Epidemiology

By

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Epidemiology

- Epidemiology is the science which deals with what falls upon people ,and it is the bridge between biomedical, social and behavioral sciences

Definition

Study of the occurrence and distribution of health-related diseases or events

in specified populations.

- Epidemiology is the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems.(WHO)
- Various methods can be used to carry out epidemiological investigations: surveillance and descriptive studies can be used to study distribution; analytical studies are used to study determinants

Purposes of Epidemiology

1. To investigate nature / extent of health-related phenomena in the community / identify priorities

2. To study natural history and prognosis of health-related problems

3. To identify causes and risk factors

4. To recommend / assist in application of / evaluate best interventions (preventive and therapeutic measures)

5. To provide foundation for public policy.

Epidemiological measurement

Incidence is a count of *new cases* of the disease (or outcome).

Uses of Incidence

1.To control disease

2.For research in to etiology, pathogenesis ,distribution of disease, efficacy of prevention and therapeutic measure.

Prevalence, on the other hand, counts *both new and existing cases* of the disease.

Uses of Prevalence

1.To estimate the magnitude and health /disease problems in community and identify potential high-risk group.

2. For administrative and planning purposes

For prevalence

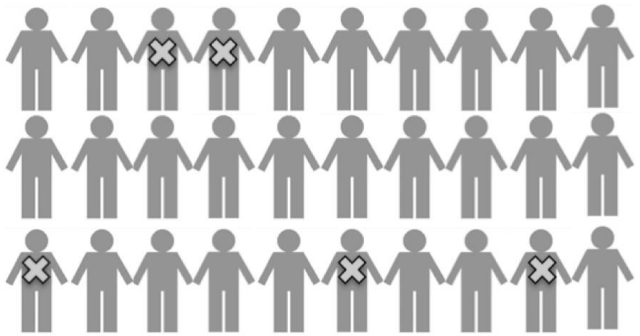
- We need a numerator (number of existing cases), and denominator (total sample size), and a time period of interest
- The time period should be specified as much as possible

Disease occurrence in a sample over a time

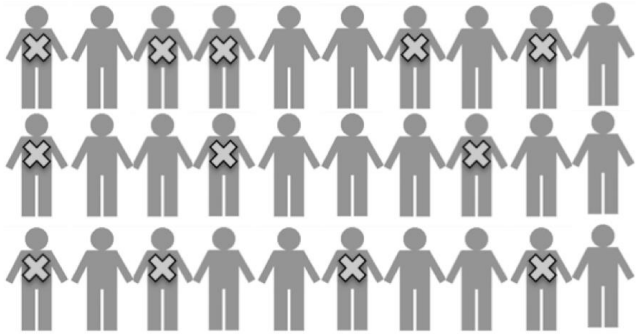
- Year 1,
- **5** individuals developed the outcome

- Year 2,
- an additional **7** people developed
- the outcome

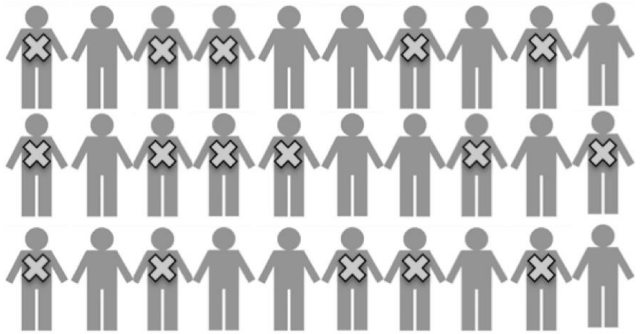
- Year 3,
- an additional **4** peopledeveloped the outcon



Year 1



Year 2



Year 3

What is the prevalence of disease in Year 2?

- What is the numerator?

  5 cases in Year 1 + 7 cases in Year 2 = 12

- What is the denominator?

  Total sample size = 30

- Prevalence = 12/30 = 0.4

  The prevalence of disease in Year 2 is 40%

Critical thinking

- **What is the prevalence of disease in Year 3 ?**

Summary: Prevalence

- For prevalence, we need a numerator (number of existing cases), and denominator (total sample size), and a time period of interest
- The time period should be specified as much as possible
- For example, when we say “in Year 2” we mean over the duration of time that spanned up to Year 2

Incidence

- Perhaps the most widely used tool in epidemiology
- Goes by many names - most common alternative name is “risk,” and less commonly, “incidence proportion”
- **Numerator** = number of **new** cases
- **Denominator** = population **at risk** of becoming a new case
- Specified over a **specific time period**

What is the incidence of disease in Year 2?

- What is the numerator?

  7 new cases in Year 2

- What is the denominator?

  25 people at risk (5 people already developed the disease in Year 1 and are thus not at risk)

- Incidence = 7/25 = 0.28

  The incidence (risk) of disease in Year 2 is 28%

- **What is the incidence of the disease in Years 2 and 3?**

Summary: Incidence

- For incidence, we need a numerator (number of new cases), and denominator (total sample size at risk), and a time period of interest
- The time period should again be specified as much as possible

Summary, incidence, prevalence

- Prevalence is affected by **incidence** and **duration**
- If a disease has short duration,
  - Prevalence ~= incidence*
- If a disease has long duration, in general,
  - Prevalence > incidence

* Assumes that incidence is constant over time

Tools of measurement the epidemiology of diseases

- **Rate:** is a ratio of the form a*/ (a+b), a* = the frequency of events during a certain period, a+b = the number at risk of the event during that time. A rate may or may not be a proportion

Death rate: Number of death people in a specific period X 1000

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population

- **Proportion**:

A/(A+B); is a ratio in which the numerator is a subset (or part) of the denominator and can be written as a/(a+b).

(A) includes only individuals who meet the case definition and they are part of the denominator (A+B) totals the numbers of individuals who meet the case definition plus those in the study population who do not meet the case definition and are at risk.

- Ex: 30% of persons over 50 years of age have been screened for colon cancer

- **Ratio A/B:**

A special fraction in which the numerator includes only individuals who meeting one criterion (e.g. the case definition) and the denominator includes only individuals in the study population who meet another criterion (e.g. do not meet the case definition but are at risk).

- **A ratio** is not dependent upon time. A ratio *as a measure of disease frequency*

Ex: 1 case of colon cancer for every 1 case of breast cancer.

Ex: 2 female cases of major depression to 1 male case of major depression.

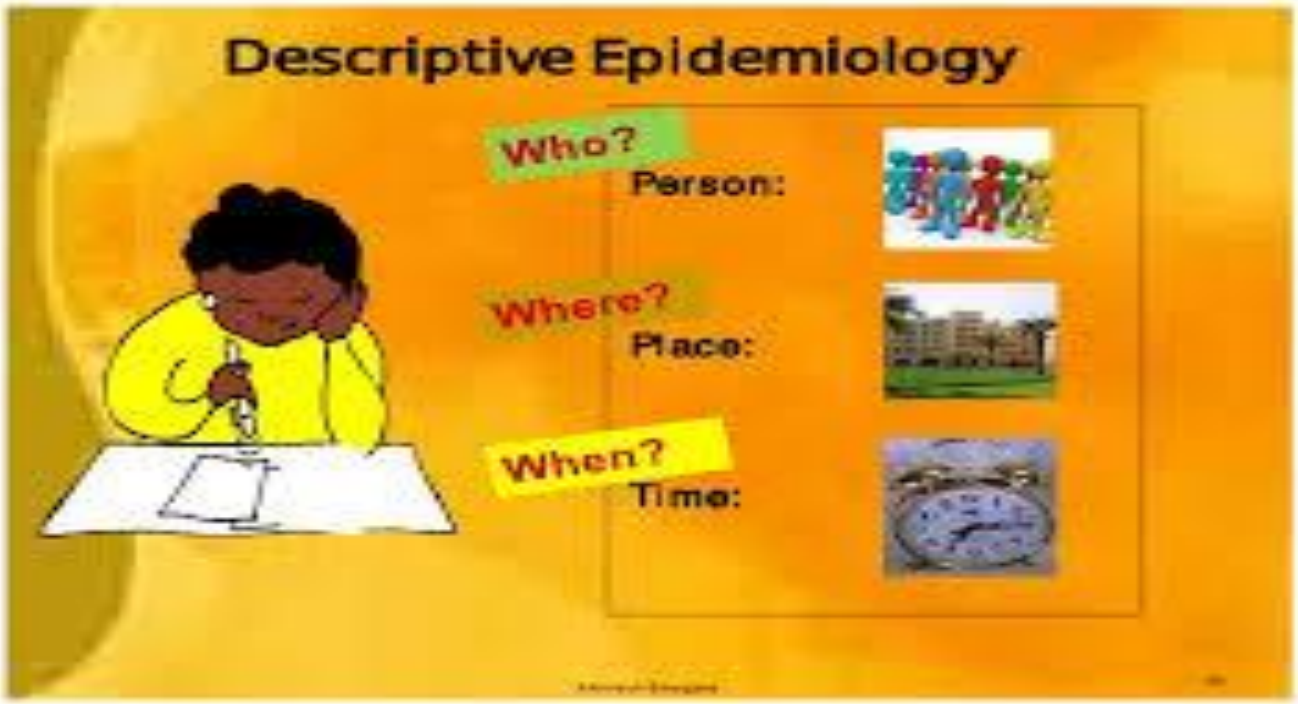
- Example

$$\frac{\text{No of children with caries in the first molar}}{\text{Total number of children at the same time}} \times 100$$

Basic Triad of Descriptive Epidemiology

The Three Essential Characteristics of Disease We Look for in Descriptive Epidemiology Are:

- **Person.**
- **Place.**
- **Time.**



Personal Characteristics (whom?)

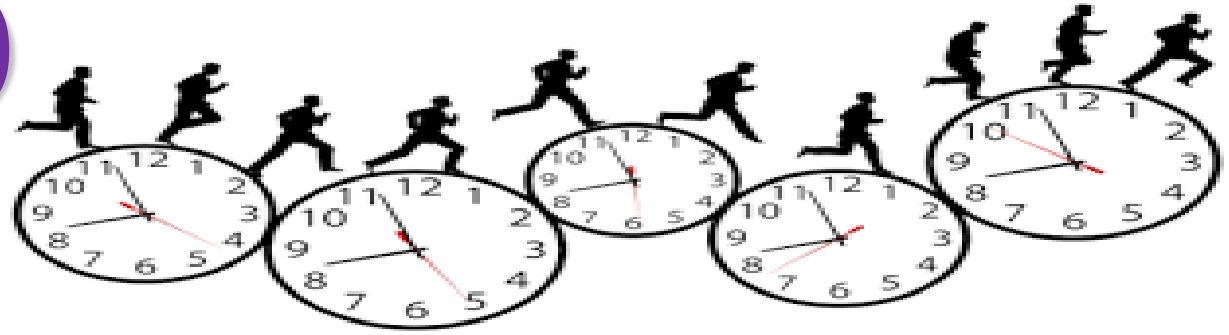
- Age: Age of the population at risk

- **Gender :** Men, women and children were all exposed and at risk
- **Socio-economic status** (education, occupation, income)
- **Marital status**
- **Ethnicity/race/genetic profile**
- **Behavior / habits**

Place(where?)

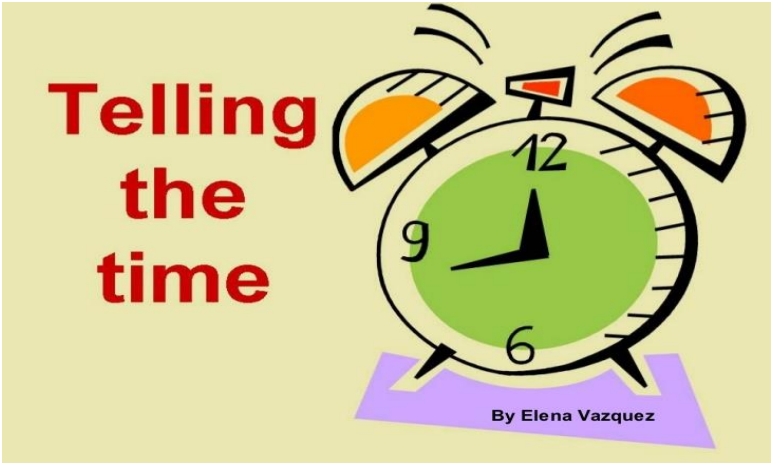
- Geographically restricted or widespread (outbreak, epidemic, pandemic)? Off-shore (tsunami…)
- Climate effects (temperature, humidity, combined effects..)
- Urban / sub-urban-squatter / rural
- Relation to environmental exposure (water, food supply, etc.)
- Multiple clusters or one.

Time (when ?)



- Changing or stable?
- Clustered (epidemic) or evenly distributed (endemic)?

- Time-trends: Point source, propagated, seasonal, secular, combinations



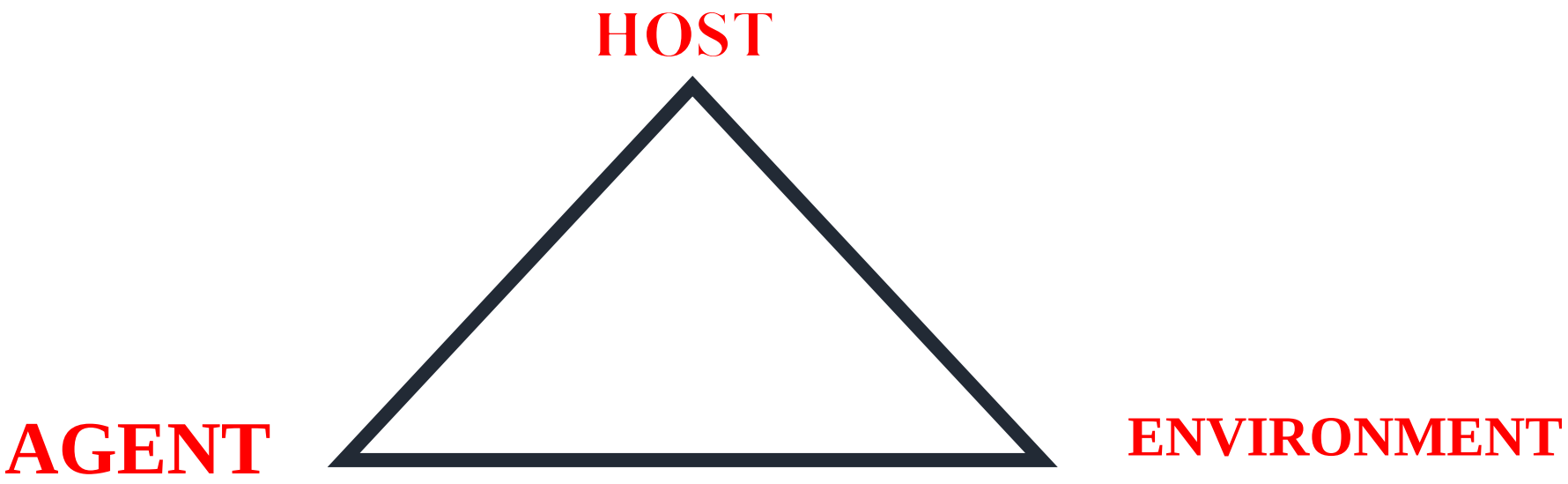
Example

- You have been asked to investigate an event in which 2,220 people were exposed and 1,520 of them died.

- Your role as an epidemiologist is to ask questions about person, place and time

Basic triad of analytical epidemiology

- **The Three Phenomena Assessed In Analytic Epidemiology are:**



Host Factors

- May be a person ,an animal or a plant.
- Host factors relate primarily to susceptibility and resistance to disease through biological immunologic status .
- Personal characteristics.
- Personal behavior .

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Agents

- Biological (micro-organisms)

- Physical (temperature, radiation, trauma, others)

- Chemical (**acids, alkalis, poisons, tobacco, others**)

- Environmental (nutrients in diet, allergens, others)

- Psychological (experiences.)

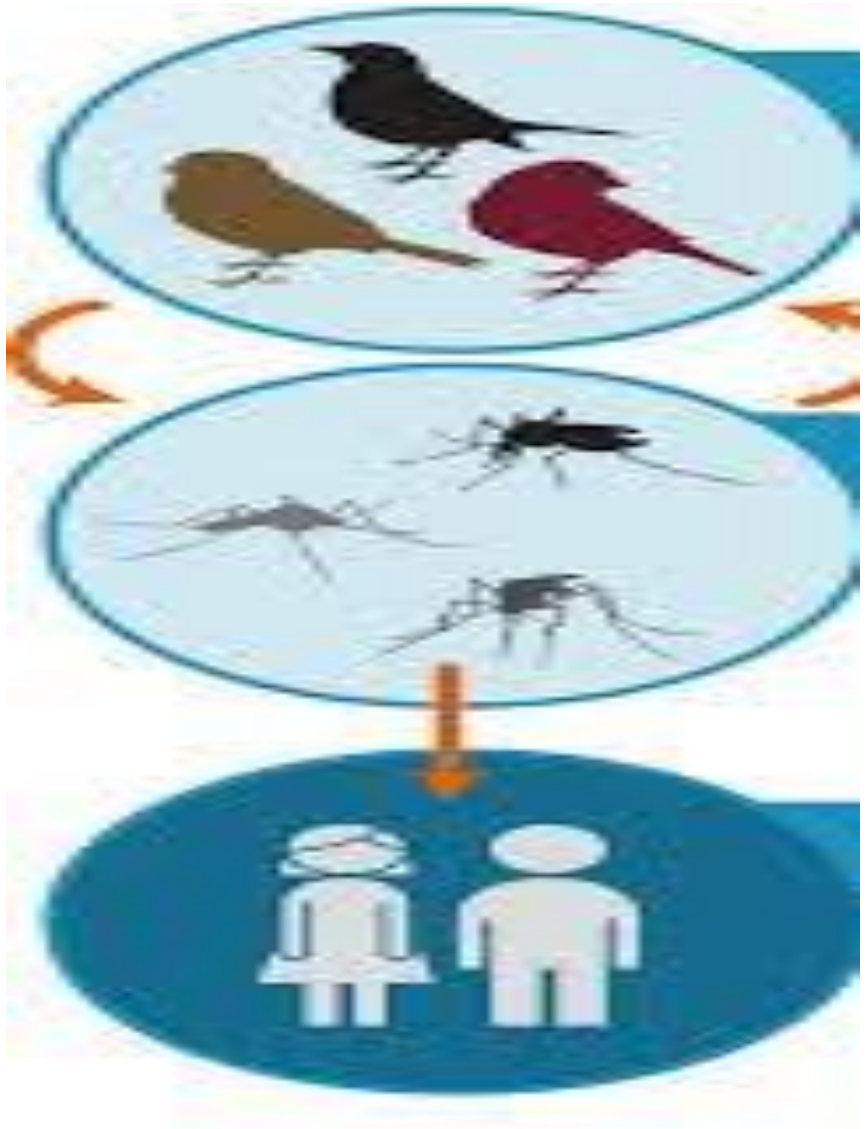
Environment

- Living conditions (housing, crowding, water supply, garbage, sewage, etc.)

- Atmosphere / climate

- Modes of communication:

phenomena in the environment that *bring host and agent together*, such as: vector, vehicle, reservoir, etc.)



Host Factors

- Tooth enamel
- Saliva (flow and composition)
- Immunity (response to pathogen
- Host(individual beliefs, values, behaviors, habits, and customs

Environmental Factors

- Plaque (quantity and quality)
- Enzymes
- Minerals.
- Bacterial substrate (fermentable carbohydrate in diet)
- Protective factors (fluoride in toothpaste ,water, etc.)
- Socioeconomic factors
- Community standards and cultural factors.
- Family and social support networks

Dental Caries

Agent Factors

- Bacterial biofilm
- Specific bacteria streptococcus mutans,lactobacillus)
- Other bacteria

Ebola hemorrhagic fever

Ebola is a severe, often-fatal disease that affects people, as well as monkeys, gorillas and chimpanzees.

Origins of the disease

■ Infection with Ebola virus, named after river in Congo, where disease was first recognized in 1976

Ebola virus

Symptoms

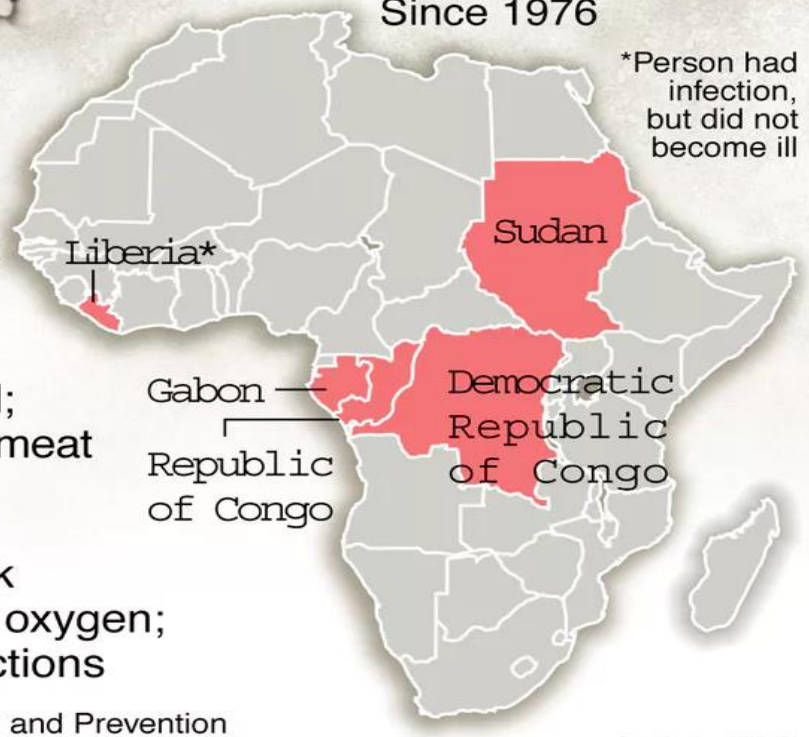
1 Fever, headache, joint and muscle pain, sore throat, weakness

2 Followed by diarrhea, vomiting

3 Rash, internal and external bleeding

Confirmed human cases

Since 1976



How it spreads

■ Direct contact with blood, secretions of infected person

■ Contact with contaminated objects, such as needles

■ Contact with infected animal; possibly eating contaminated meat

Treatment

■ No standard treatment; sick person isolated, given fluids, oxygen; treatment for secondary infections

Source: U.S. Centers for Disease Control and Prevention
Graphic: Pat Carr

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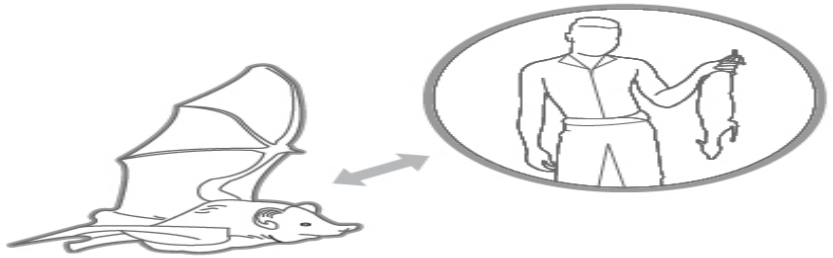
Ebola Virus Disease

Ebola is most feared for the internal and external bleeding it can cause in victims owing to damage done to blood vessels.

It was discovered in 1976, and since then the majority of the outbreaks have appeared in parts of Africa.

At least 12,800 deaths have occured globally since 1976.



According to WHO, it is thought that fruit bats are natural Ebola virus hosts

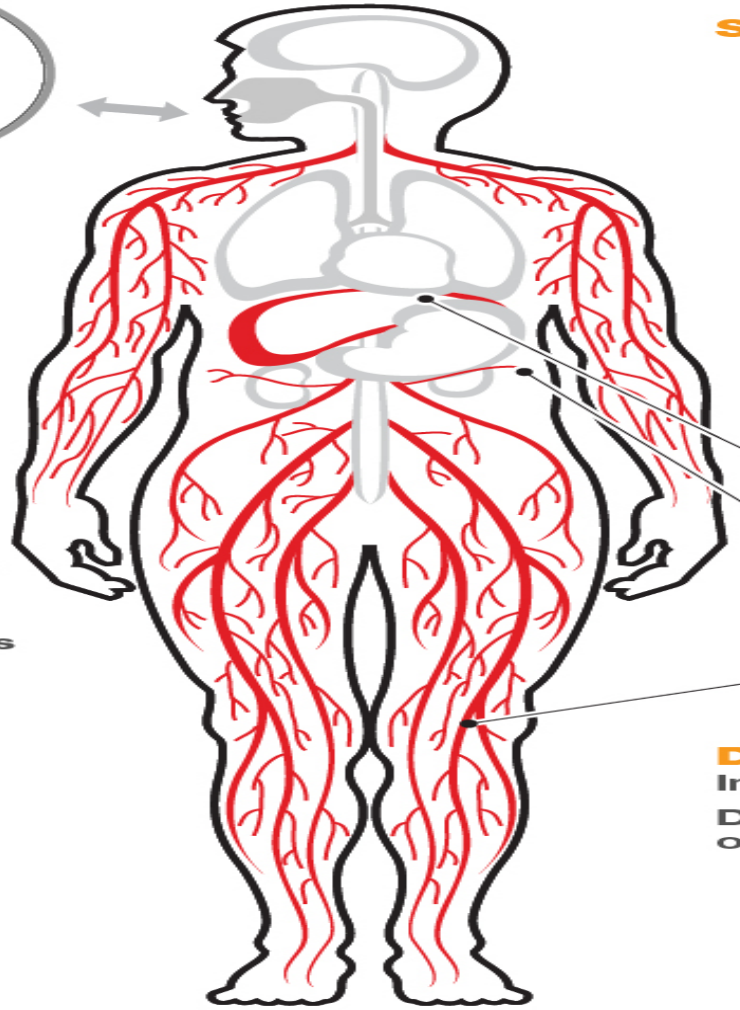
POSSIBLE ROUTES

- Contact with the blood, secretions, organs or other bodily fluids of infected or dead animals
- Consumption of infected wild animal meat
- Touching objects that have come in contact with the virus

INFECTED ANIMALS

Chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest*

*Note: List of animals is not exhaustive.



SYMPTOMS

- Fever
- Sore throat
- Severe headache
- Muscle pain
- Intense weakness
- Vomiting
- Diarrhea
- Impaired liver and kidney function
- Internal and external bleeding

TARGETS IN THE BODY

- Functional cells of the liver
- Lining of blood vessels
- Blood cells absorb foreign particles

DAMAGE

Incubation period: 2-21 days

Death is often caused by multiple organ failure and tissue death.

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SOURCE: CDC, WHO, REUTERS | MAY 20, 2018

@AJLabs ALJAZEERA

Thank you