Introduction to and History of Epidemiology

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Lecture Contents….

1. Epidemiology defined.
2. The components of epidemiology
3. Major examples of epidemiologic investigations.
4. History of epidemiology

Definitions…

Epidemiology is a core science of public health.

Major fields of public health:
1-Epidemiology
2-Biostatistics
3-Environmental health
4-Health managment
5-Health promotion

Public health

The science & art of

Preventing disease,
prolonging life, and
promoting health & efficiency
through organized community effort

Public health does not aim to cure a disease but to improve health and prevent disease .

Definitions

Health: A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO,1948)

Disease: A physiological or psychological dysfunction. (Literally, dis-ease, the opposite of ease, when something is wrong with a bodily function).

Illness: A subjective state of not being well (subjective state of a person who feels aware of not being well)

I.e:when someone says:I feel ill today,having observable symptoms is not necessary though, so it reflects how a person feels about themselves.

Sickness: A state of social dysfunction (i.e., a role that the

Sickness : when people around you can see that you are not okay …you look sick today. So it is concerned with how people see you .

Definitions

Epidemiology

يعني محور دراسته كان متمركز حول الامراض المعدية ، ما كان في مطاعيم ولا مضادات حيوية، فكانت هاي الامراض مهددة لصحة الانسان

The science of the mass phenomena of infectious diseases or the natural history of infectious diseases. (Frost 1927)

و بعدين بدؤوا يبحثوا عن اسباب المرض ، و لما فهموها صاروا يسعوا لمنعه من الحدوث

The science of infective diseases, their prime causes, propagation and prevention. (Stallbrass 1931.)

Definitions…

Epidemiology

لاحِظوا انه بالتعريف ما استخدم كلمة disease على وجه التحديد و لكن Health-related states

"The study of the distribution and determinants of health-related states or events in specified populations, and the application of the study to the control of health problems".

Prvention

(J.M. Last 1988)

Epidemiology as a Science and a Method

Epi- demio- logy: The word itself comes from the Greek epi, demos, and Logos……

literally translated it means the study (logos) of what is upon (epi) the people (demos).

When we have a new disease or health problem,we still do not know what this is , how to learn about it and prevent it , so we use scientific methods to do so . This is what epidemiology is concerned with .

It is the scientific method of disease investigation – Typically, it involves the disciplines of biostatistics and medicine.

Components of the definition

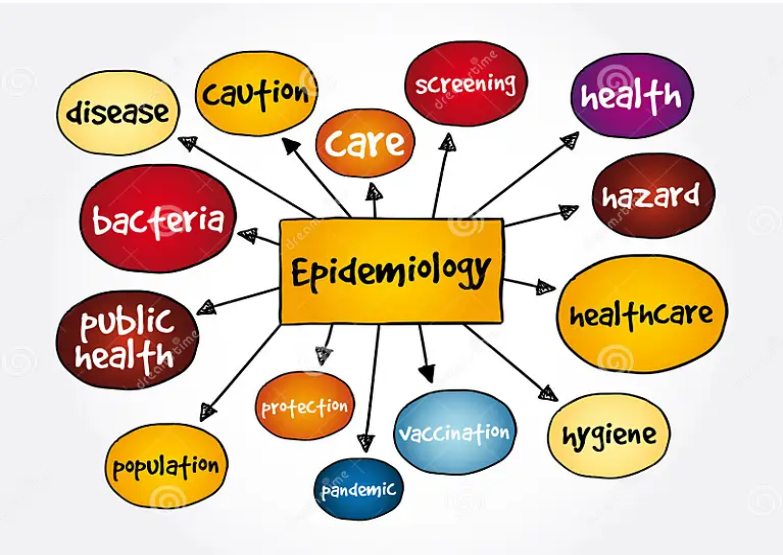
Via biostatistics

Study: Systematic collection, analysis and interpretation of data

When we interpret the results ,we can determine the factors associated with the health problem,thus we can start preventing it

Epidemiology involves collection, analysis and interpretation of health related data

Epidemiology is a science.



Components of epidemiology

Distribution: **Epidemiology is concerned with the frequency and pattern of health events in a population:**

Frequency: **A core characteristic of epidemiology is to measure the frequency (number of cases) of diseases, disability or death in a specified population.**

It also refers to the relationship of that number to the size of the population.

This falls in the domain of biostatistics, which is a basic tool of epidemiology.

مثال لتوضيح أهمية ال frequency ، هو يستخدم لحتى نعمل المنحنى الوبائي الذي يوضَّح فيه عدد الحالات لمشكلة صحية معينة خلال فترة زمنية معينة ، فإذا شفت انه الحالات كانت متركزة بفترة زمنية قصيرة إذًا في مشكلة ، بالتالي لازم نبدأ نبحث بالسبب .

مثال عملي: طبيب طوارئ يصادف حالة او حالتين تسمم غذائي باليوم ،في أحد الايام ، استقبل ٣٥ حالة مع بعض فهذا مؤشر انه في مشكلة مشتركة ، مثلا كانوا طلاب مدارس و اشتروا كلهم من نفس المطعم .

Components of epidemiology

Disease frequency:

E.g. Prevalence, Incidence rates, Death rate etc.

These rates are essential for comparing the disease frequency in different populations or sub groups of the same population

rate=number of cases/population *100%

Components of epidemiology

Distribution….. The study of the pattern of an event by person, place and time.

Epidemiology studies distribution of diseases among subgroups of the population, in different geographic areas, and also any increase or decrease over time.

It answers the question who, where and when? This is descriptive epidemiology.

An important outcome of this step is formulation of etiological hypothesis

لما تجاوب ال ٣ اسئلة فوق ، بتقدر تحط فرضية عن الفئة الي بنصيبها المشكلة الصحية ، اماكن تواجدها ، و وقتها .

PERSON DISTRIBUTION

- In descriptive studies disease is further characterized by defining the persons who develop the disease by age, gender, ethnicity, occupation, marital status, habits, social class & other host factors.

- These host factors help us to understand the natural history of disease.

PLACE DISTRIBUTION

- Study of the geography of the disease (geographical pathology) is one of the important dimensions of epidemiology.

- With the geographical pathology we learn the differences in disease patterns between two geographical areas (e.g. international, national, or urban/rural differences).

- These variations may be due to variations in population density, social class, deficiencies in health services, levels of sanitation, education & environmental factors.

TIME DISTRIBUTION

- The pattern of a disease may be described by the time of occurrence
- The occurrence of disease changes over time.
- Some of these changes occur regularly, while others are unpredictable.
- Two diseases that occur during the same season each year include influenza (winter) and West Nile virus infection (August– September).
- In contrast, diseases such as hepatitis B and salmonellosis can occur at any time.
- Day of the week or time of the day may be important.

TIME DISTRIBUTION

Epidemiologists have identified three kinds of time trends or fluctuations in disease occurrence:

1. Short term fluctuation: Single (one incubation period and one peak)(e.g. food poisoning)

شكل المنحنى الوبائي رح يكون مرتفع و ضيّق

زي المثال الي طرحته بالسلايد فوق عن تسمم مجموعة كبيرة بنفس الوقت

Single

يعني لمرة واحدة فقط ، مثلا بمثال التسمم من مطعم ...هذا المطعم حصل تسمم بسببه لمرة واحدة فقط بسبب شيء حدث في ذلك اليوم فقط (الخضراوات تلوثت ، الدجاج بقي بالخارج و فسد ...الخ) لكن الفكرة انه مش كل يوم ناس بتسمم منه

or multiple or continuous exposure (well of contaminated water-cholera)

كل اسبوع بتيجي حالات تسمم من بئر ماء فيه كوليرا لذلك صار multiple لانه بيتكرر دايما

Minamata disease in Japan??

short term

تشير الى قصر المدة بين التعرّض للمسبب و ظهور الاعراض " عدة ساعات"

2. Periodic fluctuation:

Seasonal: GI infection in Summer

Cyclic: Human coronavirus every 7-10 years..antigenic variations. (e.g. SARS-CoV in 2003, MERS-CoV in 2012, SARS-CoV-2 (COVID-19) in 2019).

كل فترة بيرجع ينتشر و بيعمل epidemic في مناطق جغرافية معينة.

3.Long-term or Secular trend (e.g CVD,lung csncer)

Chronic diseases,risk factors have to affect a person's life for a large period of time …so these risk factors take a long time to be effective

Components of the Definition of Epidemiology

Determinants:

Factors the presence/absence of which affect the occurrence and level of a health event (Risk Factor).

Epidemiology studies what determines or influences health events:

So we want know what are the risk factors related to a health condition .

- It answers the question: how and why?
- Epidemiology analyzes health events "analytical epidemiology". Here we test a hypothesis to prove right or wrong.
- Analytical strategies help in developing scientifically sound health programes, interventions & policies.

لانه الاطباء رح يصيروا ينصحوا مرضاهم انه يعملوا سلوكات صحية معينة ابناءً على الاستنتاجات الي طلعت من هاي الدراسات التحليلية.

Components…

برجع للتأكيد كمان مرة ….
Public health
لا تقتصر فقط على دراسة الامراض و منع حدوثها و لكن ايضا منع اي مشاكل تؤثر على صحة الإنسان .
بالتالي اي شيء من شأنه انه يقلل من جودة الحياة للانسان يقع ضمن مجالها

Health-related states and events

Epidemiology is not only the study of diseases.

The focus of Epidemiology is not only patients' health as individuals, but anything in the environment that may affect their health and well-being in any way.

For example , we can conduct a study that is concerned with Jordanian's attitude toward wearing seat belts, this is not a disease , but is related to humans' behaviour and at very high risk for having fatal results when accidents happen.

- It studies all health related conditions
- Epidemiology is a broad science

Components…

Here is a difference between medicine and public health
-physicians deal with idividuals.However, the individual unit in public health is a specified population
Examples of populations: Students at UJ,Medical students at UJ,workers in a factory,school students at the age of 12 .

Specified population

Epidemiology diagnoses and prevents disease in communities/ populations

- The unit of study is a population (groups of people)
- Clinical medicine diagnoses and treats patients after they get sick and go seek physician's help.
- Epidemiology is a basic science of public health.

Components…

Application

Epidemiological studies have direct and practical applications for prevention of diseases & promotion of health

- Epidemiology is a science and practice
- Epidemiology is an applied science

Applications of Epidemiology:

Epidemiology provides data essential to the planning, implementation & evaluation of services for the

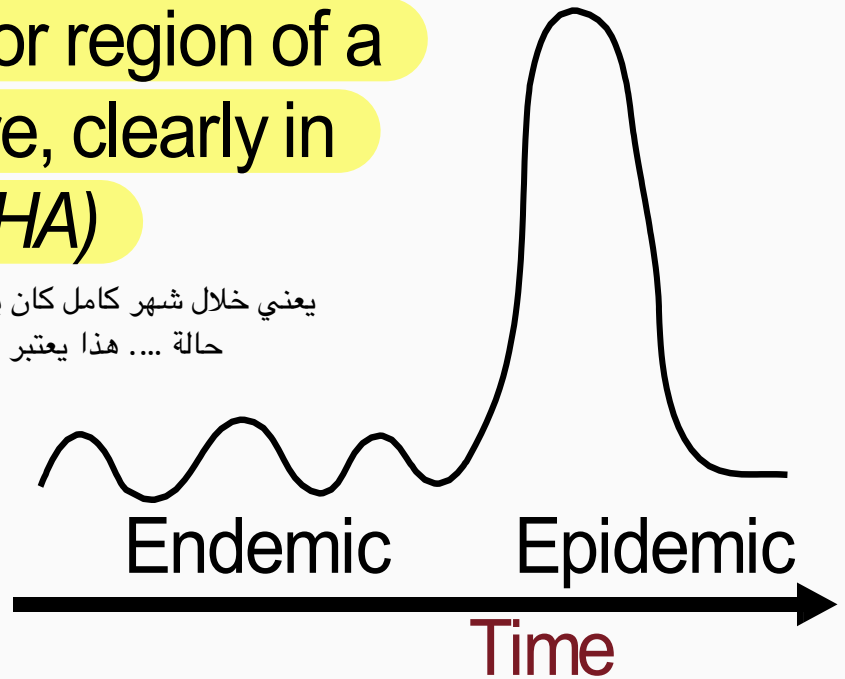
Definition of Endemic, Epidemic, and Pandemic

- **Endemic** بالعربي المرض المستوطن
  - The habitual presence of a disease within a given geographic area
  - May also refer to the usual prevalence of a given disease within such an area *(APHA)*

-معناها انه في منطقة معينة، في مرض معين موجود و معتاد عليه بنسبة معينة....مثلا في بلد معينة ، كل شهر عندهم عشر حالات حصبة ، هذا المعتادين عليه و يعتبر ضمن الحد الطبيعي عندهم ، بس بالاردن ، معدل الحصبة المتوقع هو صفر حالة لاي اسبوع او شهر من السنة و هذا الطبيعي عنّا، بالتالي لو صارت عنا رح نعتبرها epidemic رغم انها بمكان ثاني ممكن تكون endemic .

-كمان مثال ، الملاريا بافريقيا تعتبر endemic لكن بالاردن epidemic فبكون حالة استنفار لازم نعرف شو أكل و شو شرب و وين راح لانه مش معتاد على هذه لحالات ابدًا .

- **Epidemic** خلال فترة قصيرة ، يوجد عدد من الحالات بأعراض متشابهة
  l.e : single case of food poisoning
  - The occurrence in a community or region of a group of illnesses of similar nature, clearly in excess of normal expectancy *(APHA)*
  - Outbreak يعني خلال شهر كامل كان بيجي عشر حالات مثلًا تسمم غذائي ، بليلة وحدة اى ٣٠ حالة .... هذا يعتبر زائد عن المتوقع في ذلك المكان الذي يقدم الرعاية الصحية .
- **Pandemic** كورونا يعني .
  - A worldwide epidemic



Epidemiology

In Epidemiology, we ask the following questions related to the health event:

What is the event? (The Health problem).

What is the magnitude? Number of cases , so we can determine if it is usual or excess

Where did it happen ?

When did it happen?

Who is affected?

Why did it happen?

Epidemiology

In Epidemiology, we ask the following questions related to the health action:

After determining the risk factors

- What can be done to reduce this problem and its consequences?
- How can it be prevented in future?
- What action should be taken by the community? By whom should these activities be carried out?

الاهل ، المعلمين ، خطباء المساجد ،الوزارات ،مؤسسات الصحة
يعني اخر حلقة هي الطبيب ، لانه مش هدفنا نوصل العيادات...
الصحية و لكن انه نمنع المشكلة و نحمي منها بالاساس

What Do Epidemiologists Do?

Count cases of disease or injury

Define the affected population

Compute rates of disease or injury in that population

Compare rates with those found in other populations

Make inferences regarding patterns of disease

Determine whether a problem exists

Fundamental assumptions in epidemiology

- **Human disease does not occur at random**

- **Disease has causal and preventive factors that can be identified using systematic investigations**

  Epidemiological studies

Epidemiologic Reasoning

There is a natural progression in epidemiologic reasoning:

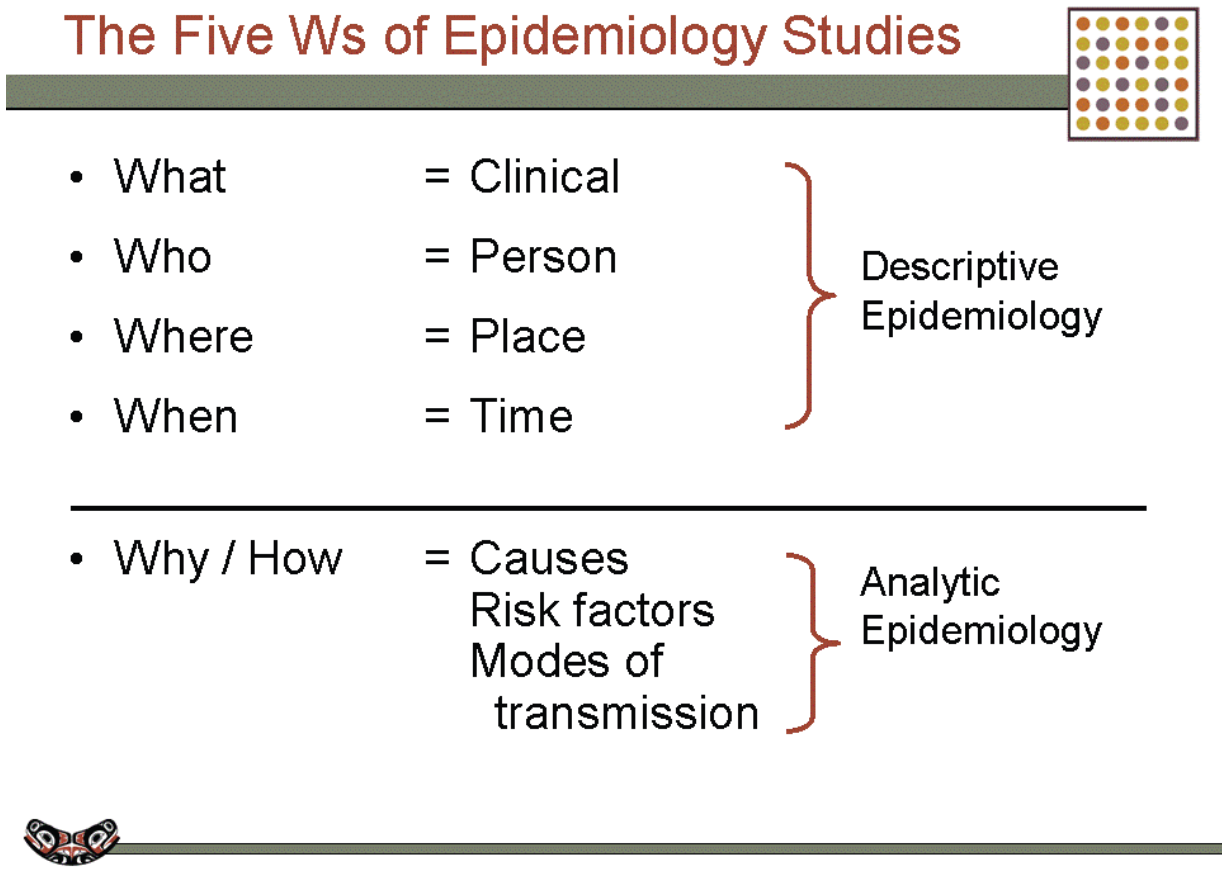
- **Begins with suspicion (clinical practice, descriptive epidemiology, laboratory research or theoretical speculation)**
- **Formulation of specific hypothesis**

Then we test the hypothesis using the analytical epidemiology (statistical analysis and P value)
P value<0.05 ….there is a significant association between the risk factor and the disease
P value>0.05 ….there is no significant association between the risk factor and the disease.

Sources of information (data) in Epidemiology

- Registration of births, deaths and diseases
- Population censuses
- Routine health information systems
- Surveillance
- Investigation of epidemics

The Five Ws of Epidemiologic Studies



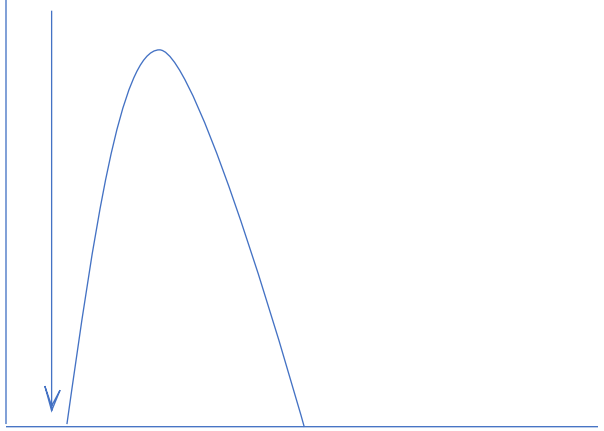
EPIDEMIC CURVE

مهم لانه بساعدني اعرف عدد ال peaks.

و دايماً الهدف انه نسطّح المنحنى، بحيث يصير اقصر و ممتد على فترة زمنية اطول عشان نقدر نقدم الرعاية الصحية .

EXPOSURE

NUMBER OF CASES



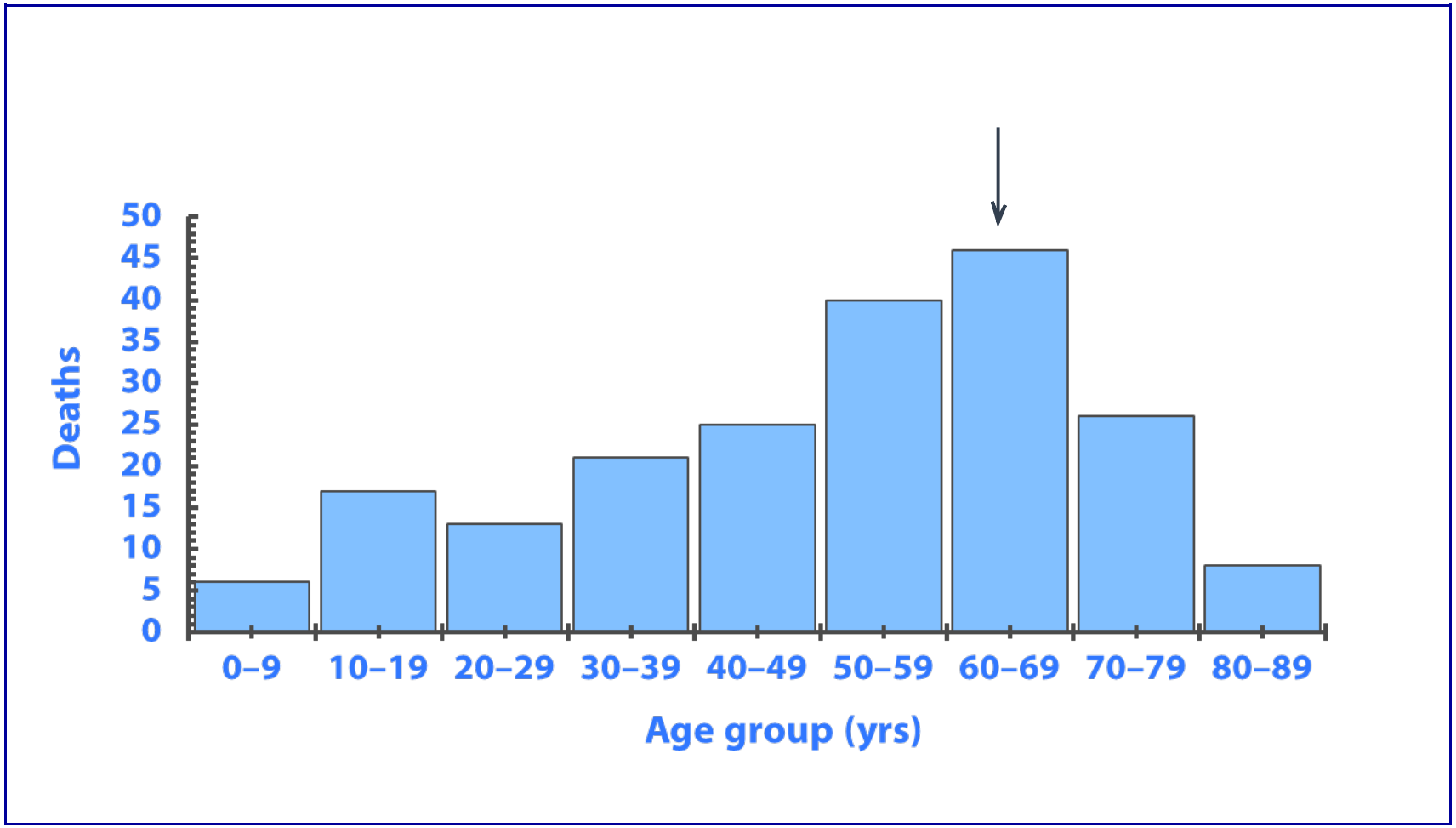
TIME

Fatalities Associated with Farm Tractors

In 1982, an epidemiologist studied the number of farm tractor-associated deaths in Georgia and described them in terms of time, place, and person by using death certificates and records from an existing surveillance system (All tractor related incidents between 1971-1981, N=166 cases).

He then generated a hypothesis for further study. Let's look at the descriptive epidemiology (Who, When and Where….)

Fatalities Associated with Farm Tractors (person)



Goodman RA, Smith JD, Sikes RK, et al. Fatalities associated with farm tractor injuries: an epidemiologic study. Public Health Rep 1985;100: 329–33.