**Ethics / Regulatory**
- Declaration of Helsinki (1964 et seq)
- Informed consent
- Institutional Review Boards
- GCP

**Demography**
- Censuses
- Life tables
- Fertility
- Age-specific mortality
- Maternal mortality ratio (rate)
- Infant mortality ratio (rate)
- Life expectancy (at age x)
- Migration

**Types of studies**
- Surveillance
- Observational
- Descriptive
- Ecological
- Cross sectional
- Longitudinal
- Analytical
  - Cohort
  - prospective v historical
- Case control
- Self-controlled designs

**Intervention**
- Before – after
- Randomised Controlled Trial
- individual versus cluster
- blinding

**Effect and impact measures**
- Attributable risk
- Risk difference (r1 – r2)
- Risk difference percent (r1 – r2)/r1
- Population attributable risk (PAR)
- PAR = p(RRobserved / expected)
- Risk (or rate) ratio (RR)
- RR = (A/C) / (B/D) = A∙D / B∙C
- hazard ratio
- Odds Ratio (OR)
- OR (A/D) / (B/C)
- rare disease assumption …

**Standardised mortality ratio (SMR)**
- observed / expected

**Population attributable fraction (PAF)**
- PAF / r = p(RR-1) / [p(RR-1) + 1]

**Protective efficacy**
- effectiveness versus efficacy
direct versus indirect effects
- externalities

**Big data**
- E-health and large-scale data linkage
- –omics
- genomics, transcriptomics, metabolomics…
- GWAS

**Genetics & mol. epi.**
- phylogenetic trees
- clustering
gene-environment interaction
- biomarkers

**Causality**
- Koch’s (Henle-Koch) postulates
- presence….. isolation….induction
- Bradford Hill “perspectives”
- strength of effect
- consistency
- specificity
temporality
- gradient
- plausibility
- coherence
- experiment
- analogy
- Causal inference
- potential outcomes / DAGS
- Triangulation
- observational / RCT evidence /
  Natural experiments
- Mendelian randomisation

**Analysis**
- Sample size
- power
- Distribution
- Contingency tables
- Hypothesis testing
- statistical inference
- Univariable
- bivariate
- multivariable
- Correlation
- Regression
- linear
- Poisson
- logistic
- Cox
- Bayesian…

**Cohort logic**
- (Selection and ascertainment issues)

**Case control logic**
- (Selection and ascertainment issues)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Outcome</th>
<th>Risk factor</th>
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<tbody>
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<td>YES</td>
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<td>A</td>
</tr>
<tr>
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<td>NO</td>
<td>C</td>
</tr>
<tr>
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<tr>
<td>NO</td>
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<td>B + D</td>
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**Validity**
- True YES
- True NO
- Test YES
- a
- b
- a + b
- Test NO
- c
- d
- c + d
- a + c
- b + d
- Sensitivity = a / (a + c)
- Specificity = d / (b + d)
- Positive predictive value (PPV) = a / (a + b)
- Agreement, (a+d) / (a + b + c + d)
- Kappa

**Danger !**
- Ecological fallacy
- Random error
- sampling error
- confidence limits
- Misclassification
- differential
- non-differential
- Bias
- systematic misrepresentation
- selection, information, etc …
- Confounding
- stratification
- regression adjustment
- propensity scores
- matching
- self-controlled designs
- restriction
- standardisation
- randomisation
- Interaction (effect modification)

**Surveillance**

**History / origins**
- Hippocrates of Cos (460-370 BC) “On airs, waters and places” discusses patterns, risk factors and epidemics (things which visit populations)

**Route data**
- London Bills of Mortality (17th C)
- Censuses
- Death certification by cause (E&W ~ 1837)
- Morbidity notification and registries

**John Snow** (1813 – 1858) London GP analysed cholera death patterns to deduce waterborne source of agent

**London Epidemiological Society** formed 1850, interests in human, animal and plant disease

**First textbook “Epidemics and Crowd Diseases” Greenwood 1935

**Outcome measures**
- Prevalence
- number, “rate”
- point or period

**Incidence**
- number
- risk (percentage)
- rate (per person time)
- incidence = prevalence / duration

**Mortality (rate)**
- case fatality rate
- excess mortality

**Health of populations**
- Time trends
- Inequalities
- International differences
- Disease burden
- DALYs
- QALYs

**Infections**
- Incidence versus illness
- Mortality versus death
- Pre-infectious period
- Infectious period
- Serial interval
- incubation period
- generation time

**Epidemic curves**
- point source
- common extended source
- propagative

**Transmission**
- direct, indirect
- horizontal, vertical
- secondary attack rate
- reproduction number
- basic R0
- net (effective)
- Rn = R0 x prop. susceptible
- vectorial capacity

**Herd immunity**
- threshold = (Rn-1)/R0 – 1 – 1/R0
- = 1 – 1/L

**At least one logic**
- Reed Frost model
- Cn = Sn(1-q^n)

**Heterogeneity**
- supershedders and superspreaders
- networks and mixing patterns
- WAIFW matrices

**Outbreak investigation**