Al-Farabi Kazakh National University

Lecture 13. Clinical Epidemiology. DEPTH model in Medicine. Implementation of epidemiologic studies in Medicine

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Plan

- Definition of Clinical Epidemiology
- Depth model
- Implementation of Epidemiological studies in Medicine

Introduction

Clinical medicine

answer clinical questions and guide clinical decision making

Epidemiology

Involved in methods used to answer the questions

Definition

Epidemiology

Study of distribution and determinants of states or events in specified populations, and the application of this study to the control of health problems

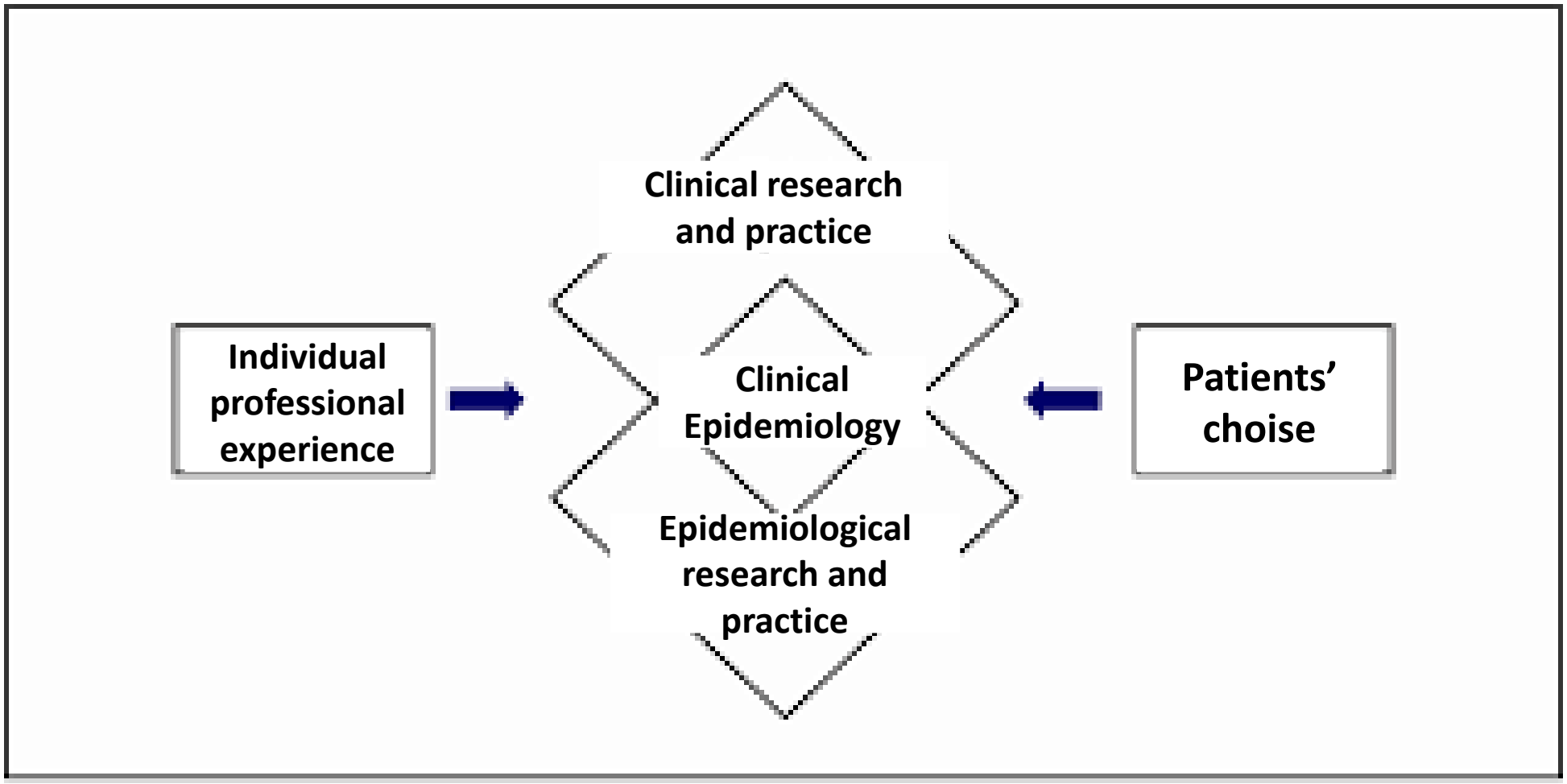
Epidemiology of communicable diseases

a science that studies the causes and conditions of emergence and spread of infectious diseases among the population for the development and implementation of preventive measures

Clinical Epidemiology

- The science of cause-and-effect relationships in the observations of population and individual people
- The study of medical interventions in people
- Code of Ethics
- Scientific principles (as much as possible to make observations and draw the correct conclusions
- practical application of the findings

Relationship between Medicine and Epidemiology



What is Clinical Epidemiology

- The science of making predictions about individual patients by counting clinical events in similar patients, using strong scientific methods for studies of groups of patients to ensure that the predictions are accurate
- Used as an aid to clinical decision making
- Lead to valid conclusions by avoiding bias and confounder

Methods of Clinical Epidemiology

- Formulate questions and hypothesis
- Choose study design
- Choose study population and sample from it
- Collect and analyze Data
- Interpret Results

Formulate questions (Hypothesis)

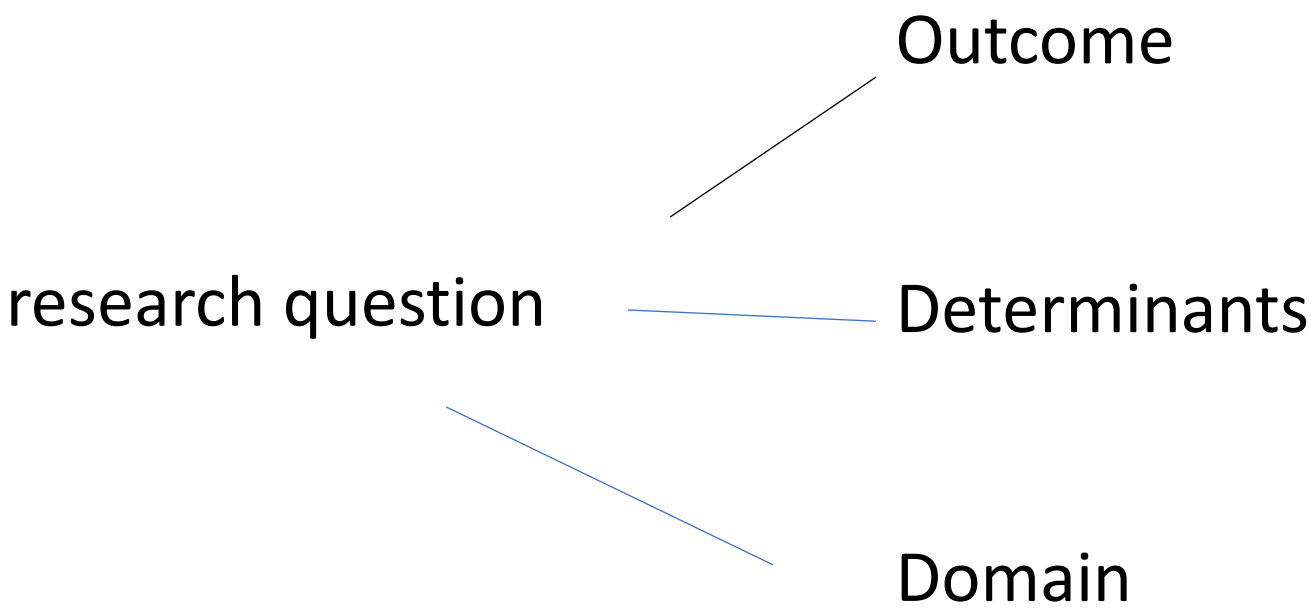
Steps in developing a research question

- Step 1 :- Do not let the research question be forced upon you.
- Step 2 :- Find a general area of interest. (" AIDS " , NCDs", "MCH" etc) (basic interest, own clinical observations, discussions with colleagues, med. Conf., Questions asked by our own students)
- Step 3 :- Read "around" the topic in width, (broad & extensive) not in depth (intensive)
- Step 4 :- Identify a specific area of interest where gaps in knowledge exist, need to be filled up (effect of antenatal counselling on Postnatal care)

Hypothesis

- Translates a research question into a prediction of expected outcomes
- Research question identifies of variables/concepts under investigation and asks how concepts might be related
- hypothesis is a predictive answer
- Ho – null hypothesis
- Ha – alternative hypothesis

Theoretical research question



The PICO Model for Clinical Questions

PICO –is the way to organize a well –built and answerable clinical question

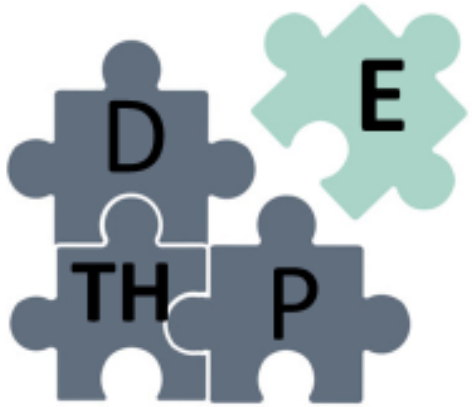
P = Patient, population or problem	***Who are the patients or populations? What is the disease?)***
I = Intervention, issue, prognostic factor or exposure	*What do you want to do with this patient ? (e.g. treat, diagnose, observe)*
C = Comparison or intervention (if appopriate)	*What is the alternative to the intervention (e.g. placebo, different drug, nothing?)*
O = Outcome	*What are the relevant outcomes ? (e.g. morbidity, mortality, death, complications)*
T = Time or type of study	

What type of question are you asking?	**Diagnosis, Etiology, Therapy, Prognosis, Prevention, Ham**
Type of study do you want to find?	What would be best study design or methodology?

DEPTH Model in Clinical Epidemiology

Classify the type of the question using DEPTH model

- Does this person have the problem?
  Question of DIAGNOSIS
- What causes the problem?
  Question of ETIOLOGY, RISK
- Who (and how likely) will get the prob
  Question of PROGNOSIS
- What is the treatment?
  Question of INTERVENTION/PREVENTI
  THERAPY



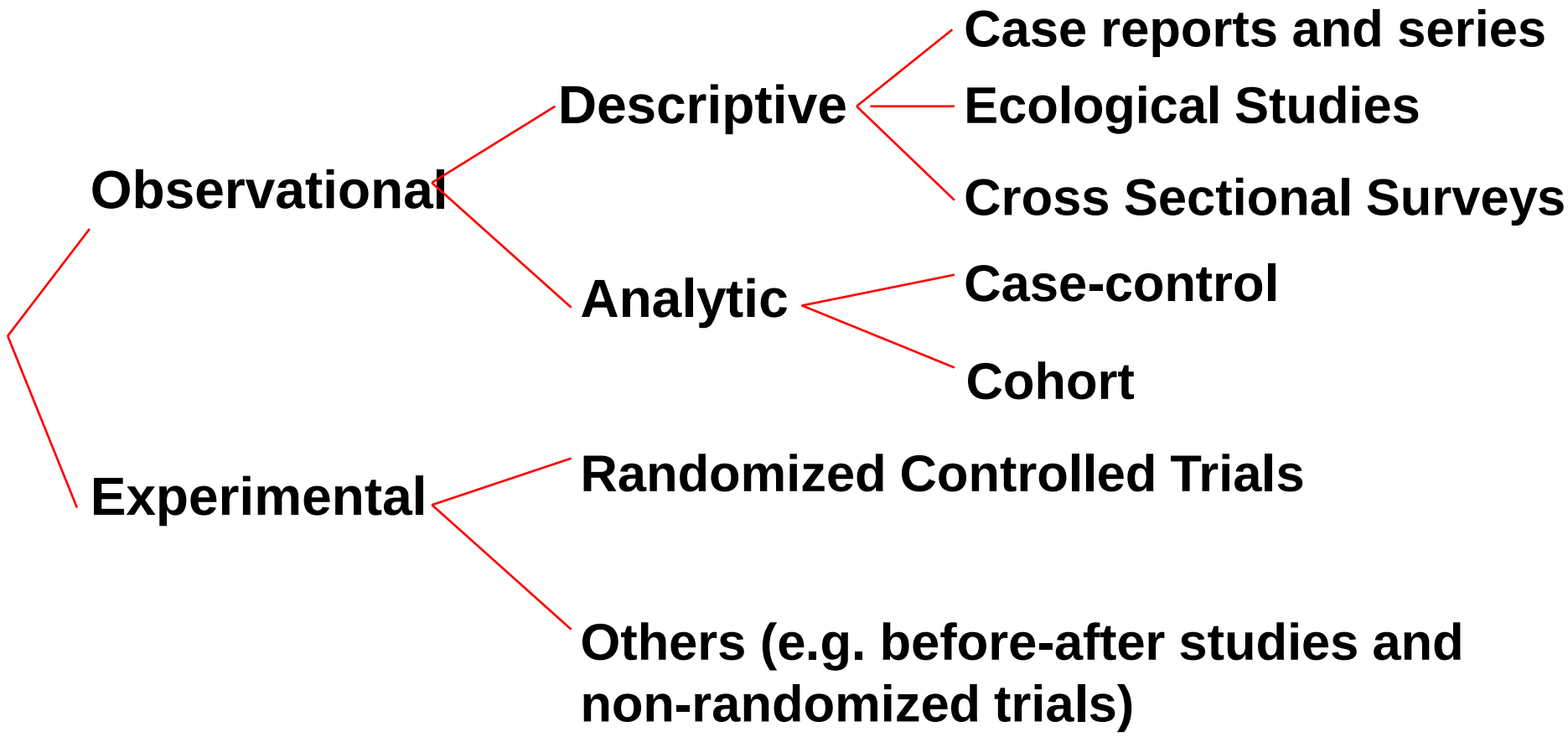
Clinical questions

Subject of discussion	Question
Abnormality	Is the patient sick or well?
diagnosis	How accurate are tests used to diagnose of disease?
frequency	How often does a disease occur?
Risk	What factors are associated with an increased risk of disease?
Prognosis	What are the consequences of having a disease?
Treatment	How does treatment change the course of disease?
Prevention	Does an intervention on well people keep disease of from arising? Does early detection and treatment improve the course of disease?
Cause	What conditions lead to disease?
Cost	What is a cost of this disease?

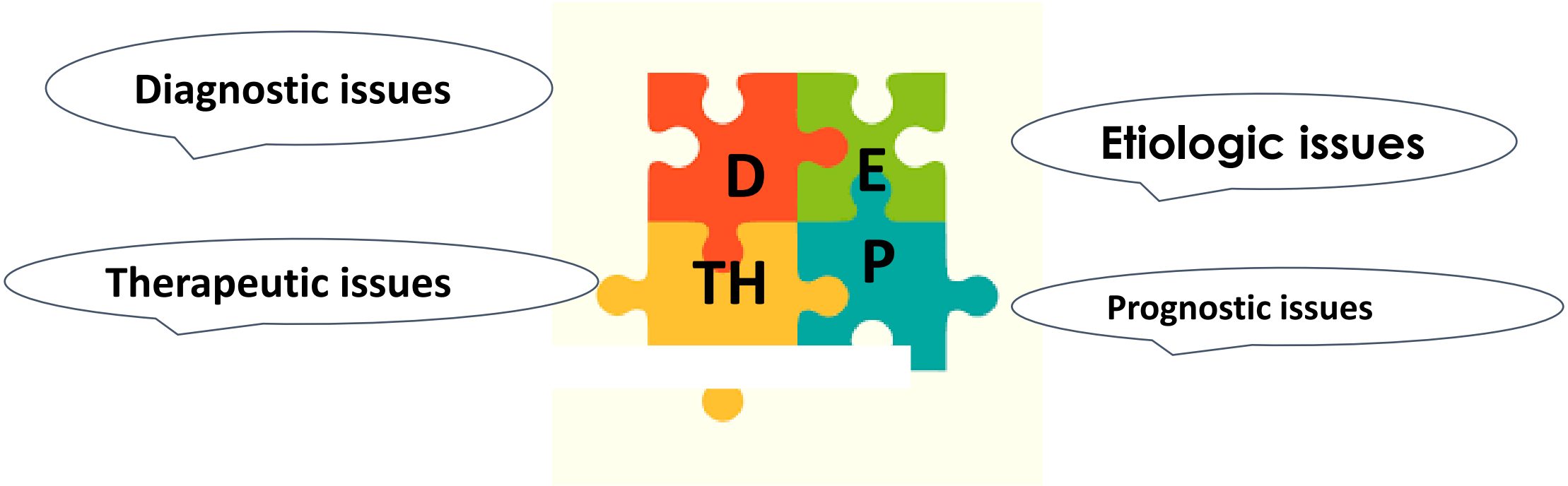
Disease outcomes – five D

Death	A bad outcome, if untimely
Disease	Set of symptoms, physical signs and laboratory abnormalities
Discomfort	Symptoms such as pain, nausea, dispnoea, itching and tinnitus
Disability	Impaired ability to go about usual activities at home, work and recreations
Dissatisfaction	Emotional reaction to disease and its care, such as sadness or anger

Epidemiologic Study Designs



DEPTH model and using of epidemiological studies in Medicine

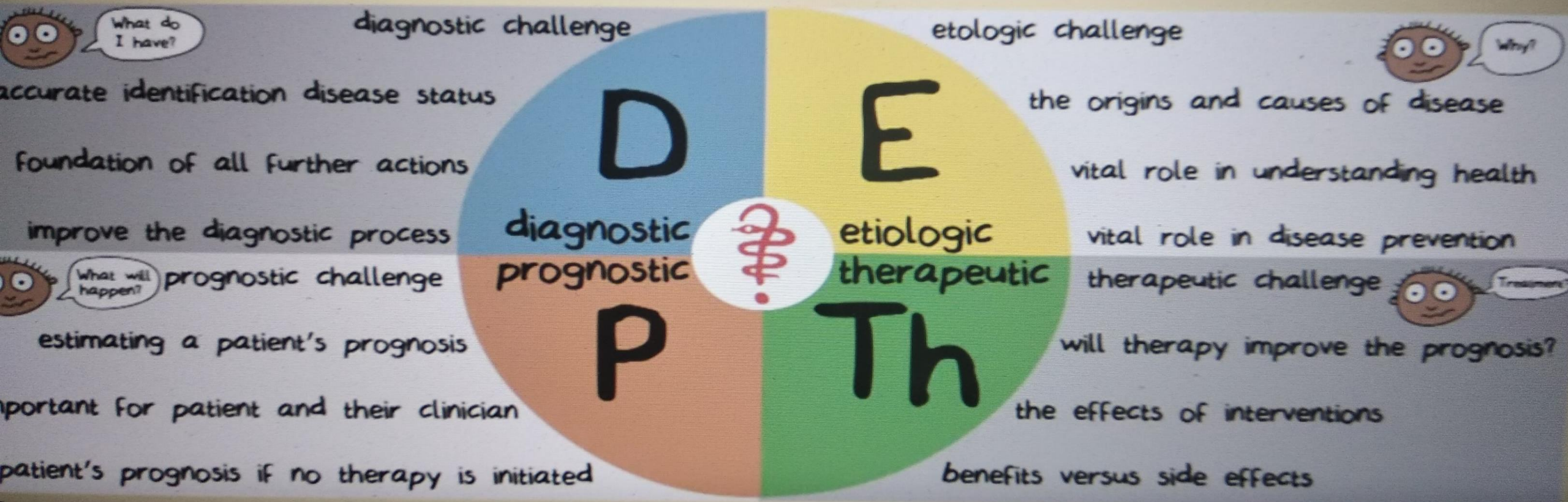


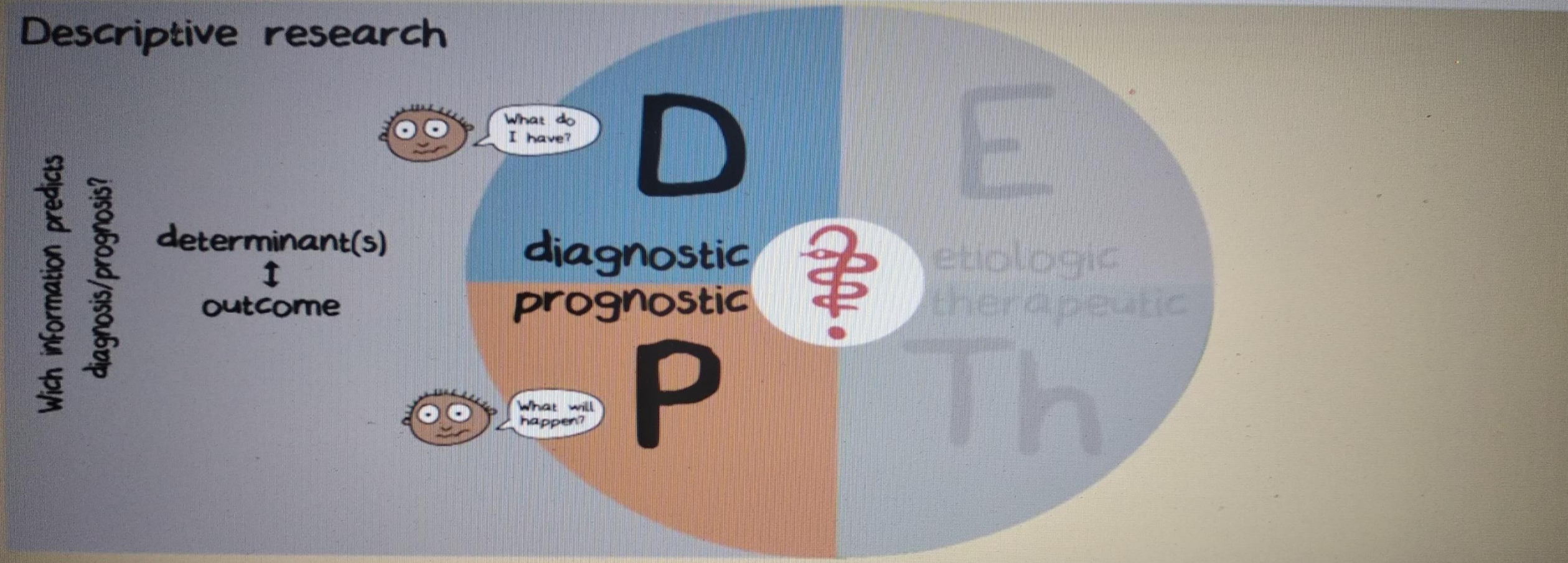
Core concepts

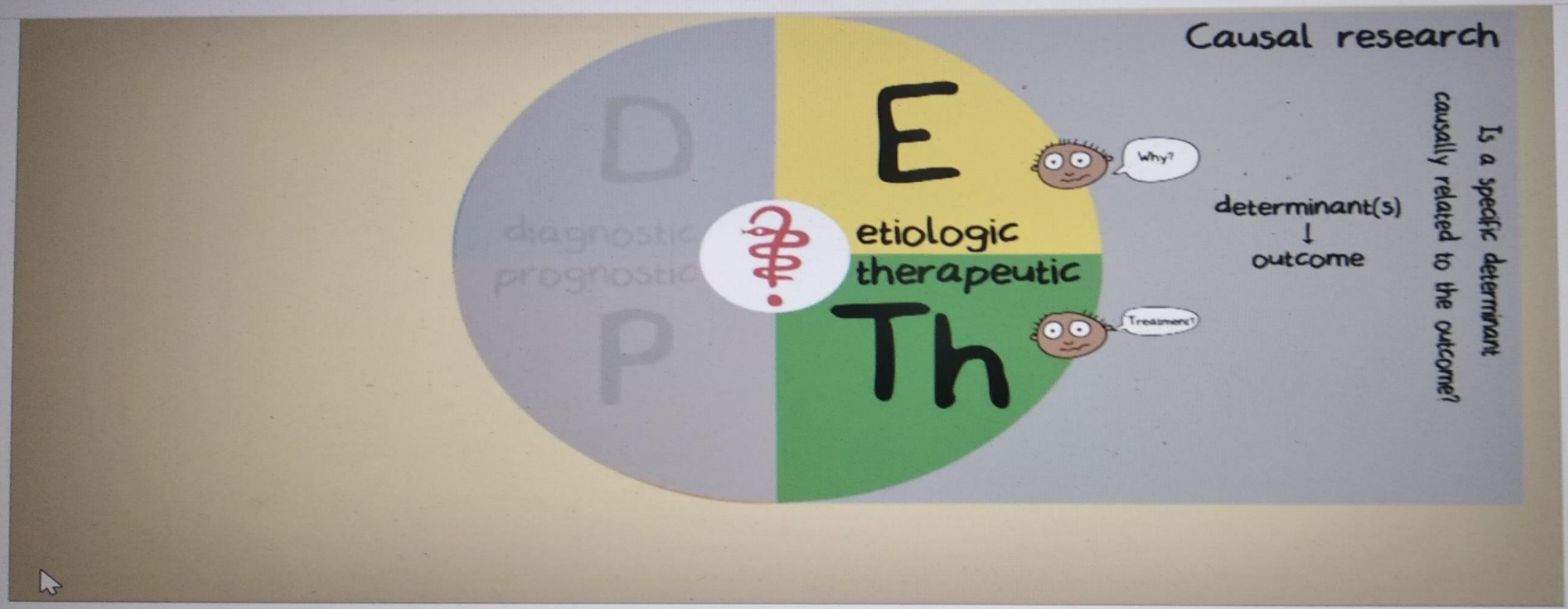
https://www.coursera.org/learn/clinical-epidemiology/lecture/S1Njm/core-concepts

https://d3c33hcgiwev3.cloudfront.net/H3uLya78EeWDcwpBfwxWiQ.processed/full/360p/index.mp4?Expires=1586304000&Signature=BvxXeshaqlGpiDLfa-qGRkH1juP925oIXVZssdSsllX0hmSws2aLYBZicEtpTauA~Nyaq0umzqXvgwtiMI3fGIYbU9ZiCa7CSDNqP6H7pX7m0gHkV4jtwEyLFgIPU8R53szUZeaBym1MeKW70xLsKNVEPFF3HMbbr2oFDfHsbdk_&Key-Pair-Id=APKAJLTNE6QMUY6HBC5A

DEPTh-model


What do I have?
diagnostic challenge
accurate identification disease status
foundation of all further actions
improve the diagnostic process
D
diagnostic
E
etiologic
Why?
etologic challenge
the origins and causes of disease
vital role in understanding health
vital role in disease prevention
What will happen?
prognostic challenge
estimating a patient's prognosis
important for patient and their clinician
patient's prognosis if no therapy is initiated
prognostic
P
Th
therapeutic
therapeutic challenge
Treatment
will therapy improve the prognosis?
the effects of interventions
benefits versus side effects


Descriptive research
What do I have?
D
diagnostic
prognostic
P
What will happen?
determinant(s)
↕
outcome
Wich information predicts
diagnosis/prognosis?
E
etiologic
therapeutic
Th



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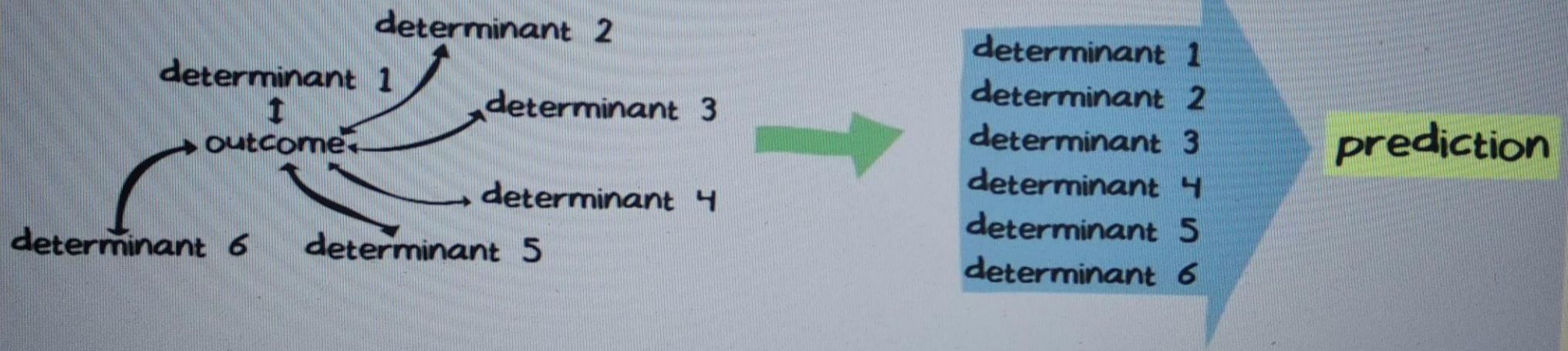
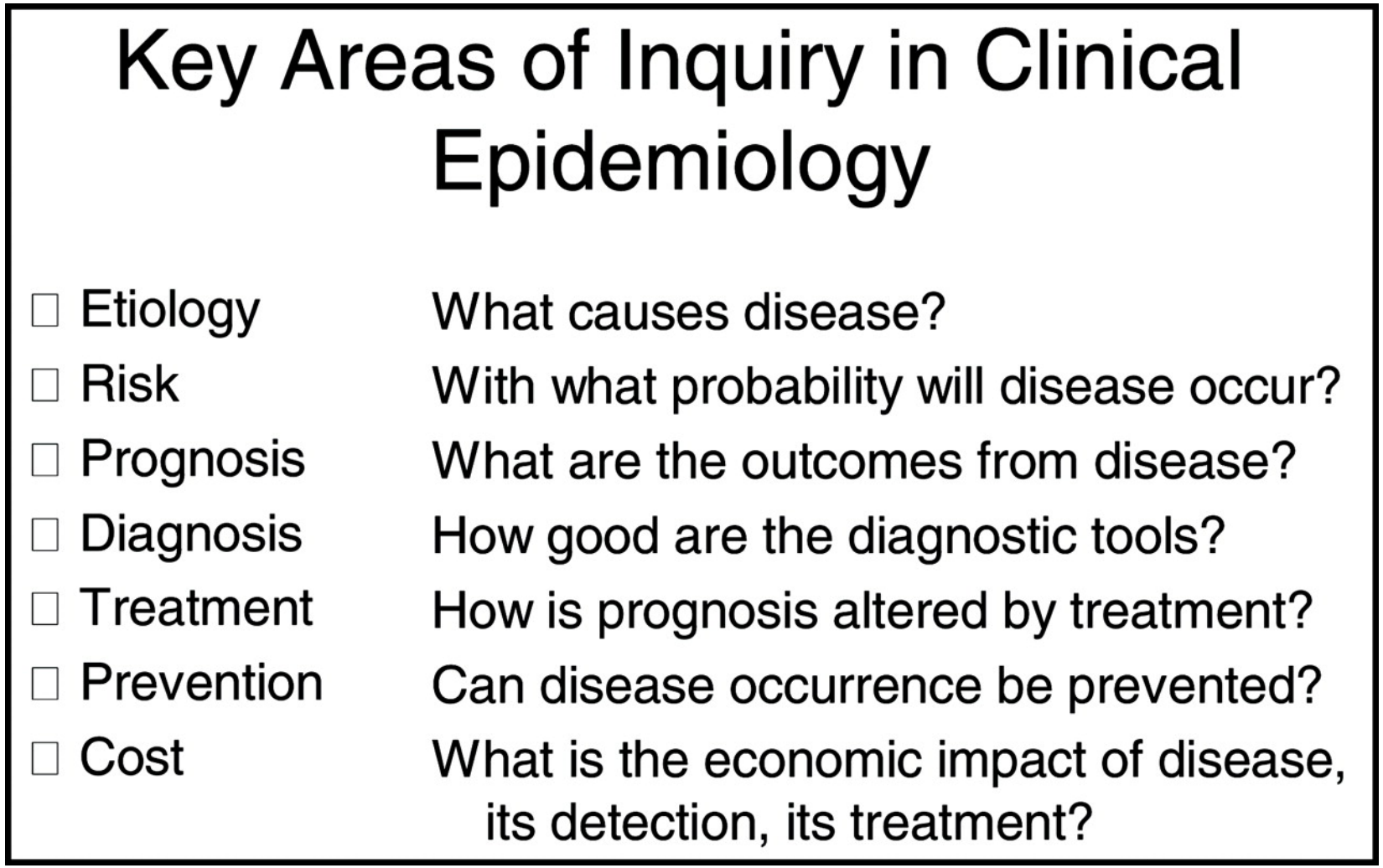
Descriptive research



EPIDEMIOLOGY vs CLINICAL MEDICINE
PRINCIPAL TASKS

CLINICAL MEDICINE	EPIDEMIOLOGY
Diagnosis	Epidemiological study
Etiology	Reason, determinants, risk factor
Prognosis	Risk assessment
Treatment	Prevention, health promotion

Key areas of inquiry in clinical epidemiology.



Chi-yuan Hsu, and Harold I. Feldman CJASN 2006;1:1115-1116

CJASN

A valid diagnostic study:

A valid diagnostic study:

1. assembles an appropriate spectrum of patients

2. applies both the diagnostic test and reference standard to all of them

3. interprets each blind to the other

4. repeats itself in a second, independent (“test”) set of patients.

5. The guidelines for achieving a valid diagnostic study consider the STARD (standards for reporting of diagnostic accuracy) initiative (http://www.consort-statement.org/stardstatement.htm

Performance of B-type Natriuretic Peptide (BPN) ≥ 18 pg/mL as a Diagnostic Test of left ventricular dysfunction (LVD)

		Target Disorder (LVD on Echocardiography)		
		Present Absent	Present Absent	Totals
Diagnostic Test Result (Serum BNP)	Positive (BNP ≥18) pg>mL2	35	57	92 a+b
	Negative (BNP 18 pg>mL2	5	29	34 c+d
		a+c	b+d	a+b+c+d
	Totals	40	86	126

***Sensitivity= a/(a + c)* = 88%** **Positive Predictive Value (PPV)= *a/(a + b)* = 35/92 = 0.38, or 38%**

***Specificity = d/(b + d)* = 34%** **Negative Predictive Value (NPV)=*d/(c + d)* = 29/34 = 0.85, or 85%**

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Scientific Principles for Case–Control Studies

1. Establish research hypothesis before the research is conducted
2. Define the exposure beforehand
3. Define inclusion and exclusion criteria for each person's baseline state
4. Exclude from the control group anyone with what could be the early signs of the outcome state or contraindications to exposure
5. Check and adjust for prognostic factors that differ between the comparison groups
6. Choose a selection process that eliminates or minimizes referral bias
7. Establish ways to eliminate or minimize recall bias
8. Establish ways to eliminate or minimize detection bias
9. Record unknown exposure as unknown, not absent
10. Manage participation bias

From Feinstein AR. *The architecture of clinical research*. Philadelphia, PA: WB S

Therapeutic issues

- To denote *both* the beneficial *and* harmful effects of an intervention when it is applied under ideal circumstances, I'll use the term: ***efficacy***
- To denote *both* the beneficial *and* harmful effects of an intervention when it is applied under the usual circumstances that apply in health care, I'll use the term: ***effectiveness***
- When speaking in general terms about the consequences of treatment, either good or bad or both, I'll use the term: ***effects***

Case Study: A Diagnostic Rule for Deep Vein Thrombosis in Primary Care

https://www.coursera.org/learn/clinical-epidemiology/lecture/1Cmu3/case-study-a-diagnostic-rule-for-deep-vein-thrombosis-in-primary-care

An Introduction to Prognostic Research

https://www.coursera.org/learn/clinical-epidemiology/lecture/kKs79/an-introduction-to-prognostic-research

Designing a Prognostic Study

https://www.coursera.org/learn/clinical-epidemiology/lecture/1GcYN/designing-a-prognostic-study

an Introduction to Intervention Research

https://www.coursera.org/learn/clinical-epidemiology/lecture/v9EQA/an-introduction-to-intervention-research

Case Study: Pneumococcal Vaccination in Adults
https://www.coursera.org/learn/clinical-epidemiology/lecture/AXIuM/case-study-pneumococcal-vaccination-in-adults

References

- Gordis: Epidemiology, 5th Edition, Saunders 2013
- Lectures of Jhon Hopkins University, Bloomberg School of Public Health
- Wolfgang, A. Handbook of Epidemiology. Vol.1//Ahrens Wolfgang, Peugeot Iris. - 2 ed.- Springer Reference, 2014.- 469 p.
- Principles and methods of Epidemiology. 3-d Edition. R. Dicker Ooffice of epidemiologic program СДС, USAID. -2012.-457 P.
- https://www.coursera.org/learn/clinical-epidemiology/home/week/7