# INVESTIGATION OF FOODBORNE DISEASES

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(Materials from Dr. Dean O. Cliver &Maha Hajmeer)

## Investigating outbreaks

- Focus on restaurants
- Not considering outbreaks dispersed in time or place
- Will not cover "Investigate Outbreaks" or "Seek Sources" sections (read)

## Analyze data

- Preliminary diagnosis, for later *laboratory* confirmation
- Tabulate signs and symptoms reported by patients
- Case definition

**Table 3. *Frequency of signs and symptoms***

| Signs & symptoms | Cases | % |
|---|---|---|
| Diarrhea | 260 | 88 |
| Abdominal cramps | 122 | 41 |
| Fever | 116 | 39 |
| Nausea | 105 | 35 |
| Headache | 68 | 23 |
| Muscular aches | 56 | 19 |
| Chills | 55 | 19 |
| Vomiting | 42 | 14 |

## Analysis continues

- Diagnosis implies incubation time(s)
- Tabulate & graph onset times
- Time intervals ≤1/4 of incubation period

## Time of exposure

- Common source—common incident
- Subtract incubation period from median onset
- May use span of onsets to estimate incubation period

## Epidemic curve

- Count total illnesses
- Determine median onset

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- Count total illnesses: 70
- Determine median onset: #35 → a.m. on 10th

## Meal attendance-attack rate

- Day/meal
- Ate/drank vs did not eat/drink
- Ill; well; total; attack rate (%)
- Difference in rates (+35%)
- Relative risk (1/17 L 6.1)
- *p* value (1/17 L $<10^{-6}$)

## Food-specific attack rates

- Food/beverage
- Ate/drank vs did not eat/drink
- Ill; well; total; attack rate (%)
- Difference in rates (%)
- Relative risk
- *p* value

## Food-specific attack rates

| Food | Rate diff. | Rel. risk | *p* value |
|---|---|---|---|
| **Turkey** | **+65** | **9.1** | **<0.000001** |
| **Dressing** | **+43** | **2.5** | **0.000005** |
| **Peas** | **+31** | **1.8** | **0.0002** |
| **Rolls** | **+23** | **1.4** | **0.006** |

## People missing?

**If many of the people who attended the meal cannot be accounted for, or for other reasons, it may be necessary to locate *controls* (well) who match the ill persons according to *selected criteria* and get *food histories* from them. Then, one produces a "Case-control vehicle exposure table"**

## Case-control exposures

- Food/beverage
- Cases (ill) vs. Controls (well)
- Ate; did not eat; total; %
- Difference (%)
- Odds ratio
- *p* value

## Case-control exposures

| Food | Diff. in % | Odds ratio | *p* value |
|---|---|---|---|
| Turkey | +37 | 30.1 | <0.0000001 |
| Dressing | +33 | 6.3 | 0.000006 |
| Peas | +31 | 3.9 | 0.0002 |
| Rolls | +24 | 2.7 | 0.007 |

## Stratified analysis

- Two (or more) highly suspect foods
- May be eaten together (turkey & dressing; ice cream on pie)
- Do *stratified analysis*

## Stratified analysis (% ill)

| | Dressing | | |
|---|---|---|---|
| Turkey | Ate | Not | Totals |
| Ate | 73 | 75 | 73 |
| Not | 0 | 8 | 8 |
| Totals | 73 | 30 | |

## Comparisons

- Difference:
  (*rate*, ate) – (*rate*, didn't)
- Relative risk:
  (*rate*, ate) ÷ (*rate*, didn't)
- Odds ratio (case-control):
  [(# ate, ill)•(# didn't, well)]
  ÷ [(# ate, well)•(# didn't, ill)]

## No common meal?

- Different people, different times — same restaurant
- Foods from retail shops, supermarkets, cooked & eaten at home
- Do *food preference* comparison

## Food preference attack rates

- Food
- Always (usually) vs never eat; purchased (or not) within *incubation period*
- Percent difference in attack rates (*substantial* N)

## Food preference attack rates

| Food | Eat (% ill) | Never eat (% ill) | Differ-ence |
|---|---|---|---|
| Milk "A" | 12.8 | 20.0 | –7.2 |
| Milk "B" | 9.6 | 20.3 | –10.7 |
| Cheese "X" | 17.7 | 0.0 | +17.7 |
| Cheese "Y" | 13.8 | 15.4 | –1.6 |
| Cheese "Z" | 14.5 | 12.2 | +2.3 |

## Choices

- Food preference for long-incubation diseases (e.g., hepatitis A)
- Common, contaminated meal: *retrospective cohort study* (food-specific attack rates, relative risk)

## Choices

- Waterborne outbreaks, sporadic cases of foodborne disease: case-control studies, odds ratio
- Statistics: relative risk, odds ratio, chi-square, Fisher's exact test

## Team assignments

First practice exercise