Epidemiology I.

Introduction

“I’m studying epidemiology”: 3 responses

- You're studying what?”

- “Does that have something to do with skin?”

- “Uh-huh. And what else are you studying?”

What is epidemiology?

"The study of the distribution and determinants of health related states and events in populations, and the application of this study to control health problems"

John M. Last, *Dictionary of Epidemiology*

What for?

1. Provide the scientific basis to prevent disease & injury and promote health.

2. Determine relative importance to establish priorities for research & action.

3. Identify sections of the population at greatest risk to target interventions.

4. Evaluate effectiveness of programs in improving the health of the population.

What for? – more

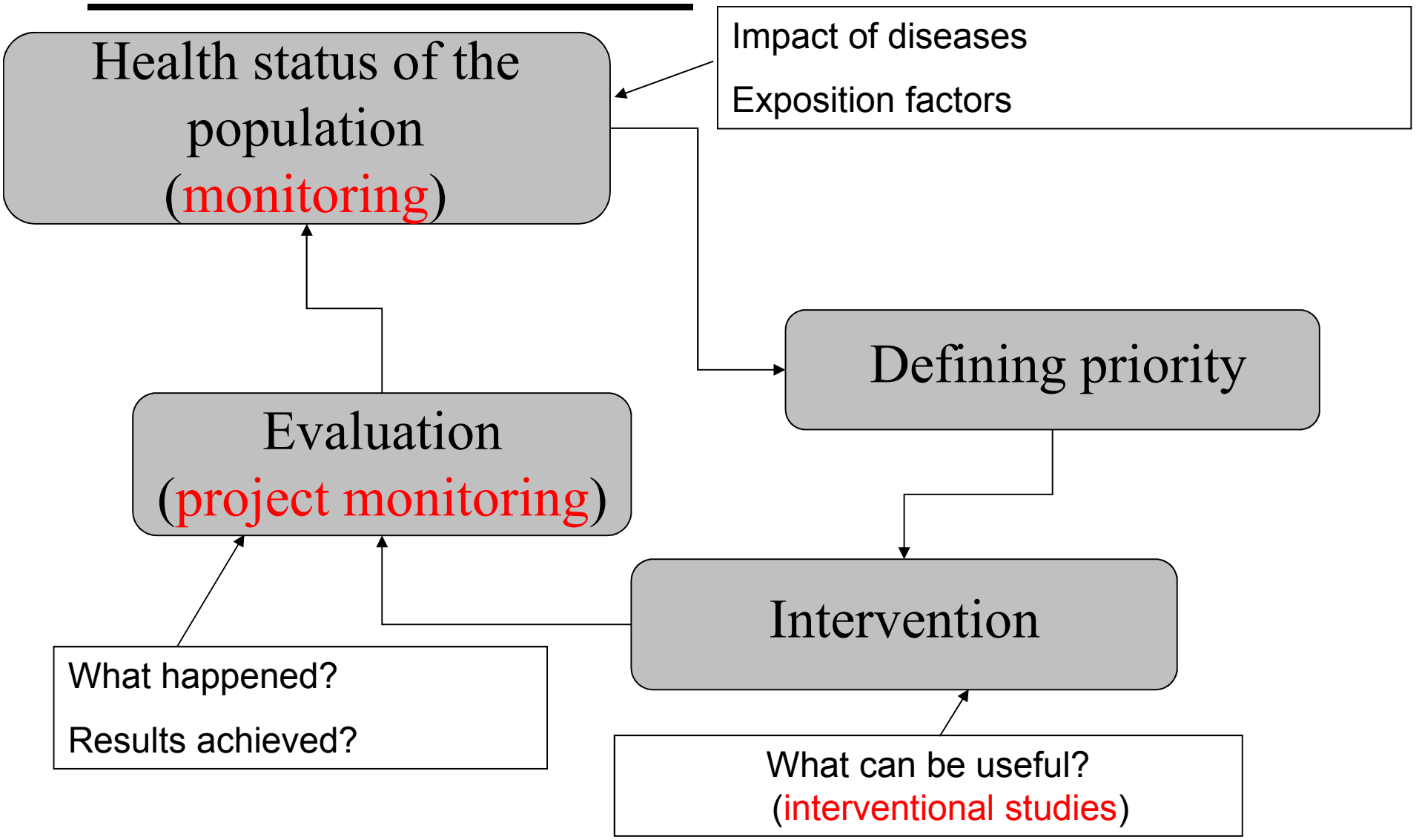
5. Study natural history of disease from precursor states through clinical course

6. Conduct surveillance of disease and injury occurrence in populations

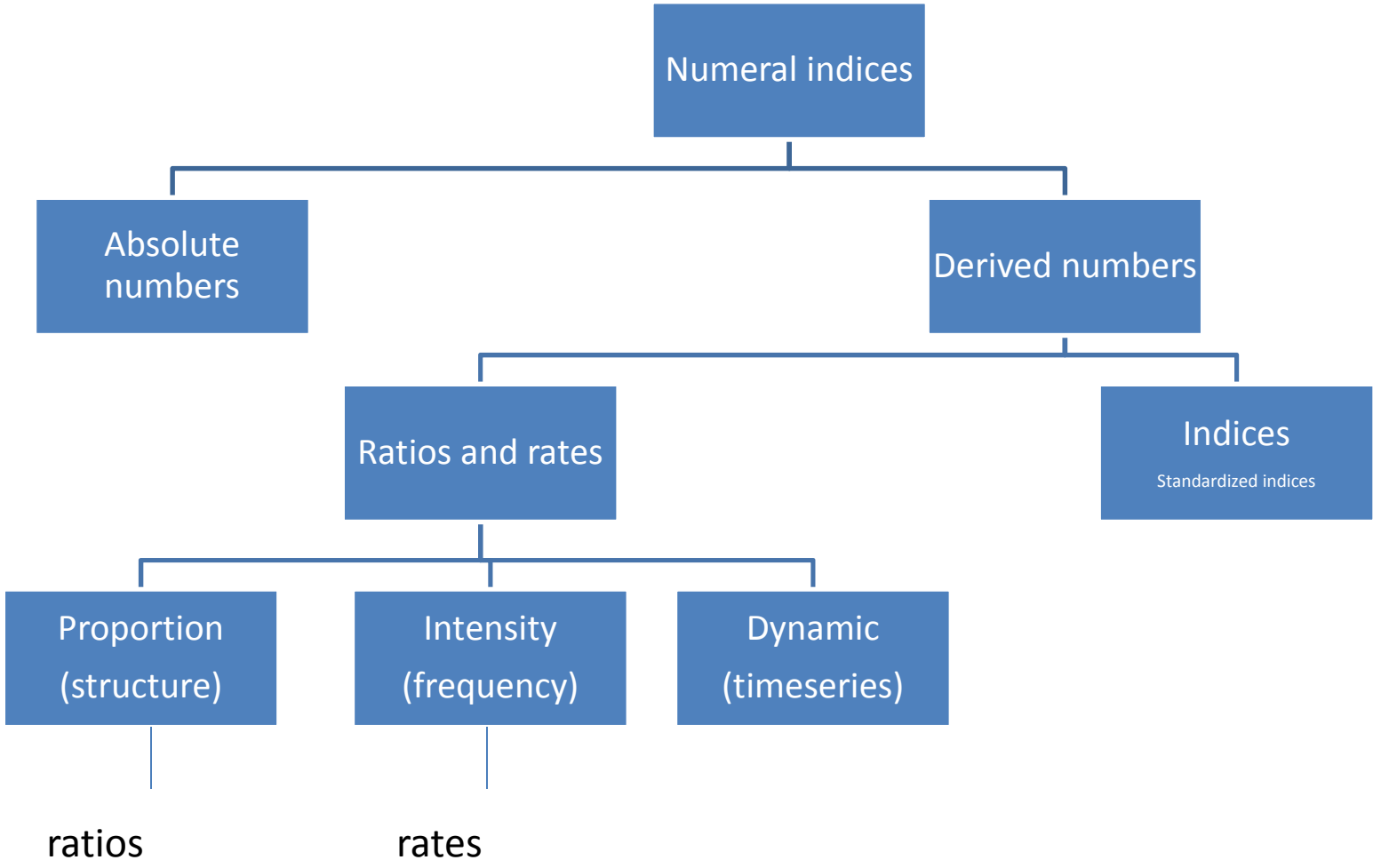
7. Investigate disease outbreaks

– Milton Terris, The Society for Epidemiologic Research (SER) and the future of epidemiology. *Am J Epidemiol* 1992; 136(8):909-915, p 912

Epidemiology in Public Health



Types of numeral indices used in demography



Proportions

- Numbers without dimension
- Part / Whole X 100
- Additive (if calculated for the same event)
- Value may change between 0% and 100 %
- Example: In 2009 cancer was responsible for 25% of all death

  Absolute numbers and proportions can not be used to calculate frequency (intensity)!

Rates (intensity, frequency)

$$\frac{\textit{Number of events (or people) in a given period of time}}{\textit{The averge number of population in the same given period of time}} \times k$$

- Incidence
- Cumulative incidence (CI)
- Incidence density
- Prevalence

Specific rates

1. Infant mortality rate
2. Foetal loss (abortion and intrauterine death)
3. Maternal death

Why are these rates are specific?

Dynamic rate

- Expresses the changes in the observed event in a given period of time
- Base rate is always a fixed number thus represents 100%
- Long-term changes are called secular trends

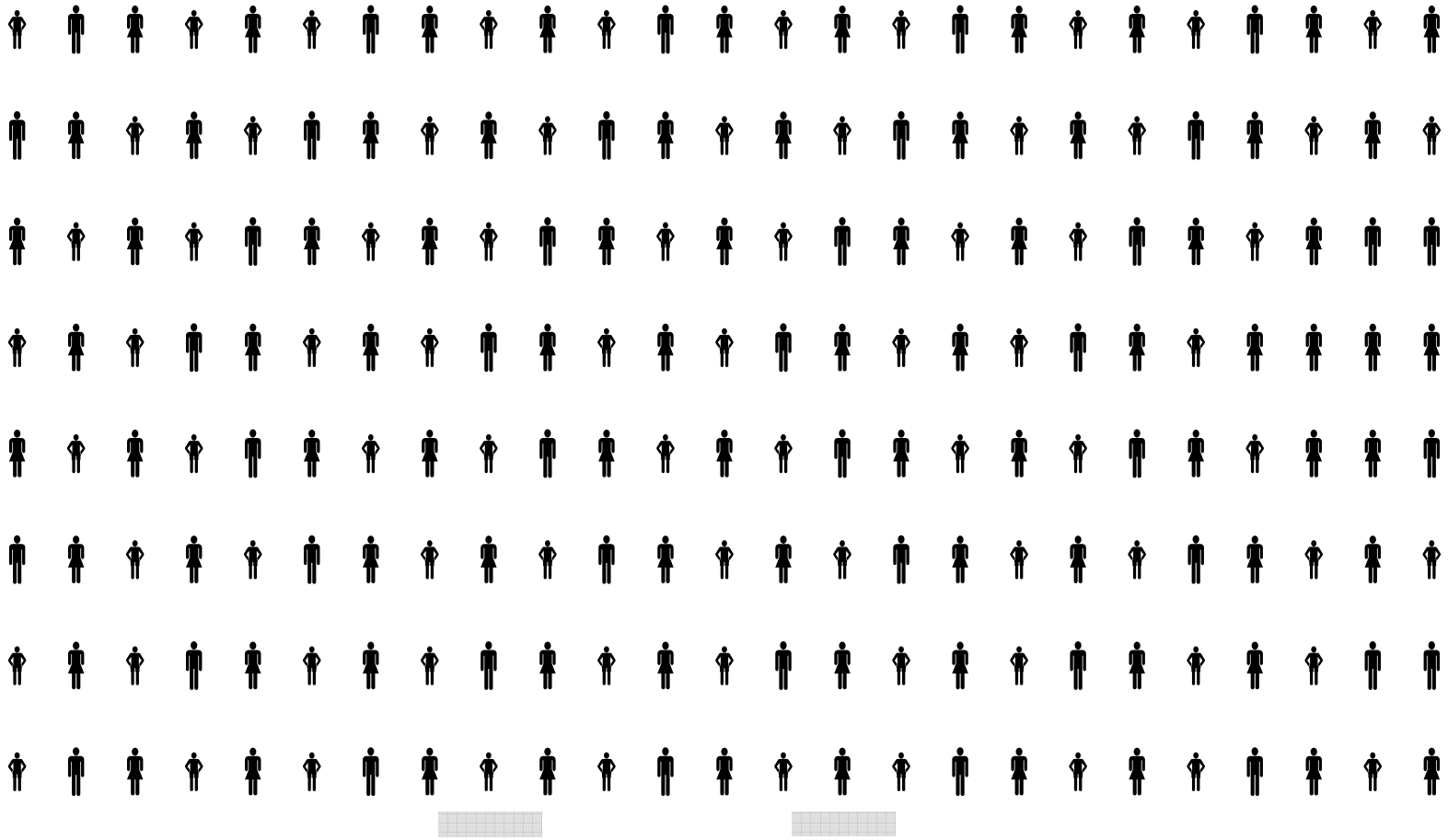
Incidence and prevalence

- Incidence: Number of new cases during a given period of time in an observed population (also called absolute risk)
- Only incidence can be used for etiology studies
- Prevalence: the proportion of a population at risk that is affected at a given time (point-prevalence)
- The impact of diseases on a population level (prevalence) is important when defining health care

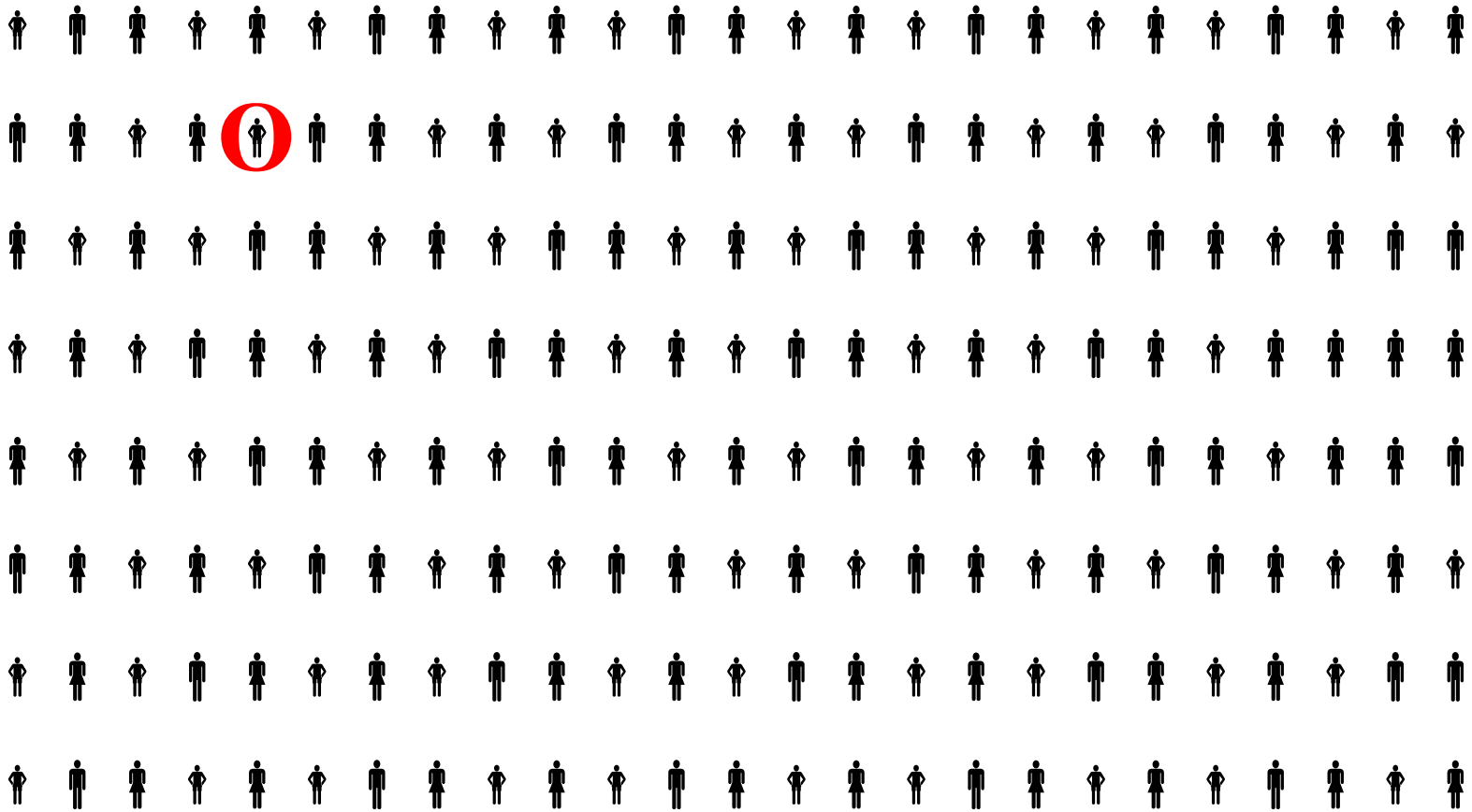
Incidence

$$I = \frac{\textit{New cases in a given period of time}}{\textit{Exposed population in the same period of time}} \times k$$

An example population (N=200)



How can we quantify disease in populations?



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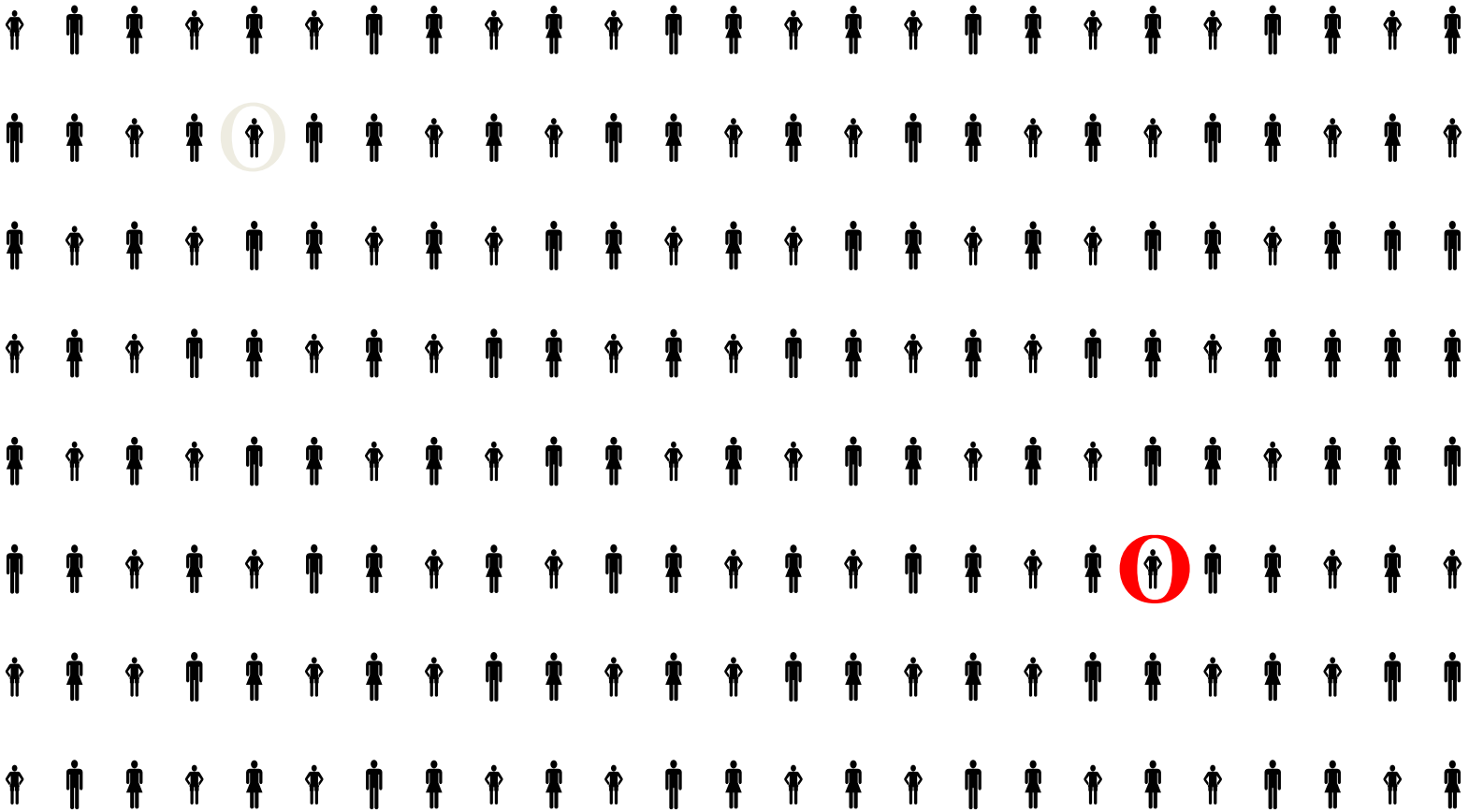

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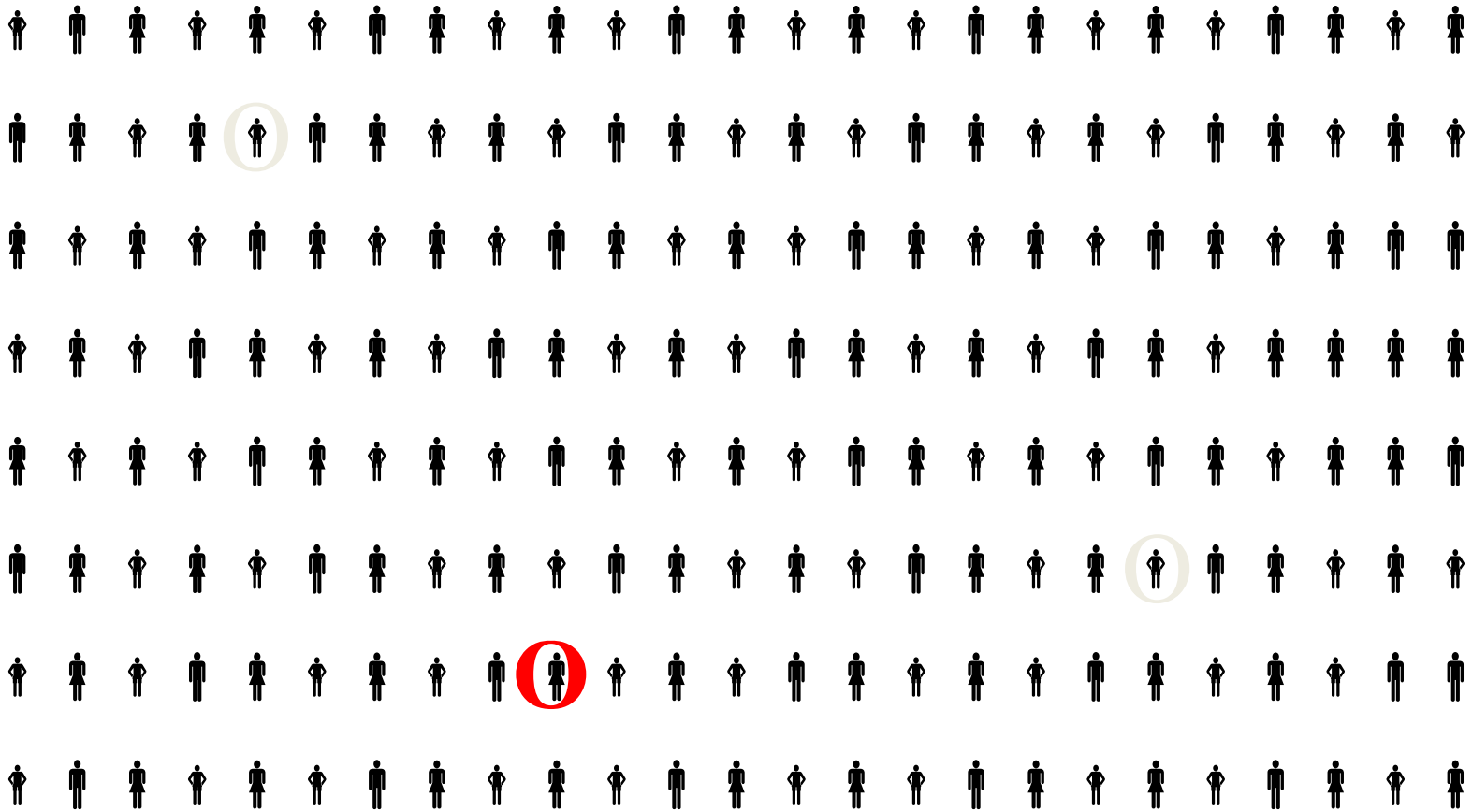

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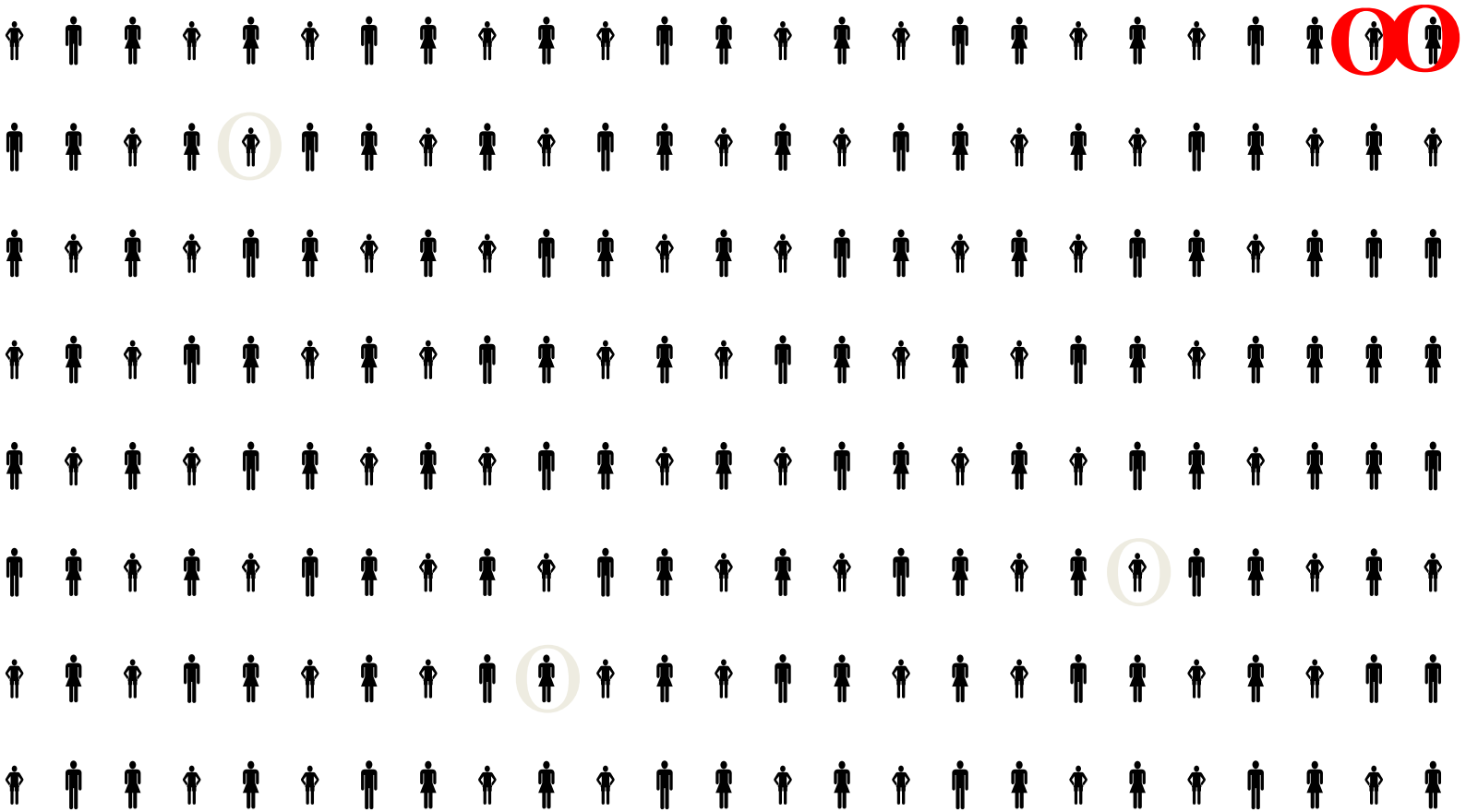

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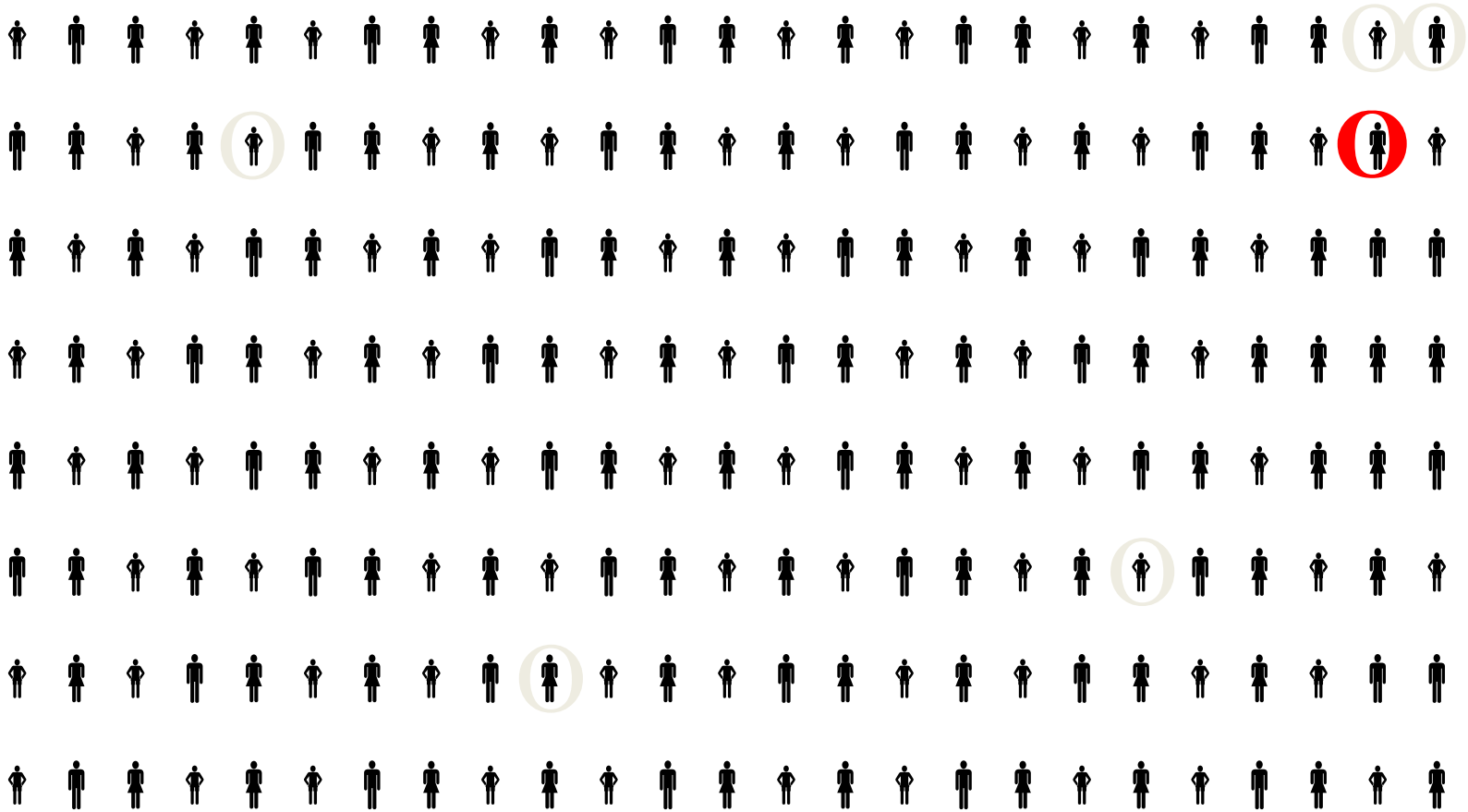
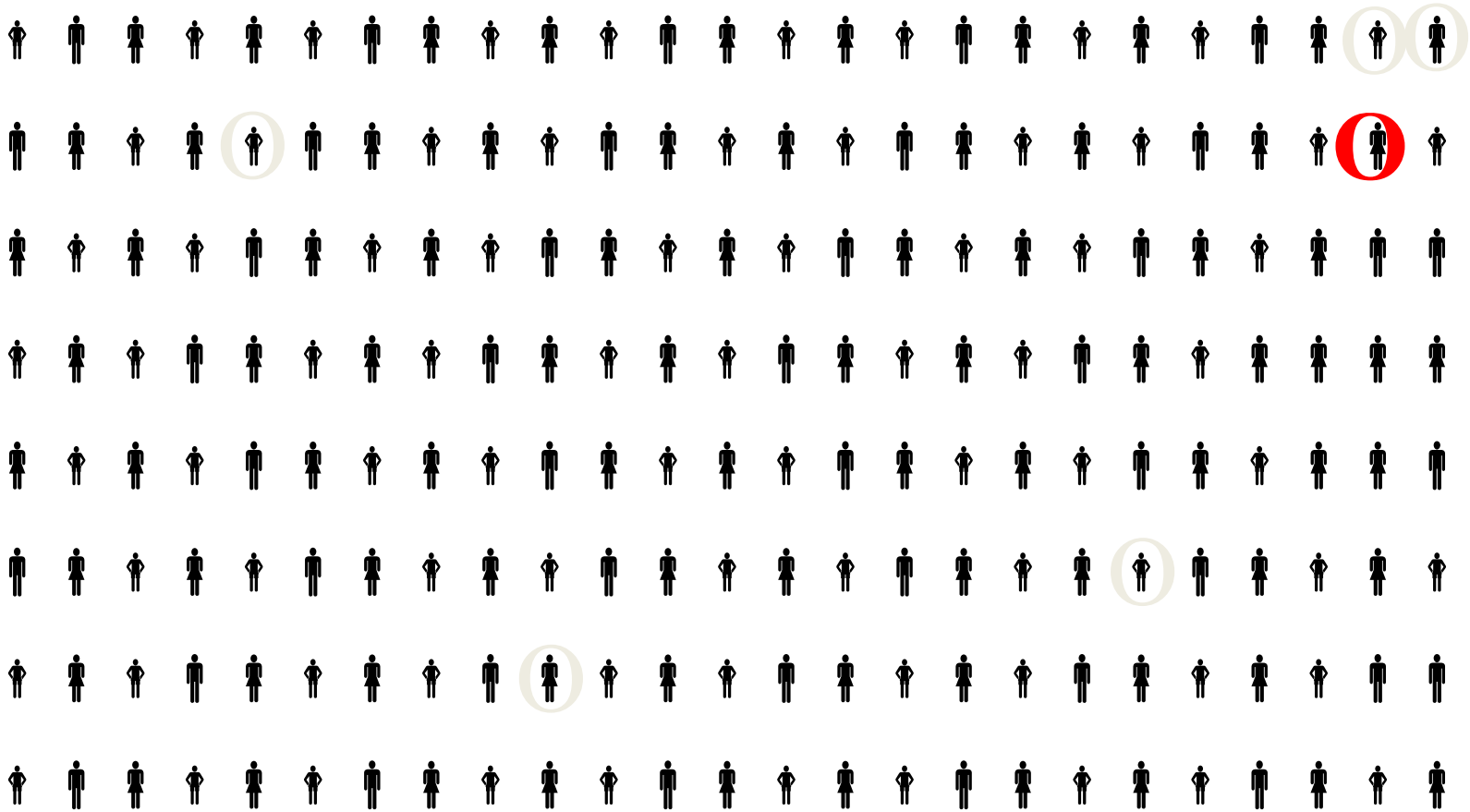
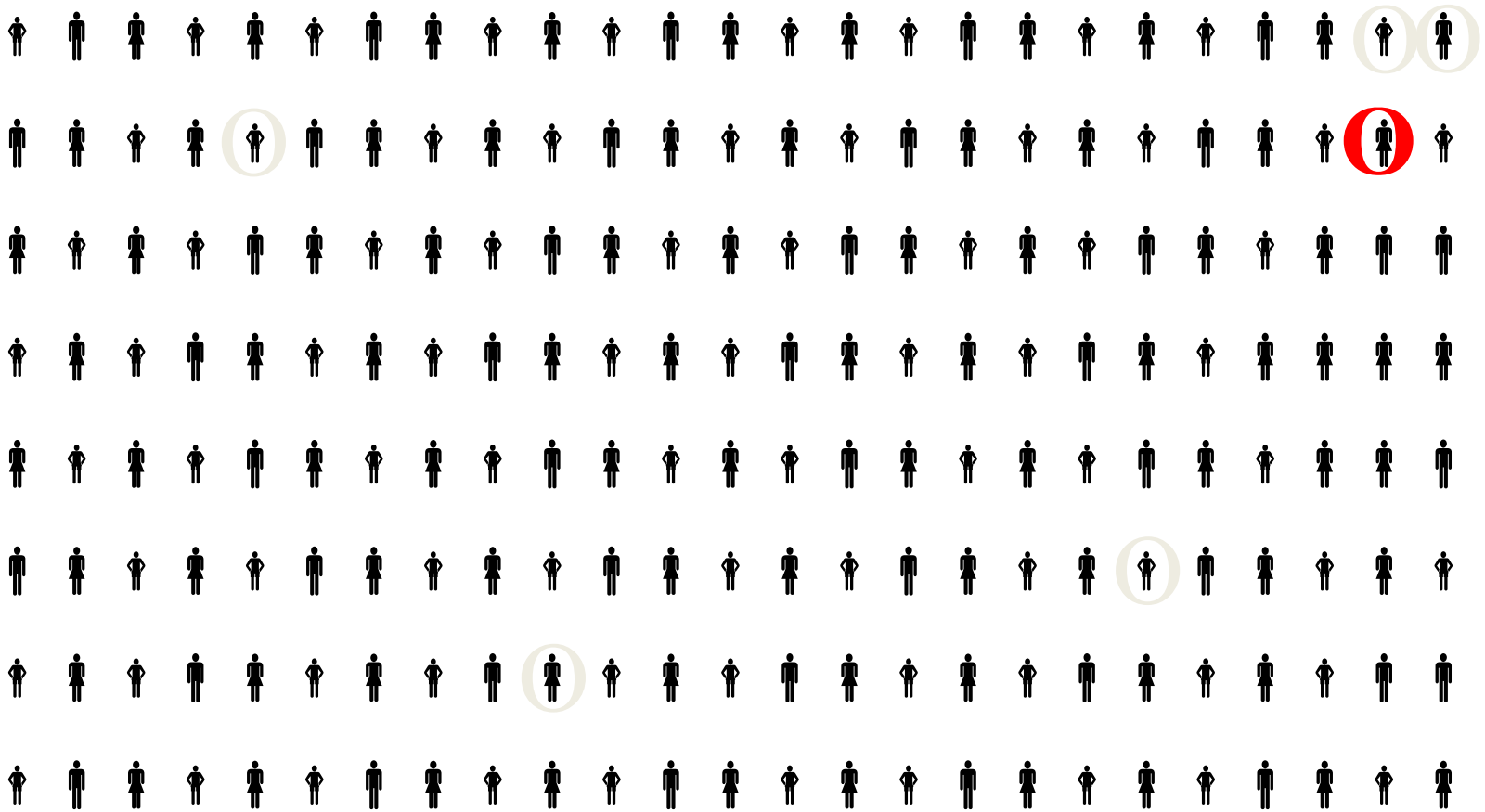


How can we quantify the frequency?



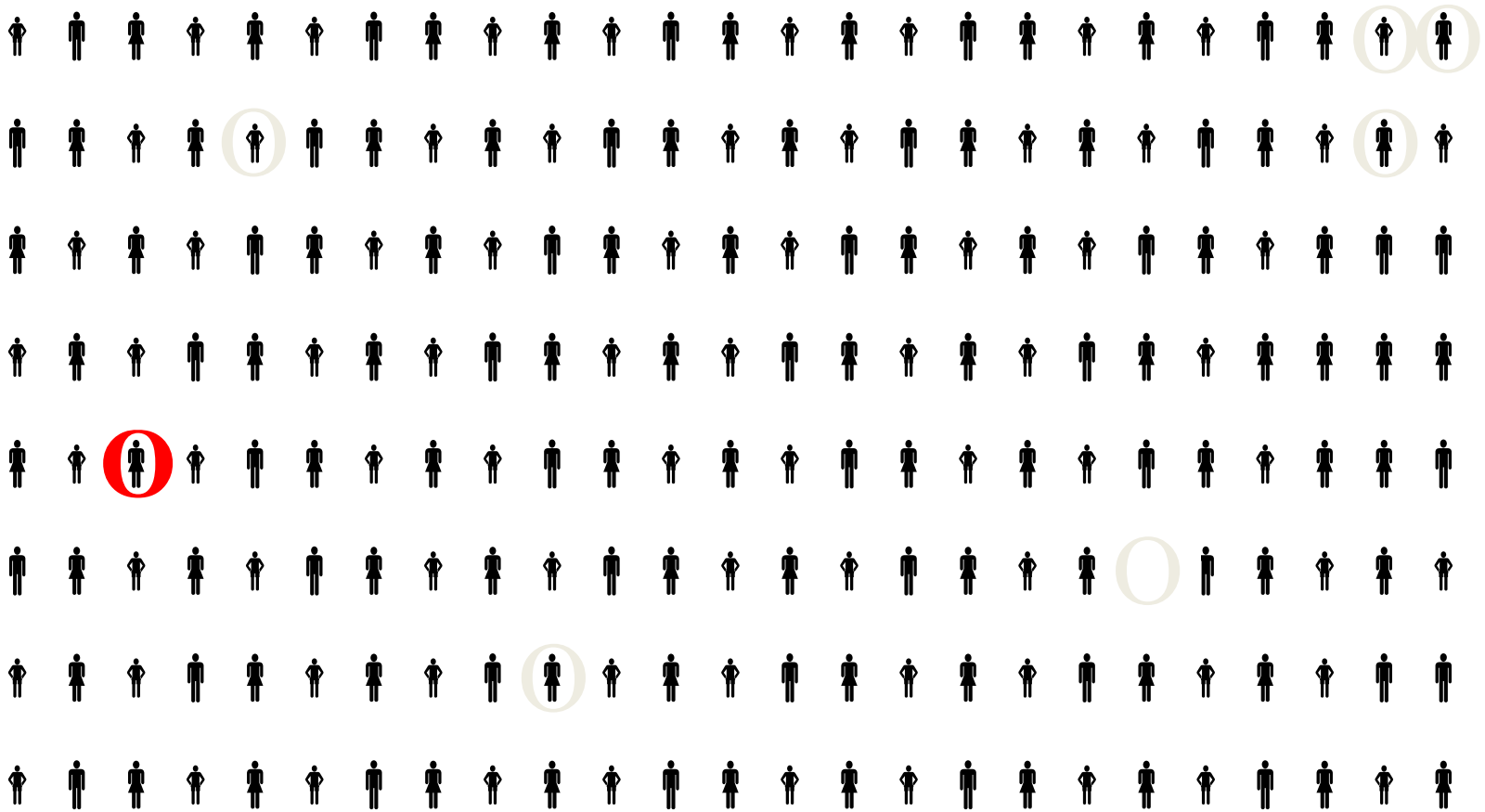
Incidence: **new cases per population** (6/200)



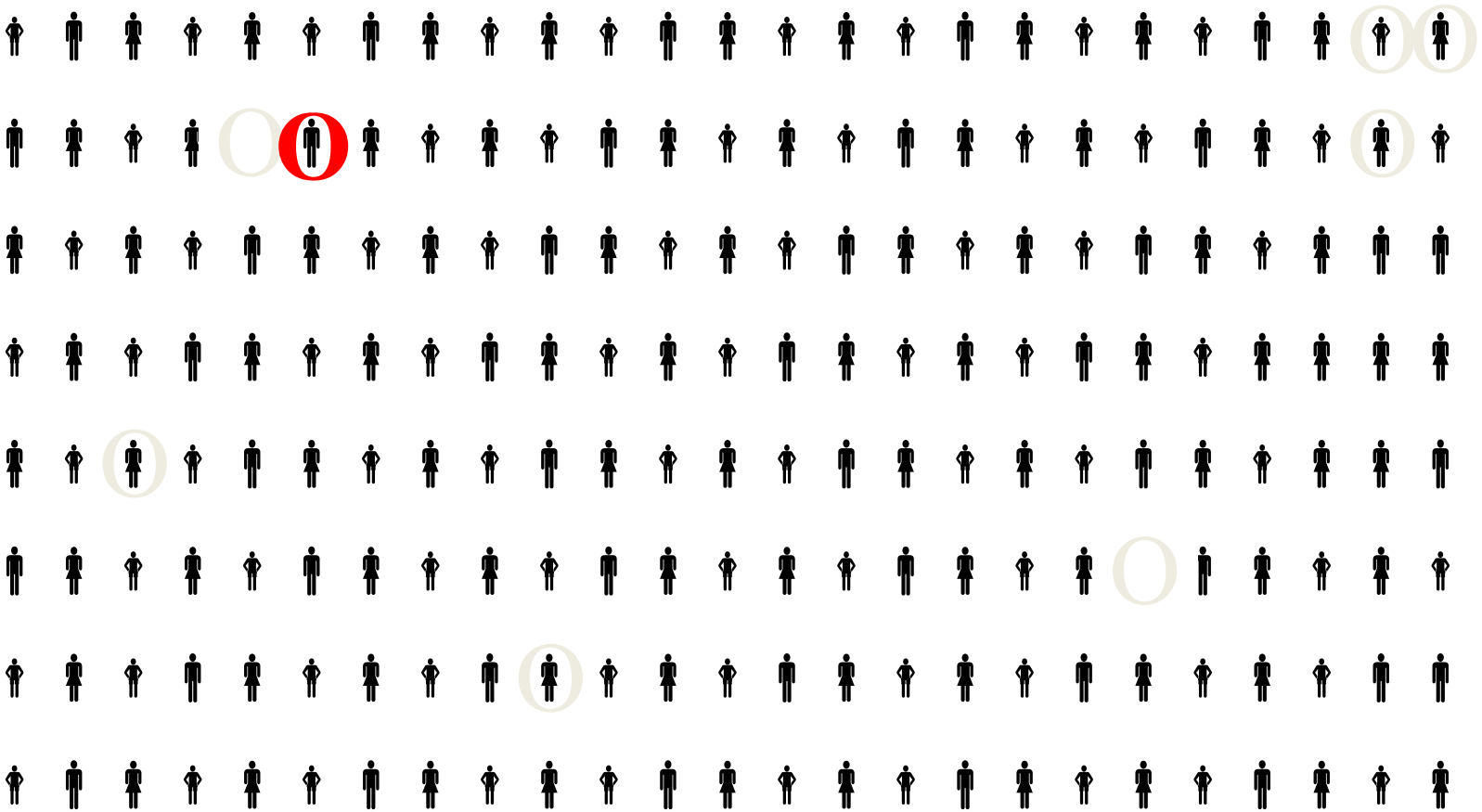
Prevalence

$$P = \frac{\textit{New and existing cases in a given point of time}}{\textit{Exposed population in the same period of time}} \times k$$

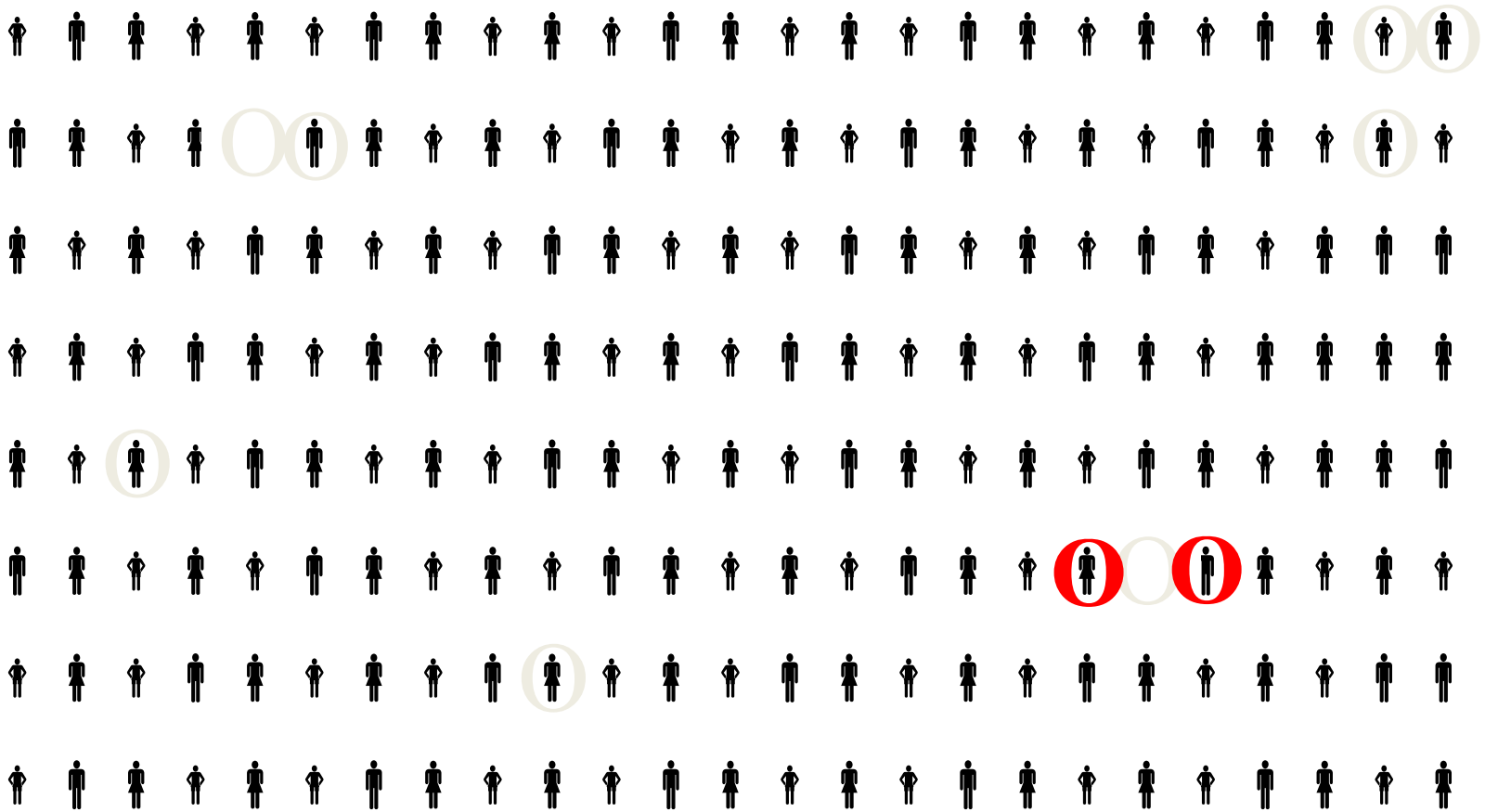
1 new case, 1 death



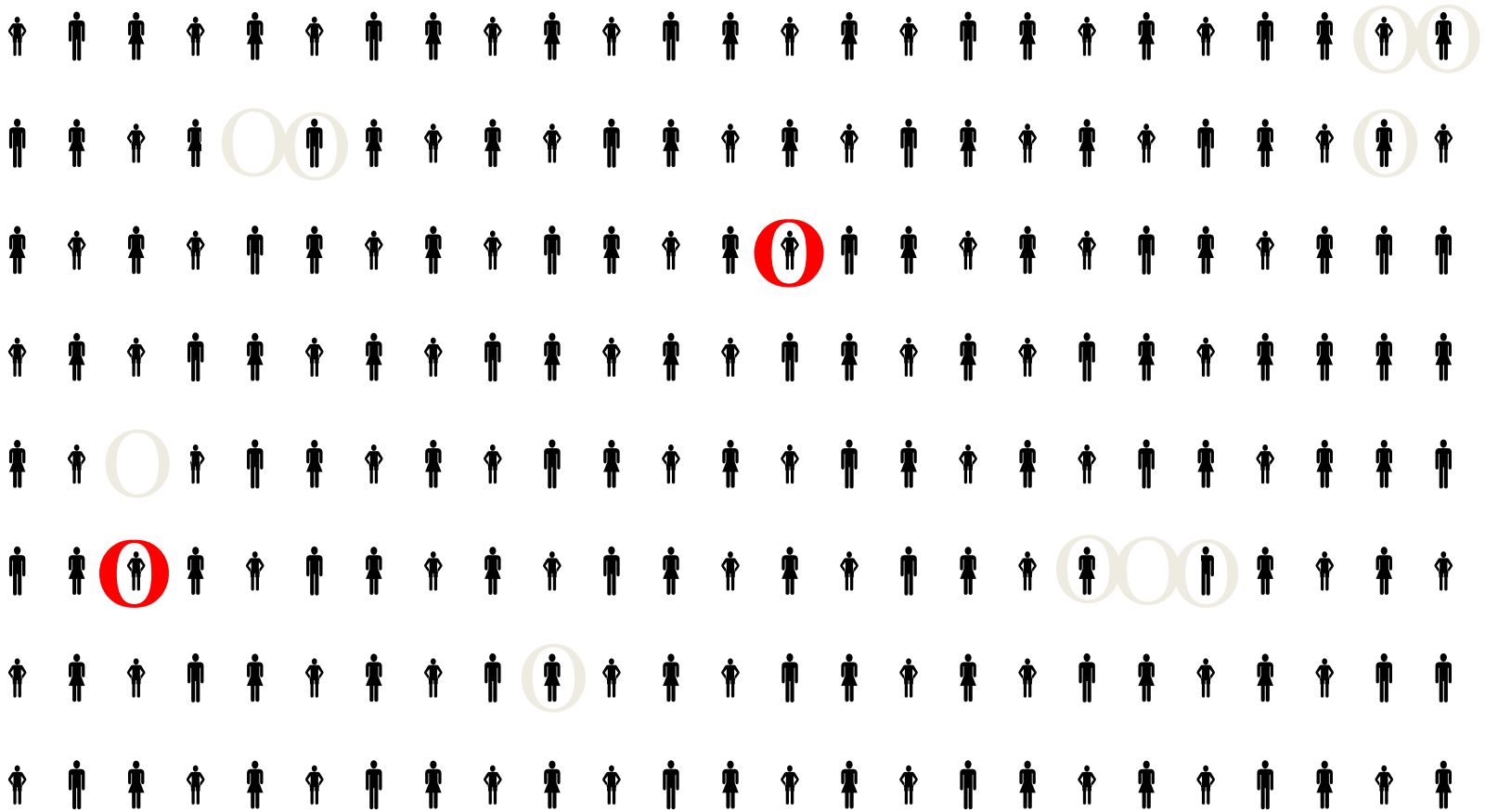
1 new case, 1 new death



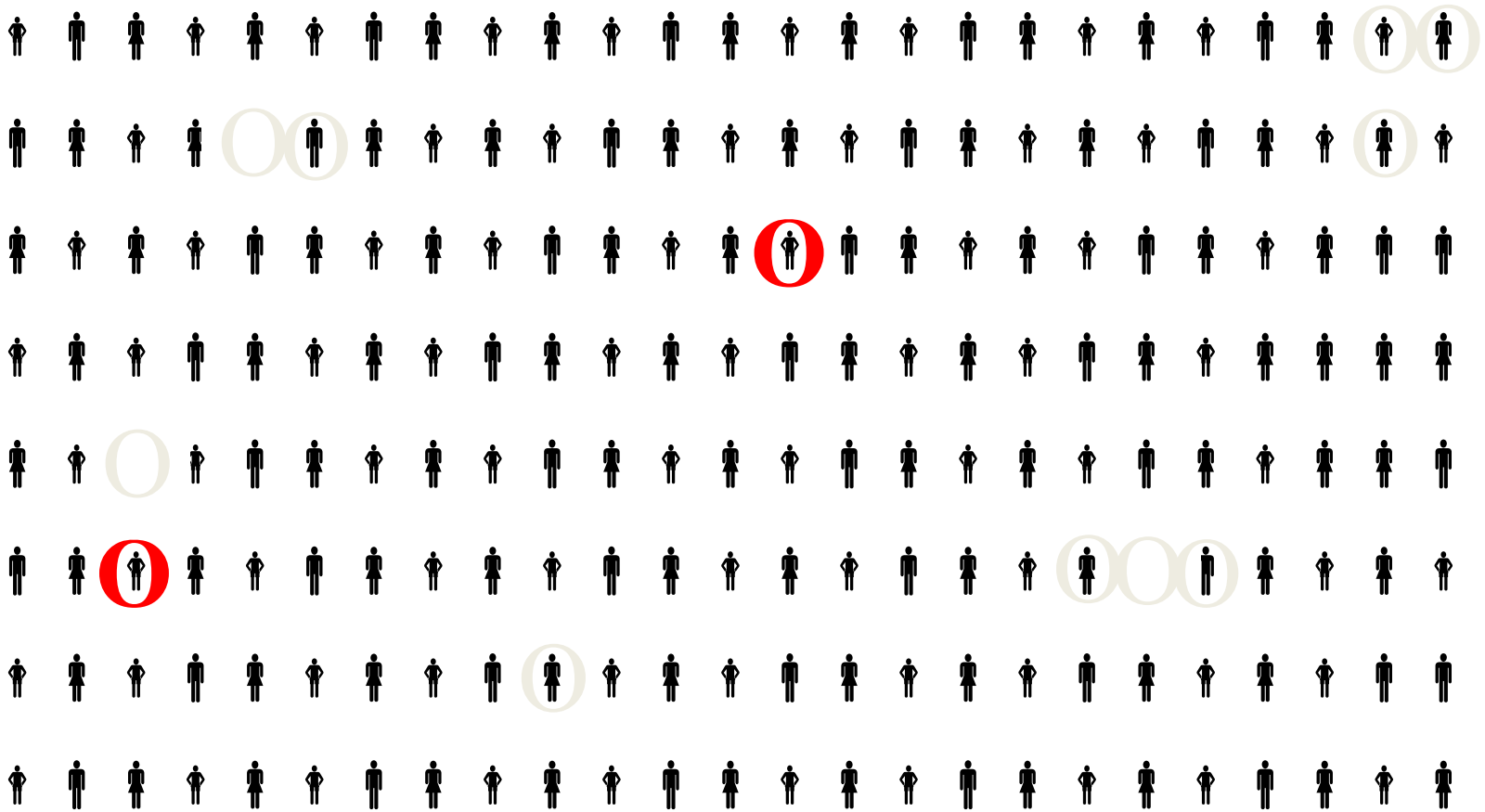
2 new cases, no deaths



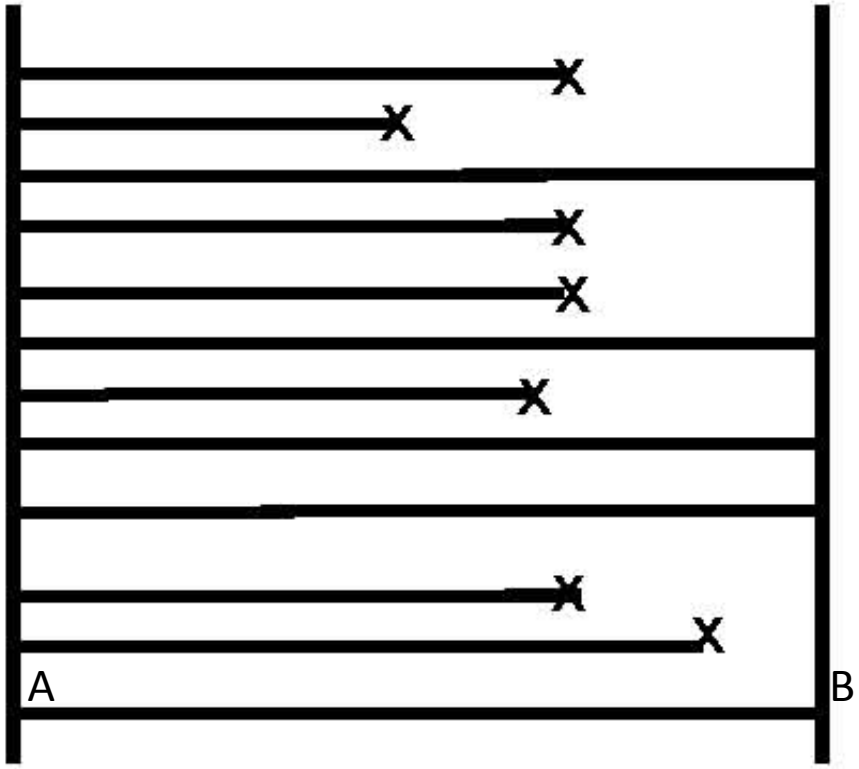
2 new cases, 1 new death



Prevalence (point) **= existing cases per population** (9 / 197)



Cumulative incidence



- The diagram to the left represents an observed population of 12 people (e.g. in a clinical trial)
- X – the occurrence of the disease
- A – start of observation
- B – end of observation

- CI= 7/12 = 58%

Cumulative incidence (CI)

- Has no dimension
- Value may vary between 0 and 1
- Specified in time (e.g. 5 years)
- All members of the given population should be observed until the occurrence of the event or until the end of the observational period
  Survival rate (SR): 1-CI

Cumulative indicence rates used in medicine

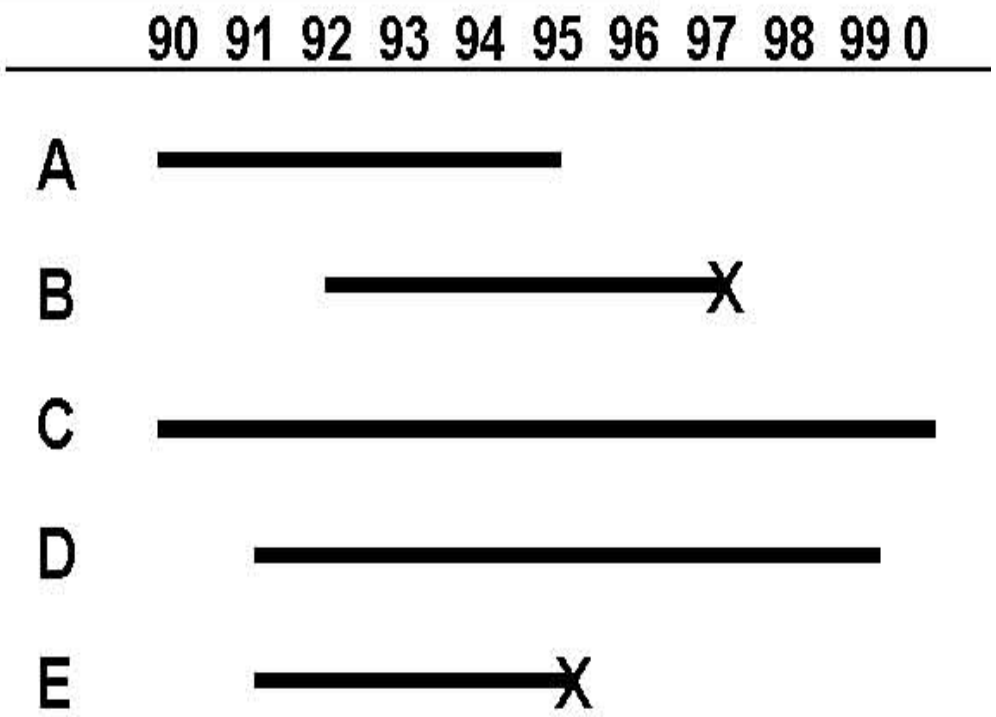
- Absolute risk (incidence)
- (Case) Fatality rate is the ratio of death within a designated population of people with a particular condition, over a certain period of time.
- Five-year absolute survival rates describe the percentage of patients that are alive five years after their disease is diagnosed.
- Five-year relative survival rates describe the percentage of patients with a disease that are alive five years after their disease is diagnosed divided by the percentage of the general population of corresponding sex and age that are alive after five years.
- Attack rate cumulative incidence of infection in a group of people observed over a period of time during an epidemic, usually in relation to foodborne disease.

Incidence rate (“incidence density”)

$$\frac{\text{Number of new cases}}{\text{Avg population at risk} \times \text{Time interval}}$$

$$= \frac{\text{Number of new cases}}{\text{Population-time}}$$

Incidence rate



- The diagram to the left represents an observed population of 5 people from 1990 to 2000 (90-0)
- X – the occurence of the disease
- A-E – Individuals observed
- — length of observation

- Total observed period: 35,5 years
- Incidence rate= 2 / 35,5 person-years = 0,0056/ person year = 56 / 1000 person-years

Incidence rate (density)

- Rate at which new cases of a disease occur in a population given that the population is both studied and at risk for varying length of time

- Person-time: the number of disease-free time (e.g. years) contributed by each individual in the study

- Value may vary between 0 and infinite

WHO HFA Database

- http://data.euro.who.int/hfadb/

Indicators

- Mortality
- Morbidity
- Risk factors

Analysis by time and by country

EXERCISE

- Check the changes of cardiovascular death in Hungary!
- Compare the incidence of lung cancer among European countires in a 10-year long period!
- Observe the changes in smoking habits during the same period!