Prevention, identification and management of infections in health workers in the context of COVID-19

2022.4.07-2022.4.30

Second year PhD student (D2) at
Lab. of DDS Design and Drug Disposition,
Graduate School of Medical and Pharmaceutical Sciences, Chiba University
LIU YI

2022.9.29

Overview

Organization

World Health Organization

Modules

- Understanding SARS-CoV-2 infection in health workers
- Preventing SARS-CoV-2 infections in health workers
- Managing SARS-CoV-2 infections in health workers

Purposes

Health workers are people engaged in actions with the primary intent of enhancing health, including social care workers who often have roles in the provision of care in long-term care facilities and in community settings.

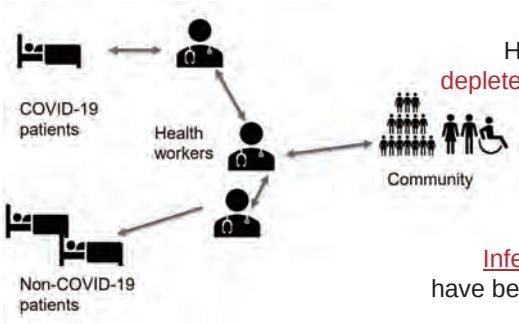
Purposes

- Highlight the epidemiology and risk factors associated with health worker infections with SARS-CoV-2.
- Review measures that can be put in place to reduce risks.
- Support identification of infection in health workers and review strategies for managing health workers to safely return to work post infection.

Epidemiology of Infections in Health Workers

Some studies* have found:

- the incidence of health workers who are PCR positive is between 0.4% to 49.6%.
- reported health worker infections in Europe and the Americas ranges from 1-32% of all confirmed cases in those regions.



Health worker infections lead to a depleted workforce in a time of high demand.

Training and education of Infection prevention and control (IPC) have been associated with decreased infection risk in health workers.

Key IPC strategies in the context of COVID-19

1. Elimination

vaccines, antimicrobials

2. Engineering and environmental controls

- ventilation 
- use of physical barriers (e.g. at reception desks)
- adequate spacing between patients and between health workers
- infrastructure for items such as hand hygiene and waste management 

Key IPC strategies in the context of COVID-19

3. Administrative Controls

- Policies, procedures and processes for screening, early recognition and source control for suspect and confirmed cases
- Regular education and training of all staff on IPC measures (safe handling of sharps, environment cleaning, etc.)

4. The use of personal protective equipment (PPE)

- Adequate training in the use of PPE
- Timely access to sufficient supplies and appropriate sizes
- Universal masking policies for health workers

Managing SARS-COV2-2 infections in health workers

1. Reporting exposures

- Policies and procedures should be in place: health workers should be encouraged to report any exposures to a patient with SARS-CoV-2 infection, in a confidential manner.
- A blame-free system should be in place.

2. Managing health worker infections- symptomatic or positive

- Any health worker who identifies as symptomatic or has a positive test result for SARS-CoV-2 virus should:

• immediately stop work
• self-isolate
• notify their supervisor, to receive more instructions
• seek care if feeling unwell or symptoms worse

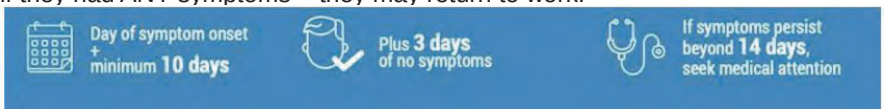
Managing SARS-COV2-2 infections in health workers

Asymptomatic:

• if a person tested positive and was asymptomatic throughout their illness - they may return to work 10 days after their positive test.

Symptomatic:

- if they had ANY symptoms – they may return to work:



Upon return to work, health workers should receive the following supports:

- refresher training in IPC and recommended public health measures
- continue to self-monitor for symptoms
- ongoing support for potential long-term health complications and potential psychological implications

Summary & Learning Outcomes

- **Infection prevention and control programmes** and training could be effective in reducing health worker SARS-CoV-2 infections.
- **Screening and testing** of health workers are strategies that can assist with early identification of health worker infections.
- **A blame-free system** should be in place to promote and support policies that allow health workers to report any exposures.
- Health workers who **develop symptoms of SARS-CoV-2 infection or test positive should stop working immediately** and seek advice from Occupational Health.
- Health workers **can safely return to work post** SARS-CoV-2 infection in consultation with their physician, Occupational Health and IPC.

Impression

There was an urgency to slow the spread and keep health systems from being overwhelmed with patients. An equally serious concern was avoiding system collapse by protecting the safety of health workers.

IPC occupies a unique position in the field of patient safety and quality universal health coverage since it is relevant to health workers and patients at every single health care encounter.

Highly effective vaccines and medicines in prevention and treatment for health workers with highly risk exposure to patients infected with covid-19 might be needed.

September. 29. 2022. Presentation about MOOCS

From June. 1st. 2022. to September. 24. 2022

Udacity's Free Courses for Data Scientist

Name: Katsuyuki Chida
Affilation: Graduate School of Medical and Pharmaceutical Sciences
Grade: Second year of Doctor course

Free Courses I Took and The Goal of This Presentation

I took these courses
- **Data and Visual Analytics**
- **Statistics**
- **AI Fundamentals**

Only introduction to Artificial intelligence (AI) with Microsoft Azure, a data analysis platform

Why I chose these courses?

I started my data science research.
Statistical and data analysis skills are essential for data science.

Today's goal

Share what you can learn at Udacity as a foundation for getting started in data science

This presentation includes
- **Data and Visual Analytics**
- **Statistics**

About Courses

- **Statistics**

By: **San José State University**

Course Schedule: **Approx. 4 months**

Topics:
- **Descriptive Statistics**
  - **Frequency distribution**
  - **Variability**
  - **Sampling Distributions**
- **Inferential Statistics**
  - **Estimation**
  - **Hypothesis Testing**
  - **Regression**

Course Objectives

Make the most informed decisions about life

From Udacity's course page

- **Data and Visual Analytics**
  (Data Analysis and Visualization)

By: **Georgia Institute of Technology**

Course Schedule: **Approx. 16 weeks**

Topics:
- **Programming in R programming language**
- **Data Analysis**
  - **Preprocessing, processing, visualization**
- **Regression**
  - **Logistic Regression**
  - **Linear Regression**
  - **Regularization**

Course Objectives

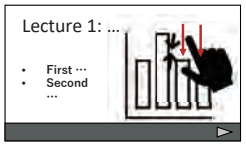
Cover the state of the art in data modeling and visualization techniques using R

From Udacity's course page

Udacitiy's Learning Styles

- **Courses are mainly on-demand video lectures**
- **In Statistics, Google spread sheet is often used**
- **In Data and Visual Analytics, R studio (posit) is used**

Watch Video

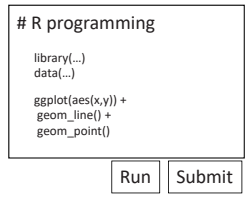


Like a lecture or about an interview

We learn very efficiently because we can immediately put into practice what we have learned.

Try Quizzes

Many quizzes are overlayed on lecture videos



Coding quizzes are also included

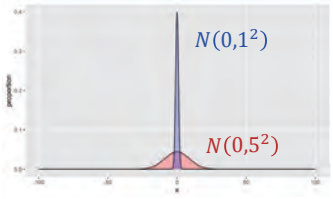
Descriptive Statistics (Statistics)

How to describe the center of a data set
⇒ Mean, median, mode

The means of each distribution are the same.
Are these distributions the same?

How to describe the spread of a data set
⇒ Interquartile range (IQR), variance, standard deviation (SD),

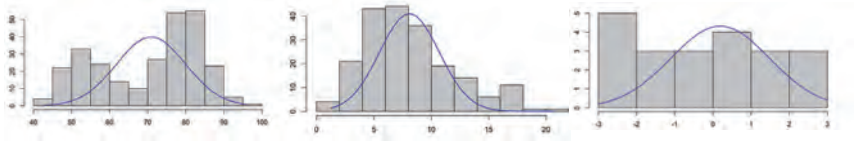
Normal distribution



When we compare multiple data sets, just comparing averages may produce wrong results

Central limit theorem

Blue line is the distribution of **sample** mean (not population)



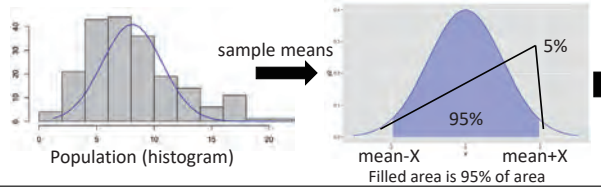
The distribution of sample mean become normal distribution whose SD is population SD divided by $\sqrt{n}$

Inferential Statistics (Statistics)

Estimating population parameters

- **Point estimation**: the value calculated directly from the sample of a population
- **Interval estimation**: the range created using an assumed known distribution

Due to the central limit theorem, the sample mean is ideally normally distributed



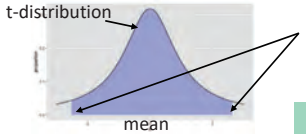
95% confidence interval

mean − X < x < mean + X

※ sample mean

Population mean falls within this x range 95% of chance.

In practice, SD is also estimated from the sample, so the "t-distribution" is assumed.



mean ± t-critical value*SE

- SE is SD divided by $\sqrt{n}$ (n: sample size)
- T-critical value is already calculated, so use the t-table

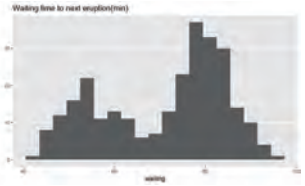
We estimate population parameters using known distribution.

Several Types of Visualization Method (Data and Visual Analytics)

Data and Visual Analytics course teaches us the characteristics and drawing of various types of graphs

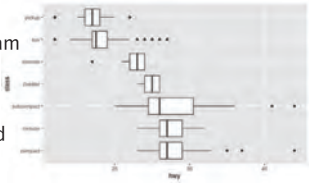
Histograms

- Show frequency
- Divide the range into bins
- Need to set bin width correctly



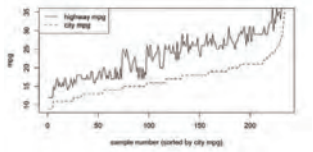
Box plots

- Alternative histogram
- Lose more data
- Percentile points
- Outliers determined by their IQRs



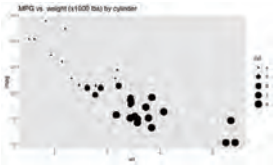
Line plots

- Show relations between x and y as a line
- Correspond to a mathematical function



Scatter plots

- Graph the relationships between two numeric variables
- Whether positive or negative correlation
- How well correlated

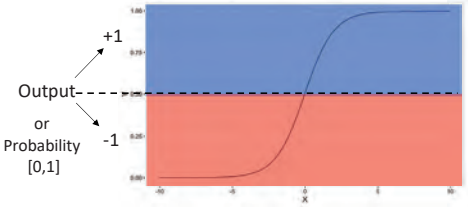


We learned how to draw and how to use these graphs

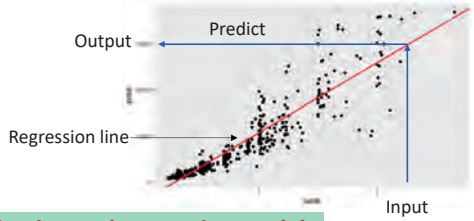
Regression (Data and Visual Analytics)

The course also teaches us the characteristics and the usage of two common regression models

- **Logistic Regression (Linear Classifier)**
  - **For classification**
  - **Fraud detection, click prediction, digital advertisement**
  - **Binary outcome**
  - **R code: glm(y~x⋯,data, family=binomial)**



- **Linear Regression**
  - **For predicting a number**
  - **Finance, demand forecasting, pricing strategies**
  - **Numeric outcome (predicted values)**
  - **R code: lm(y~x⋯, data)**

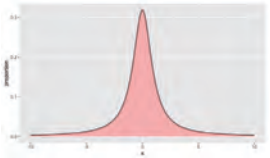


We learned the most common classification and regression model

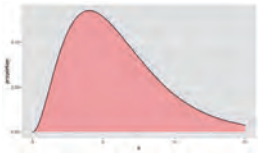
Learning Outcomes

Statistics,

- **Be able to describe a data set briefly and to compare data sets**
  - Types of a distribution
  - Statistical tests



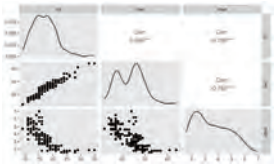
- t-distribution, df = 1



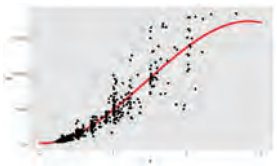
chi-squared distribution, df = 6

Data and Visual Analytics,

- **Be able to draw several types of graphs and to use the most common models**
  - Types of a plot
  - Classification
  - Regression



Facets to check correlations in each variable pair



Regression line

I am currently using this knowledge to conduct my own epidemiological research

My Thoughts

Although I had previously learned some parts of the content in class, learning them again in English allowed me to understand them from a different angle and learn how to express technical terms in English.

Statistics is the basis of science. Thinking about SE of a sample distribution, I think it's an important perspective that we need to increase the sample size by a factor of 4 to reduce SE by half.

Due to time constraints, I only presented part of the course content. These course include many other topics.

If you are interested in learning about statistics or data analysis, I recommend these courses as an introduction.

Reference

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H. Wickham. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York, 2016.

Schloerke B, Cook D, Larmarange J, Briatte F, Marbach M, Thoen E, Elberg A,Crowley J (2021). _GGally: Extension to 'ggplot2'_. R package version 2.1.2, <https://CRAN.R-project.org/package=GGally>.

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2022/09/29
Student of Pharmaceutical Sciences M2
Natsuki Yamanaka
selected OpenWHO

Key considerations for SARS-CoV-2 antigen RDT implementation

This course

About…
antigen based rapid diagnostic testing (Ag-RDT)
for SARS-CoV-2

Topics
1. **The different types of test**
2. **General recommendations for the use of Ag-RDTs**
3. **Testing strategy**
4. **Characteristics of Ag-RDGs (advantages and limitations)**
5. **Key Points**

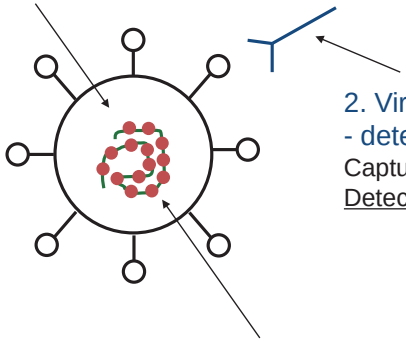
This course…

Learning objectives

- **describe testing principles of antigen based rapid diagnostic testing for SARS-CoV-2 (Ag-RDTs) and their advantages and limitations.**
- **explain the role of Ag-RDTs as part of the COVID-19 diagnostic testing strategy.**
- list and describe the key implementation considerations for integrating SARS-CoV-2 Ag-RDT testing into a national response plan.

1. The different types of test

1. Viral RNA - detected by molecular tests.
Amplification of small amounts of the viral genome
(RNA) until reaching detectable levels. Ex) PCR test.
Detect current infection



2. Virus-specific human antibodies
- detected by antibody tests
Capture of antibodies on a test.
Detect past-infection

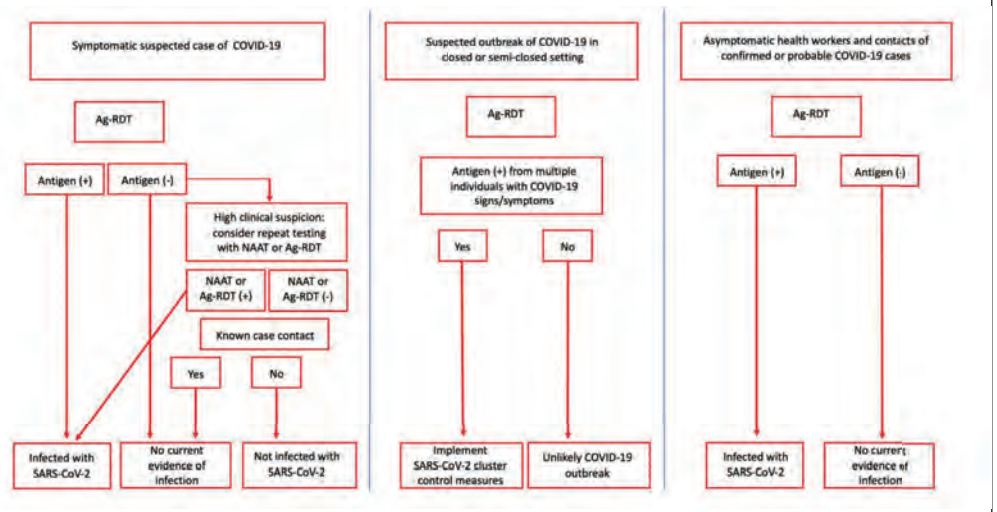
3. Viral proteins - detected by antigen tests (Ag-RDTs)
Caputure of antigens – most often the nucleocapsid of virus
Detect current infection

2. General recommendations for the use of Ag-RDTs

- Most reliable in areas with **ongoing community transmission**.
- In areas with low or no community transmission, PCR is the preferred first line testing method.
- Only SARS-CoV-2 Ag-RDTs that meet recommended performance criteria (≥ 80% sensitivity and ≥ 97% specificity) should be considered for use.

3. Testing Strategy

SARS-CoV-2 antigen RDT algorithm



4. Characteristics of **Ag-RDTs** (advantages and limitations)

Advantages

- Easy-to-use
  using a nitrocellulose strip enclosed in a plastic cassette.
  a few process without special technics
- **Rapid**
  results are readable in **10 – 30** minutes.

Limitations

- Performance depending on some factors
  Patient factors (Time from illness onset, immune status)
  Viral factors (Concentration)
  Sample type, quality control, *etc* …

5. Key Points

1. Target populations for Ag-RDT include symptomatic individuals meeting the case definition of suspected COVID-19, asymptomatic individuals at high risk of COVID-19, and suspected COVID-19 cases in outbreak investigations.

2. Ag-RDT has adavantages, on the other hand, many factors may affect the performance of Ag-RDT, such as patient and virus factors, sample type, storage conditions, among others, therefore findings in clinical settings may be variable.

My Achivement …

- I learned how to use Ag-RDTs
  symptomatic or asymptomatic
  community transmission
  care-worker
  →SARS-CoV-2 antigen RDT algorithm

- Advantage and disadvantage
  rapid, easy to use
  however, depending on many factors (patients, virus, etc…)

My Impressions…

- ✓ Confirme information of diagnosis for COVID-19
- ✓ It is so interesting how Ag-RDT should be used.
  When? Whom? How to use?
- ✓ SARS-CoV-2 antigen RDT algorithm should be introduced in Japan ?

Reference

This course;
https://openwho.org/courses/SARS-CoV-2-Ag-RDT-implementation/

Food and Health

MOOCs course name：Stanford Introduction to Food and Health
Course period：July 3rd to the 24th
Name：chou ei
Institute : Graduate School of Nursing
School year：M 1
Reporting date：september 29th

Course content

MOOCs course offering University

Stanford University

The goals of the course

In this course, learners will be given the information and practical skills they need to begin optimizing the way they eat. This course will shift the focus away from reductionist discussions about nutrients and move, instead, towards practical discussions about real food and the environment in which we consume it.

Course structure topics and Course schedule overview

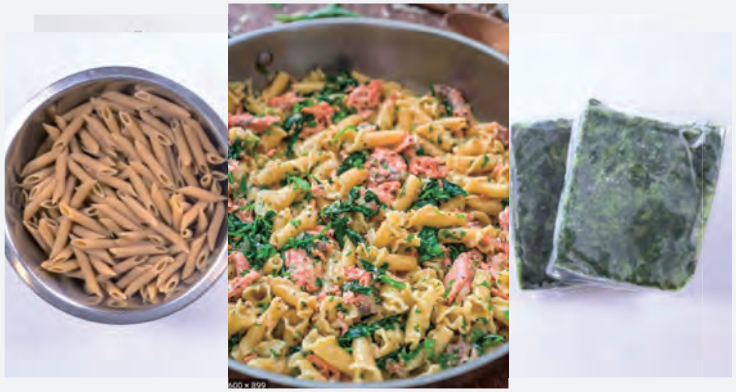
First week Background on Food and Nutrients
Second week Contemporary Trends in Eating
Third week Future Directions in Health-Part 1
Fourth week Future Directions in Health-Part 2
Fifth week Cooking Works

What I learned

Background on Food and Nutrients

Contemporary Trends in Eating

Future Directions in Health-Part 1



Future Directions in Health-Part 2

Cooking Works

learning outcomes

Thoughts

Fundamental Neuroscience for Neuroimaging

4 weeks of study; 2 hours per week

MARAL SERTAP

Department of Cognitive Behavioral Physiology, Graduate School of Medicine, Chiba University

29/08/2022

Course Outline:

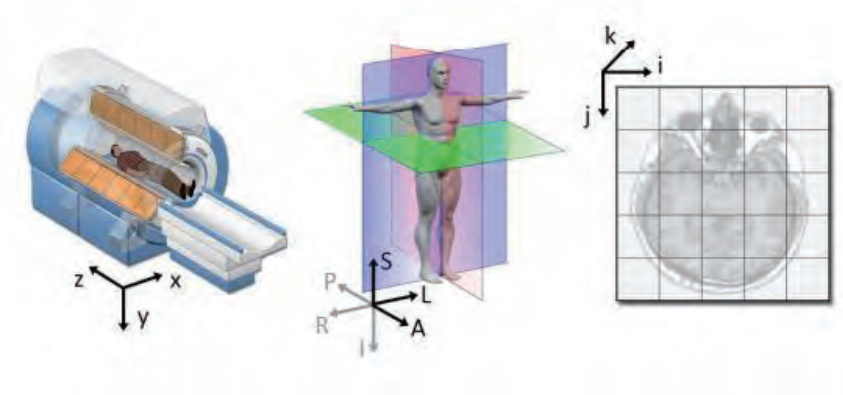
- Johns Hopkins University

- An overview of neuroscience topics relevant to the understanding, analysis, collection and interpretation of neuroimaging data.

Course Topics:

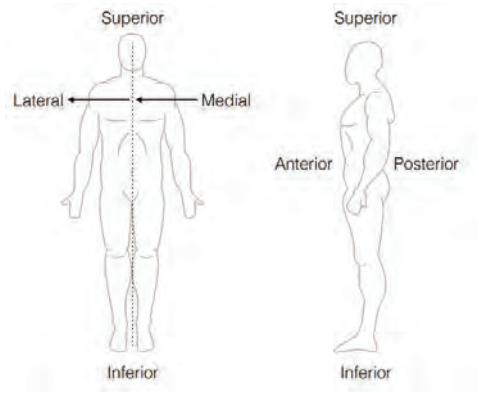
- The structural and functional organization of the brain
- Terminology of brain organization
- Brain networks and communication in the brain
- Cognition and cognitive domains
- The principles of magnetic resonance imaging
- Neuroimaging methods (broadly) and experimental design and neuroimaging studies

The Terminology of Brain Organization



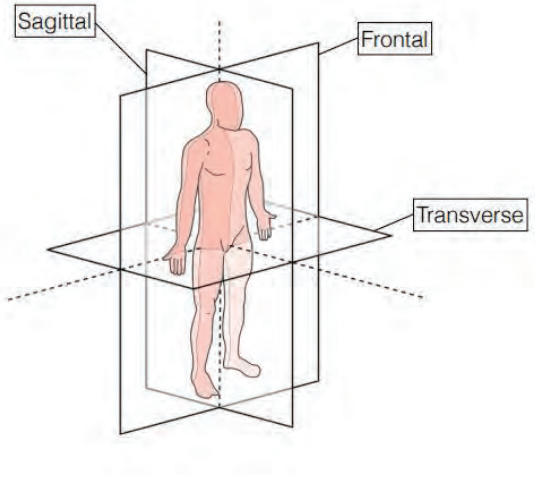
The Terminology of Brain Organization

- Anterior (front)
- Posterior (back)
- Superior (top)
- Inferior (bottom)
- Medial (towards center)
- Lateral (away from center)



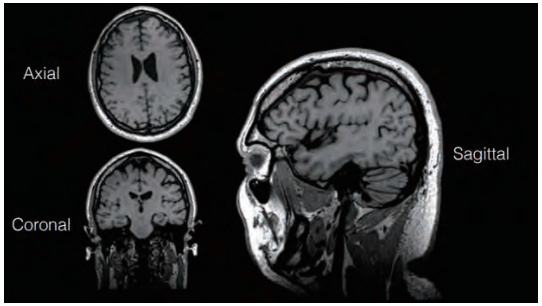
The Terminology of Brain Organization

- Planes of orientation:
  - Frontal plane
  - Transtransverse plane
  - Sagittal plane



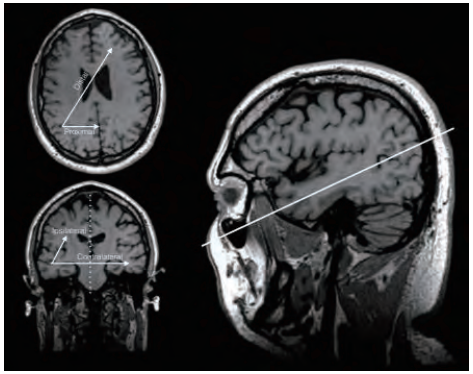
The Terminology of Brain Organization

- In human MRI images, the planes of orientation are commonly labeled:
  - Coronal (Frontal plane)
  - Axial (Transverse plane)
  - Sagittal plane



The Terminology of Brain Organization

- Other commonly used terms in brain organization include:
  - Proximal (closer to point of attachment)
  - Distal (further point of attachment)
  - Ipsilateral (same side of brain)
  - Contralateral (other side of brain)
  - Oblique plane (angled plane)



Learning Outcomes

- My research theme: **Inhibitory Control and Mental Rotation in Obsessive-Compulsive Disorder**
- The Research Plan:

1. Neuropsychological Testing (Master's) Mental rotation task and Stop-Signal Task
2. fMRI study (PhD)

Impressions & Thoughts

- An introductory course to brain
- The desire for self-improvement
- Motivation
- Recognize of strengths and weaknesses
- Take advantage of free access to many courses from the top universities all around the world.

(All images used in this presentation belong to the course.)

220929

医学薬学府総合薬品科学専攻 修士2年
Takuya Kimapara

WHO's commitment to cholera elimination

~from course “cholera: introduction”~

Course period: 220702

Introduction of “cholera: introduction”

・Provider of this course

WHO cholera team

Speaker: Kate Albeti (Technical officer of cholera team)

・Contents

Module1: cholera: the disease and its transmission

Module2: Prevention and control of cholera

Module3: Ending cholera: A Global Roadmap to 2030 and Global Task Force on cholera Control (GTFCC)

Module4: Additional resources

Introduction of “cholera: introduction”

Target of this course

・When you finished this course, you can…

1, Describe the disease and main transmission routes

2, Explain cholera prevention and control principles

3, Describe the strategies of Ending cholera –A global Roadmap to 2030 and role of the Global Task Force on cholera control (GTFCC)

4, Localize cholera resources

What I have learned is…

What is cholera??

Disease

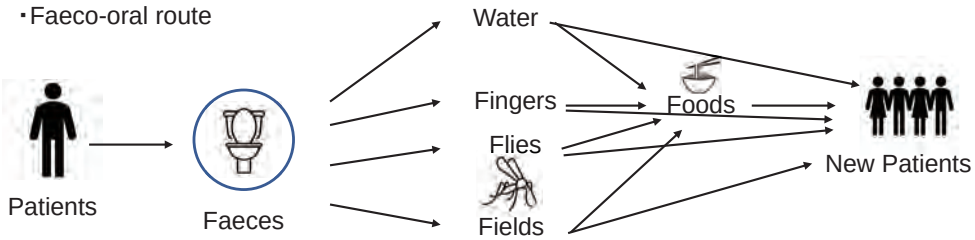
・characterized by acute diarrheal infection

・can lead to dehydration and death in patients with severe forms of disease

・If left untreated in patients with severe forms of disease causes up to 50% mortality

Transmission Route

・Faeco-oral route



What I have learned is…

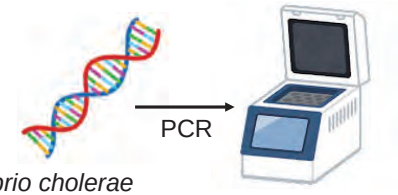
What is cholera??

Diagnosis

Clinical diagnosis
・Based on signs and symptom→enough to start treatment

Culture or Polymerase chain reaction
・current methods for confirmation

・specimen must be sent to a laboratory



Vibrio cholerae

Population at risks

Communities that
・lack access to clean water and sanitation

・have poor access to healthcare

→Peri-urban slum, refugee camp, flood zone etc…

What I have learned is…

Prevention and control of cholera

5 complimentary pillars form the basis of prevention and control

1, epidemiological and laboratory surveillance and reporting
→rapidly detect outbreaks and confirm suspected cases

2, water, sanitation and hygiene (WASH)
→providing access to safe drinking water sources, improved sanitation facilities

3, use oral cholera vaccine (OCV)

4, healthcare system strenghthening
→offering rapid access to treatment

5, community engagement

These pillars should be well-coordinated

What I have learned is…

Ending cholera

Global Roadmap to 2030

Based on 3 strategic axes
1, Prompt detection and containment of outbreaks
2, implementing multisectoral long term control intervention in priority areas
3, effective coordination of and advocacy for cholera control

Target by 2030
・Eliminate cholera in 20 countries
・no more uncontrolled cholera epidemics
・90% reduction in cholera deaths

Global Task Force on cholera Control (GTFCC)

Vision: collective action can stop cholera transmission and cholera deaths

Key Role: promote and support implementation of Global Roadmap to 2030

My achievement

Ending cholera

Global Roadmap to 2030

Based on 3 strategic axes
1, Prompt detection and containment of outbreaks
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Global Task Force on cholera Control (GTFCC)

Vision: collective action can stop cholera transmission and cholera deaths

Key Role: promote and support implementation of Global Roadmap to 2030

Impressions

Impressions of this course

My thoughts

It was very interesting to learn what WHO is doing to eliminate cholera. In addition, by deepening understanding of diseases that are not my specialty, I was able to improve my motivation for my research.

For future MOOCS students

I've taken several Open WHO courses and they were all very interesting, so I hope they take a variety of courses. In addition, you can expand the possibilities of new discoveries by studying fields that are not your specialty. Therefore, please try to take courses that are not limited to single specialty.

Source

Please find links below to additional resources that may be helpful to refer to during this training.

GTFCC website: https://www.gtfcc.org/

GTFCC technical guidance on cholera: https://www.gtfcc.org/resources/

cholera Outbreak Response Field Manual, October 2019: https://www.gtfcc.org/wp-content/uploads/2020/05/gtfcc-cholera-outbreak-response-field-manual.pdf

cholera App: https://www.gtfcc.org/cholera-app/

Ending cholera. A Global Roadmap to 2030: https://www.gtfcc.org/wp-content/uploads/2019/10/gtfcc-ending-cholera-a-global-roadmap-to-2030.pdf

Interim Guiding Document to Support Countries for the Development of their National cholera Plan: https://www.gtfcc.org/wp-content/uploads/2020/11/gtfcc-interim-guiding-document-to-support-countries-for-the-development-of-their-national-cholera-plan.pdf

Guidance and tool for countries to identify priority areas for intervention: https://www.gtfcc.org/wp-content/uploads/2019/11/guidance-and-tool-for-countries-to-identify-priority-areas-for-intervention1.pdf

Causes of Human Disease: Exploring Cancer and Genetic Disease

Causes of Human Disease: Exploring Cancer and Genetic Disease (Future Learn)
Study Requirement ：2 weeks, 4 hours per week

Yoshiki Shinomimya
D3, Department of Molecular Pathology
2022. 9. 29

Causes of Human Disease: Exploring Cancer and Genetic Disease

・this course provided by UNIVERSITY OF LEEDS in Future Learn.

・The aim of this course：
Learn about the causes of cancer and genetic disease, including the structure, functions and maintenance of genes. In addition, I studied the genetic diseases and cancer that can result from malfunctions in genes.

About the main learning topics of this course

・The chemical structure of DNA, genes and chromosomes.

・The importance of DNA in understanding the causes of genetic diseases.

・DNA replication and cell reproduction.

・The role of genes and proteins in controlling the activities of the cell and the cell cycle.

・How genes and chromosomes can be permanently altered when mistakes happen during DNA replication.

・The wide variety of different substances that can cause cancer.

・The differences between normal cells and cancer cells.

・Genetic Diseases and Modes of Inheritance.

・Different types of genetic diseases and how they may arise.

DNA replication and cell reproduction

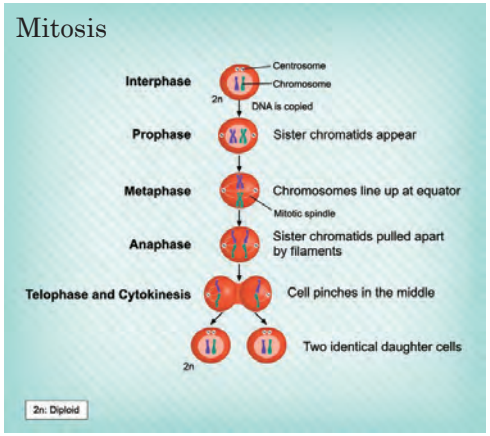
Cells must replicate DNA before they can divide.

Because cell division and DNA replication require accuracy, multiple proteins are intricately involved.

DNA replication also involves replicating the cell's chromosomes, and the replicated chromosomes must be precisely sorted into two daughter cells.

The process by which chromosomes are replicated to produce two daughter cells is called mitosis.
The figure on the right shows the steps involved in mitosis.

When errors occur in the chromosome sorting process, abnormalities in the number of chromosomes (aneuploidy) occur, which is a common feature of cancer cells. Loss or gain of a chromosome means that the wrong number of genes present on that chromosome is inherited.



Source: YourGenome (Genome Research Limited) based on an image from https://www.yourgenome.org/facts/what-is-meiosis

DNA replication and cell reproduction

Human cells contain 22 pairs of autosomes and one pair of sex chromosomes.
Cells with such an overlapping set of chromosomes are called diploid.

One pair of autosomes and one pair of sex chromosomes are inherited from each parent when the egg is fertilized by the sperm. The sperm and egg cells are called gametes and have only one set of chromosomes, which are called haploids.

haploid cells are created by a process called meiosis. In many ways, meiosis is similar to mitosis, but with the additional step of chromosome segregation. This takes place before the replicated chromosomes are separated.

Errors in DNA replication and chromosome segregation in meiosis are the basis of many genetic diseases.

Meiosis and the formation of gametes

Source: YourGenome (Genome Research Limited) based on an image from https://www.yourgenome.org/facts/what-is-meiosis

Single gene diseases

It is a general term for diseases caused by mutations in a single gene.
Many well-understood genetic diseases result from a mutation in a single gene that is inherited by all the cells that arise from a fertilized egg cell (zygote). The single gene or monogenic traits that are the consequence of these mutations display a Mendelian pattern of inheritance.

Three main patterns

・Autosomal dominant inheritance pattern
This pattern requires only one parental gene to have the mutation. It is often a gain-of-function mutation, in which the disease develops as the mutated gene gains function.

・Autosomal recessive inheritance pattern
This pattern requires both parent genes to have mutations. It develops because both genes lose function and are unable to produce normally functioning proteins.

・X-linked recessive inheritance
In males with one X chromosome and one Y chromosome, a recessive loss-of-function mutation on the X chromosome is linked to disease expression. This is because there is no normal copy of the gene to produce a protein with normal function.

Causes of Cancer

Any substance or exposure that increases the risk of developing cancer may be referred to as a carcinogen.

・Chemical compounds (e.g. alcohol, tobacco, aflatoxin)
・Infectious agents (e.g. Hepatitis B virus, human papillomavirus)
・Minerals (e.g. asbestos)
・Radiation (e.g. X-rays, gamma rays, ultraviolet rays, ionizing radiation)
・Physiological (e.g. Estrogen)

Characteristics of carcinogens

・DNA damage, direct or indirect
The damage caused by these substances can be converted into mutations.
These mutations can be passed on to daughter cells when the DNA containing the damage is replicated.

・Promotes cell division
Sustained stimulation of cell proliferation can fix DNA damage and lead to the expansion of mutant cell clones.
Even in the absence of DNA damage, unnecessary cell proliferation increases the risk of spontaneous mutation.

The Hallmarks of Cancer

A number of different types of cancer are now recognized. Various mutations affecting carcinogenesis have also been identified. All of these various genetic abnormalities and phenotypes can be grouped into six different cellular characteristics or features.

1. Independence from positive growth signals.
2. Resistance to negative growth signals.
3. Evasion of programmed cell death.
4. Limitless cell division.
5. Ability to induce angiogenesis (the formation of new blood vessels).
6. Ability to invade and metastasise (spread to other parts of the body).

In order for a normal cell to evolve into a cancer cell, it must acquire mutations in specific genes that would allow it to demonstrate the characteristics listed above.
Nearly 600 different genes have been implicated in various types of cancer.
The majority of them , through a gain or loss of function, can contribute to at least one of the hallmarks above.

Learning Outcomes

By taking this course, I was able to reflect on the basics of genomics.

Genetic searches are an integral part of many studies, including my own.

I believe that having a solid review of the fundamentals of genes and heredity was extremely helpful.

I am doing research on invasive pancreatic ductal carcinoma, and cancer is a disease caused by genetic mutations, so the topics on the causes of cancer were very useful.

Impressions

This was the first time I learned about MOOCs and took the course for the engine exercise.

I took a relatively basic course, but it was very useful because the course was set up in such a way that there was no lack of learning content.

MOOCs have a very large number of well-known universities from all over the world participating, and courses are set up not only for basic but also for advanced courses.

I hope that some students will make good use of MOOCs and learn more.

Using Infection Control to Combat Antimicrobial Resistance

University of East Anglia

Taichi Kamo (D3)
Graduate School of Pharmaceutical Scienes, Chiba University

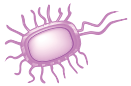
I-1. Instructors

Prof. Laura Bowater

Prof. David Livermore

Dr. Caroline Barker

I-3. Student Goals



Understand drug-resistant bacteria, a major social issue

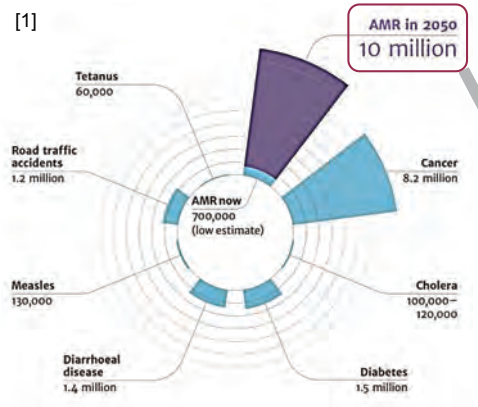
I-4. Program

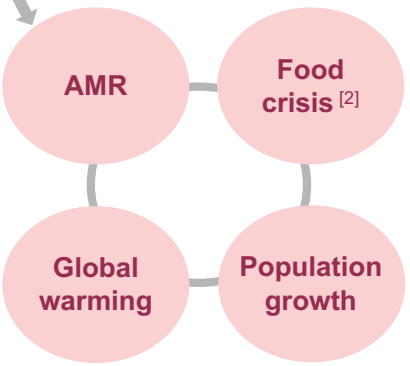
Week 1. The global threat of antibiotic resistance
- ☐ Risk of bacterial infection
- ☐ Increase in drug-resistant bacteria
- ☐ Nosocomial infections in low- and middle-income countries

Week 2 and 3. Combatting antibiotic resistance (general & personal)
- ☐ Acquisition of drug resistance in bacteria
- ☐ Problems caused by the spread of infectious diseases
- ☐ Infection control to protect society and families

II-1. The Global Threat of Antimicrobial Resistance (AMR)

[1]

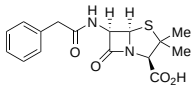




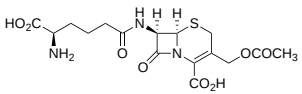
[1] O'Neill Report (**2014**) / [2] Rohr, JR. *et al. Nat. Sustain.* **2019**, *2* (6), 445-456

II-2. Beta-Lactam Agents | Major Antibiotics Group [3]

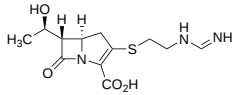
Major β-lactam agents: Inhibit bacterial cell wall synthesis



Penicillin G
(Penicillin group)

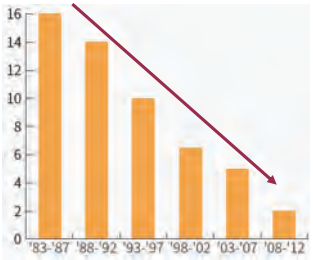


Cephalosporin C
(Cephalosporin group)



Imipenem
(Carbapenem group)

Antibiotics approved in the U.S.

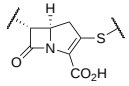


Issues

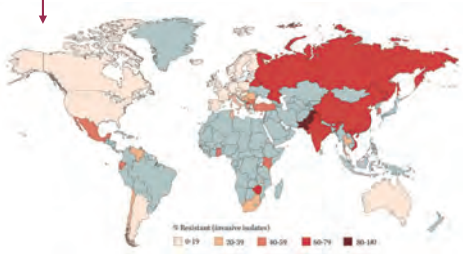
- ☐ Emergence of drug-resistant bacteria
- ☐ Pharmaceutical companies reluctant to develop new drugs

II-3. MDR | Multidrug Resistance [4, 5]

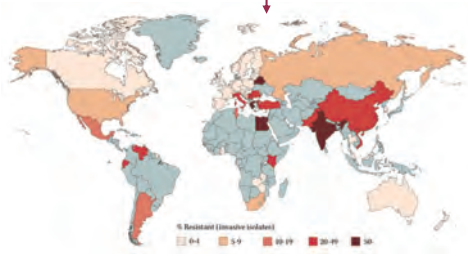
MRSA | Methicillin-Resistant *Staphylococcus aureus*
ESBL | Extended-Spectrum Beta-Lactamase
CRE | Carbapenem-Resistant Enterobacteriaceae
MDRP | Multidrug Resistant *Pseudomonas aeruginosa*



Carbapenem
"Last Resort"



Resistance of *E. coli* to cephalosporins (2012-2017)



Resistance of *K. pneumoniae* to carbapenems (2012-2017)

Multidrug-resistant bacteria are spreading worldwide

II-4. Class of β-Lactamases [6-10]

Serine β-lactamase (SBL)

Class C	Class A	Class D
AmpC	TEM, SHV, CTX	OXA
	KPC, SME, CTX-M	OXA-48

Metallo β-lactamase (MBL)

Class B
B1: IMP, NDM, VIM
B3: L1, FEZ / **B2**: CphA

"Carbapenemase"

Evolved by use of antibiotics

IMP-1

Evolved by host immune mechanisms

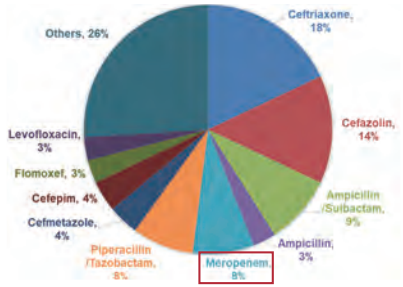
NDM-1

VIM-2

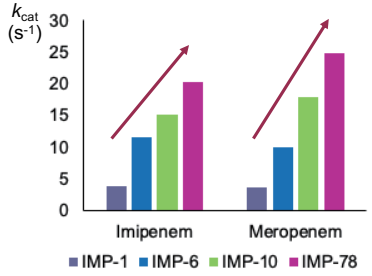
No launched inhibitor

II-5. Infection Control in Japan [11]

Parental antibiotics consumption (2016)



Enzyme activity of IMP-1 variants



Contributing to MDR

II-6. COVID-19 and Drug-Resistant Bacteria [12]

In the current COVID-19 pandemic, secondary bacterial infections have been identified in up to 30% of critically ill patients, significantly reducing survival.

Treatment with broad-spectrum antibiotics as symptoms cannot be differentiated (**Increased risk of acquired resistance**)

III. Conclusion

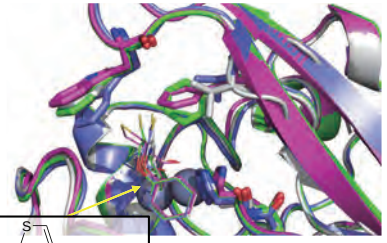
University of East Anglia

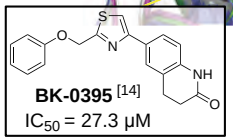
III-1. Conclusion and Outlook

- ☐ Antibiotic use promotes bacterial drug resistance
- ☐ Appropriate management of antibiotics is important

III-2. My Works

Development of Inhibitory Compound against Imipenemase (IMP)





BK-0395 [14]
IC_{50} = 27.3 μM

Variants	Binding Energy (kcal/mol)
IMP-1	-23.64361
IMP-6	-25.00661
IMP-10	-29.17332
IMP-78	-26.28075

As a result of Docking simulation via *Orientation*[13],
It was suggested that **BK-0395** equally inhibits IMP-1variants

Expected as New Medicine

[13] Fuji, H. *et al. Chem. Pharm. Bull.* **2017**, *65* (5), 461-468 / [14] Kamo, T. *et al. Chem. Pharm. Bull.* **2021**, *69* (12), 1179-1183

IV. Impression

University of East Anglia

IV-1. Impression and Message

- ☐ Reconfirmed the social significance of my own drug discovery research.
- ☐ The development of anti-infective drugs is an area where academia can lead, and it is important to learn about infectious diseases extensively.

IV-2. References

[1] O'Neill Report (**2014**)
[2] Rohr, JR. *et al. Nat. Sustain.* **2019**, *2* (6), 445-456
[3] Kewis, K. *Cell* **2020**, *181* (1), 29-45
[4] Suzuki, S. *J. Infect. Control Prevention* **2019**, *3* (1), 23-28
[5] Gu, Y. and Ohmagari, T. *Jpn. J. Chemother.* **2019**, *67* (1), 13-22
[6] Cheng, Z. *et al. Antimicrob. Agents Chemother.* **2021**, *65* (4), e01714-20
[7] Cheng, Z. *et al. J. Biol. Chem.* **2018**, *293* (32), 12606-12618
[8] Cheng, Z. *et al. mBio* **2019**, *10* (6), e02412-19
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[10] Makena, A. *et al. Antimicrob. Agents Chemother.* **2016**, *60*, 1377-1384
[11] Tsutsui, A. *et al. J. Infect. Chemother.* **2018**, *24* (6), 414-421
[12] Mojica, MF. *et al. Lancet Infect. Dis.* **2022**, *22* (1), e28-e34
[13] Fuji, H. *et al. Chem. Pharm. Bull.* **2017**, *65* (5), 461-468
[14] Kamo, T. *et al. Chem. Pharm. Bull.* **2021**, *69* (12), 1179-1183

Thank you for listening!!!

2022.09.29

The Pharmaceutical Industry : Bench Science to Bedside

- Drug commercialization
- Pharmaceutical & medical device innovations

Sudeshna Kundu
Doctoral course (D2)
Laboratory of Pharmaceutical Technology
Graduate School of Pharmaceutical Sciences

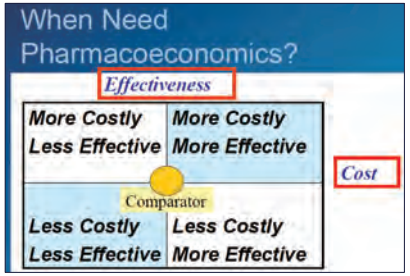
Outline of 1st course

- ***Course title***
  Drug commercialization
- ***Learning platform***
  Coursera
- ***Offered by***
  University of California San Diego
- ***Duration of course***
  4 weeks of study, 3-4 hours/week with graded assignments and quizzes
- ***Learning objective***
  To gain a comprehensive understanding about the various steps of drug commercialization
- ***Topics covered***
  Week 1 & 2- Pharmacoeconomics in drug development, intellectual property strategy, business models of innovator, generic and OTC drugs
  Week 3 & 4- Strategic alliances between academic and pharma industry followed by a case study on strategic academic-industry alliance

Pharmacoeconomics - Introduction

- ***What is Pharmacoeconomics?***

Pharmacoeconomics is the study of identifying, measuring and comparing the cost (i.e. resources consumed) and outcomes (i.e. clinical effect, economic and humanistic) of pharmaceutical products and services against an alternative drug or comparator.



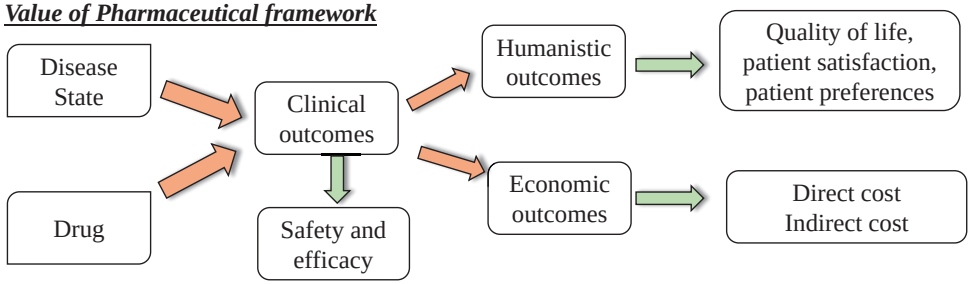
$$\frac{\text{Cost}}{\text{Outcome}} = \text{VALUE}$$

- ***Why study Pharmacoeconomics?***

1. The main reason for studying pharmacoeconomics is to be able to estimate and understand the full impact of a new therapy.
2. It helps to decide which drugs to develop.
3. It helps to make the best use of limited resources.

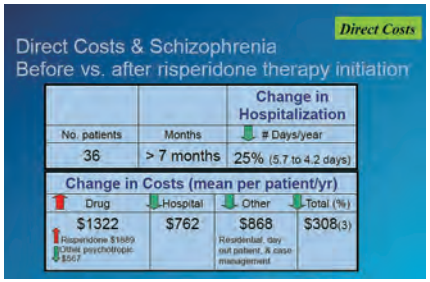
Pharmacoeconomics evaluations - Key components

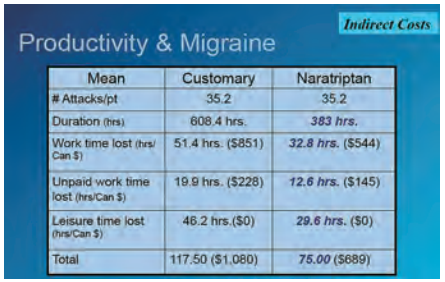
Value of Pharmaceutical framework



*ECHO model- Economic, Clinical and Humanistic outcome

Example of direct and indirect cost from the course





Academics and pharma industry partnership - 1

❖ ***What is the need for partnership between academics and pharma industry?***

Historical model

Academics
- Basic fundamental biological research

Lack of translation

Industry
- Discovery
- Preclinical
- Clinical
- ……
- ……
- ……
- Manufacturing and marketing

New model

Examples of what could be attractive for Pharma

✓ Opportunity to diversify portfolio
✓ Access to leading research and disruptive science
✓ In vivo disease model expertise
✓ Target and new pathway expertise
✓ …..

Examples of what could be attractive for Academics

✓ Translational application of discovery
✓ Synthesis capacity and scale up
✓ Access to multidisciplinary development team
✓ …..

Academics and pharma industry partnership - 2

❖ ***Emerging models used between Academics and Industry***

1. ***Corporate Venture Capital (CVC)***

➢ Company helps Academic experts to start company focused on specific problem or platform, with additional support of private investors (could by any kind of investment)
➢ Need clear timelines and exit predefined terms

2. ***Competition, challenging (Request for proposals)***

➢ Company solicits ideas/challenges from academic scientists, and selects most promising for further support (discovery award)
➢ Award for possible drug candidate with a contribution of pharma to use computational molecule screen and to validate target based assays.
➢ Examples - Eli Lilly, GSK Pharma in Partnership model

3. ***Institute creation supported by Pharma***

➢ Pharma funds the establishment of a new centre within the institute with many investigators tackling the same subject.
➢ Examples- (Gilead-Yale School Med, cancer therapy; GSK –Harvard Stem Cell)

Outline of 2nd course

➢ ***Course title***

Pharmaceutical & medical device innovations

➢ ***Learning platform***

Coursera

➢ ***Offered by***

University of Minnesota

➢ ***Duration of course***

4 weeks of study, 2-4 hours/week with graded assignments and quizzes

➢ ***Learning objective***

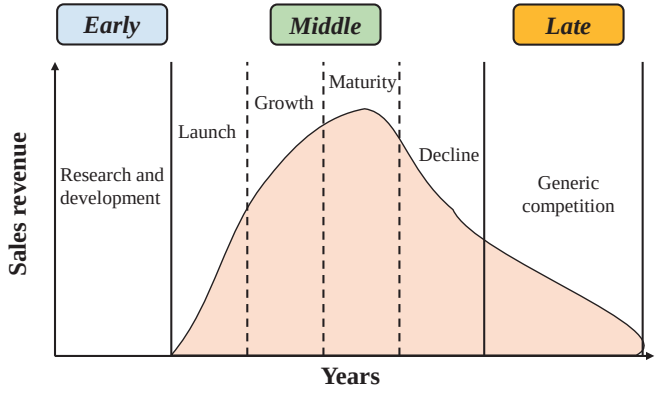
To explore an in-depth view of the healthcare marketplace and the strategies deployed for marketing.

➢ ***Topics covered***

Week 1 - Overview of pharmaceutical industry, development and regulatory aspect
Week 2 - Pharmaceutical market deployment and management
Week 3 - Medical device industry
Week 4 - Medical device market deployment and management

Pharmaceutical market deployment

❖ ***Pharmaceutical product life cycle***



A novel drug's life cycle can be divided into three separate stages:
•The early stage: research and development; from drug discovery through market launch.
•The middle stage: the time between its initial release and the loss of market exclusivity.
•Late stage: the period following the loss of market exclusivity (when generics can enter the market).

❖ ***What is the marketing strategic plan?***

Marketing strategic plan

Environmental scanning	***Strategy formulation***	***Strategy Implementation***
Analyzing market opportunities and competitors	STP ➢ Segmentation ➢ Targeting ➢ Positioning	Marketing mix ➢ Product ➢ Price ➢ Place ➢ Promotion

Marketing strategy is based on three main steps: segmentation, targeting, and positioning.
Segmentation is dividing the market into homogenous groups, based on age, gender or geography.
After determining all conceivable market groups, the marketer must identify the ***target market.***
Positioning is the final and most crucial step in the STP process.
It is critical to position your product to appeal to the target market in order for the customers to be interested in what you have to offer and, as a result, prescribe and/or purchase.

Thank you for your attention.

➢ ***My objective to pursue these courses***

In the near future, I want to work closely with industrial research. So, I pursued these courses to gain a deeper knowledge and understanding about the drug commercialization process and also about the various models of strategic alliances between academic and pharmaceutical industry. The courses helped me the know the present scenario of pharmaceutical industrial research and the emerging areas of research.

➢ ***Personal impression about MOOCs***

My overall impression about MOOCs platforms, particularly, coursera has been great.
There are a diverse and extensive categories of courses from various prestigious universities around the world in the coursera platform. It is the most convenient to find and study courses of our choice. I think that the video lectures and graded quizzes really helped me to enhance my learning in this online platform.

References

https://www.coursera.org/learn/drug-commercialization/home
https://www.coursera.org/learn/pharma-medical-device-innovations/home