plague and pneumonic plague; from the Crimea berthed in Messina on the Sicily Island and spread to other
parts of Italy. This plague claimed millions of life. In the 16th century another outbreak of epidemics proved even more deadly than the earlier plague that ravaged the new world. In 1518, there was an outbreak of smallpox in Hispaniola Island and other countries; this also claimed many lives. For instance Mexico’s population was reduced from 30 million to 3 million and Peru from 8 million to 1 million. The gravity of smallpox was described to have claimed hundreds of millions of live far more than plague and all the wars of the twentieth century combined. (Awake, 2004)

There came victory over infectious diseases at the discovery of the causes of disease and also proffered cure for them through vaccine and antibiotics along side with application of the principles of hygiene in the 20th Century. As more research took place, more antibiotics were developed. In the last 60 years, antibiotics have become an indispensable weapon in the fight against infectious diseases as they have helped practically all of us shrug off one infection or another (Davis and Lederberg, 2000). Unfortunately, in spite of the remarkable victory over infectious diseases, infectious disease remains the world’s leading cause of death worldwide for three reasons: (1) emergence of new infectious diseases (2) re-emergence of infectious diseases (3) persistence of intractable infectious diseases. www.niaid.nih.gov/research/topics/emerging/introduction.htm

EMERGING AND REEMERGING INFECTIOUS DISEASES

Fifty years ago many people believed mankind age long battle against infectious diseases was virtually over as many diseases have been made obsolete and many more are drawing closer and closer to being conquered through the advancement science. Hence mankind is the winner. However, the events of the past two decades have shown that human beings are not winning the battle against infectious diseases. For example report have shown that for the past two decades, at least a dozen new diseases have been identified (such as Acquired Immune Deficiency Syndrome (AIDS), Legionnaire Disease and Hantavirus Pulmonary Syndrome West Nile Bird, Flu, Bio-Engineered Diseases etc), and traditional or old diseases that appeared to be “on their way out” or protected against (such as malaria and tuberculosis) are resurfing (Lynn and Smith, 2001, Davis and Lederberg, 2000, http://www3.niaid.nih.gov/research/topics/emerging/research.htm, http://educate-yourself.org/ed/). The United State Government Accountability Office (2004) equally reported that the new diseases unknown in United States just a decade ago such as West Nile virus and Severe Acute Respiratory Syndrome (SARS) emerged and known infectious diseases consider to be in decline have reappeared with increase in frequency.

The surging and resurfing of infectious diseases can be referred to as emerging and remerging of infectious diseases. Davis and Lederberg (2000) stated that emerging infectious diseases are (1) disease that have never occurred in humans before (2) have occurred previously but affected only small number of people in isolated places e.g. AIDS, Ebola and hemorrhagic fever (3) have occurred throughout human history but have recently been recognized as distinct diseases due to infectious agent (e.g. Lyme disease and gastric ulcer). Emerging diseases include outbreaks of previously unknown diseases or known diseases whose incidence in human has significantly increased in the past two decades. Re-emerging diseases are diseases that were once health problems globally or in a particular country and then declined dramatically, but are again becoming health problem for a significant proportion of the population (malaria and tuberculosis). Re-emerging diseases are known diseases that have re-appeared after a significant decline in incidence. Within the past two decades, innovative research and improved diagnostic and detection methods have revealed a number of previously unknown human pathogens. For example, within the last decade chronic gastric ulcers, that were formerly thought to be cause by stress or diet, were found to be the result of infection by the bacterium helicobacter pylori (www.nih.gov/research/topics/emerging/introduction.htm)
Emerging and Re-emerging Infectious Diseases

Some of the emerging diseases according to Davis and Lederberg (2000) are shown below:

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Infectious agent</th>
<th>Year recognized</th>
<th>Contributing factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lassa fever</td>
<td>Arenaviridae family (virus)</td>
<td>1969</td>
<td>Urbanization and other conditions that favour the rodent host; nosocomial transmission</td>
</tr>
<tr>
<td>Ebola hemorrhagic fever</td>
<td>Filoviridae family (virus)</td>
<td>1977</td>
<td>Unknown natural reservoir, nosocomial transmission</td>
</tr>
<tr>
<td>Legionnaire disease</td>
<td>Legionella pneumophilia</td>
<td>1982</td>
<td>Cooling and plumbing systems</td>
</tr>
<tr>
<td>Hemolytic uremic syndrome</td>
<td>Escherichia coli 0157:H7</td>
<td>1982</td>
<td>Mass food production systems</td>
</tr>
<tr>
<td>Lyme borreliosis</td>
<td>Borellia burgdorferi (bacterium)</td>
<td>1982</td>
<td>Conditions favouring the tick vector and deer, such as reforestation near homes</td>
</tr>
<tr>
<td>AIDS</td>
<td>Human immunodeficiency (virus)</td>
<td>1983</td>
<td>Migration to cities, global travel, transfusions, organ transplants, intravenous drug use, multiple sexual partners</td>
</tr>
<tr>
<td>Gastric ulcers</td>
<td>Helicobacter pylori (bacterium)</td>
<td>1992</td>
<td>Newly recognized as due to infectious agents</td>
</tr>
<tr>
<td>Cholera</td>
<td>Vibrio cholerae 0139 (bacterium)</td>
<td>1993</td>
<td>Evolution of new strain of bacteria combining increased virulence and long term survival in the environment</td>
</tr>
<tr>
<td>Hantavirus pulmonary syndrome</td>
<td>Bunyaviridae family (virus)</td>
<td></td>
<td>Environmental changes favouring contact with rodents</td>
</tr>
<tr>
<td>Pandemic influenz</td>
<td>Orthomyxoviridae family (virus)</td>
<td></td>
<td>Pig duck agriculture (possibly)</td>
</tr>
</tbody>
</table>
Other emerging diseases are Severe Acute Respiratory Syndrome (SARS) and Avian (bird) flu caused by Influenza A virus that occur naturally among birds infected human beings in 2003 (National Aviation Resource Manual for Quarantifiable Diseases, 2006).

### Re-emerging Diseases

Some re-emerging diseases according to Davis and Lederberg (2000) are shown below:

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Infectious agent</th>
<th>Contributing factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cryptosporidiosis</td>
<td>Cryptosporidium parvum (protozoa)</td>
<td>Inadequate control in water supply, international travel; increased use of child-care facilities</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Corynabacterium diptheriae (bacterium)</td>
<td>Interruption of immunization program due to political changes</td>
</tr>
<tr>
<td>Malaria</td>
<td>Plasmodium species (protozoa)</td>
<td>Drug resistance, favourable conditions for mosquito vector</td>
</tr>
<tr>
<td>Meningitis, necrotizing fascitis</td>
<td>Group A streptococcus (bacterium)</td>
<td>Uncertain</td>
</tr>
<tr>
<td>(flesh-eating diseases), toxic shock syndrome, and other diseases</td>
<td>Bordetella pertussis (bacterium)</td>
<td>Refusal to vaccinate based on fears the vaccine is not safe; other possible factors; decreased vaccine efficacy or warning immunity among vaccine adults</td>
</tr>
<tr>
<td>Rabies</td>
<td>Rhabdovirus group (virus)</td>
<td>Breakdown in public health measures; changes in land use; travel</td>
</tr>
<tr>
<td>Rubeola (measles)</td>
<td>Morbillivirus genus (virus)</td>
<td>Failure to vaccinate; failure to receive second dose of vaccine</td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>Schistosoma species (helminth)</td>
<td>Dam construction; ecological changes favouring small host</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Mycobacterium tuberculosis (bacterium)</td>
<td>Antibiotic-resistant pathogens; immunocompromised populations (malnourished, HIV-infected, poverty-stricken)</td>
</tr>
<tr>
<td>Yellow fever</td>
<td>Flavivirus group (virus)</td>
<td>Insecticides resistance; urbanization; civil strife</td>
</tr>
</tbody>
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### Why of Emerging and Re-emerging Infectious Diseases

Emerging infectious diseases according to Heyman (2000) are closing, or have the potential to close windows of opportunity for infectious diseases eradication or elimination. Shortly, after the declaration of the eradication of small pox in the 20th century, another infectious disease, Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome (HIV/AIDS) appeared and rapidly colonized Africa and the world.

Innovative research and improve diagnostic and detention methods have revealed a number of unknown human pathogens. For example, within the past two decades, chronic gastric ulcer that was formerly thought to be caused by stress or diet was found to be as a result of infection by the bacterium Helicobacter pylori.

2. Other causes of emergence of infectious diseases are changes in human demographic, behaviours, land use, etc. The stated factors are contributory to new diseases emergence by changing transmission dynamics to bring people into closer and more frequent contact with pathogen. Exposure to animal or arthropod as pets and food sources contribute to the rise in opportunity for pathogens to jump from
animal reservoirs to human being. For example close contact with exotic rodents imported to USA as pets were found to be the origin of the rodent outbreak of small pox, and the use of exotic cats for meat in China was the route by which the SARS corona virus made the transmission from animal to human host.

3. Natural genetic variations, recombination and adaptations are other causes of emergence and re-emergence of infectious diseases. These factors allow new strains of known pathogens to appear but the immune system has not been previously exposed and is therefore not primed to recognition (e.g. influenza).

Human behaviour plays an important role in re-emergence of infectious diseases. For example, increased and sometimes imprudent use of antimicrobial drugs and pesticides has led to the development of resistant to pathogens, thereby allowing many diseases that were formerly treatable with drugs to make a comeback (e.g. tuberculosis, malaria, nosocomial and food borne infections).

4. It has been discovered that recent decreased compliance with vaccination policy has also led to re-emergence of diseases such as measles and pertussis that were previously under control.

5. The use of deadly pathogens, such as smallpox or anthrax, as agents of bio-terrorism is an increasing acknowledged threat to the civilian population. Also many important infectious diseases have never been adequately controlled, either at the national or international level. Infectious diseases that have posed ongoing health problems in developing countries are re-emerging in the US such as food and water borne infections, dengue fever and west Nile virus.

**Recommendation**

Considering the rate of emerging and re-emerging diseases worldwide, the Nigerian Government should be more alert and sensitive to protect the citizens. There should be high sensitization through school health education on the occurrence of such diseases.

The people should be educated on the need to utilize health care services in time of illness.

**Conclusion**

The belief of man is that scientific discovery has almost brought to an end the presence of infectious diseases in mankind. Unfortunately the activity of mankind in the environment has given room for new diseases to emerge and the traditional diseases to stage a comeback in the society. The society should be sensitized about the presence of new disease and reemergence of the old diseases and their possible causes.
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