Icebreaker “Outbreak investigation with the disease detectives”

The card game “Disease detectives” can be used as an icebreaker exercise to get to know the epidemiological methods of relative risk, epidemic curve and food item-specific risk of illness in a playful way. The exercise is divided into two blocks of around 30-40 minutes each with a coffee break in the middle.

Preparation:

- 16 to 26 participants can take part. If necessary, participants can share a card or the game master takes more than one.
- If there are 16 participants, use the cards that have “Size: 16” written on the lower right-hand corner.
- If there are 26 participants, use the cards that have “Size: 16” and additionally those that have “Set 16+10” written on the lower right-hand corner. The additional “Set: 16+10” cards have a striped border around them.
- You will also need a blackboard or a flipchart with chalk/pens.
- The participants need pen and paper.

The model answers to the questions are in the text boxes. The group will work out the answer by themselves, the game master writes the answer on the board/flipchart. The answer provided by the group can of course differ from the model answer at the discretion of the game master.

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Instructions

1. The cards are distributed one by one to the participants, each participant gets a card. All 16 or 26 cards should be distributed, if necessary the game master can take several cards or two players share a card.
2. The game master tells the story: *“We are re-enacting together a food-borne outbreak. Everyone in this room was invited to a wedding party last weekend. Unfortunately some of you have brought back something that is causing you, or your digestion, problems. This is where your cards come into play. Those who have a card with a light green border are ill. Those with a light blue border have stayed healthy. The details of your symptoms are on your card, they are the pictures below. The food you have eaten is at the top of the card. The incubation period is at the very bottom of the card. Turn to your neighbour and tell them what you ate and what your symptoms are.”*
3. Wait 2-3 minutes, participants discuss with their neighbour and get familiar with their card. Perhaps participants notice that someone has cold-like symptoms and not gastroenteric symptoms. Tell them that we will get back to this later.
4. The game master says: “*The first step of an outbreak investigation is often the confirmation that it is an outbreak. How would you define outbreak*?”
   After a short discussion the game master continues: “*Time: Last weekend. Location: wedding party. Person: All the ill people in the room. Whoever is ill, please raise your hand.*” Small pause. Game master: “*Does a runny nose with fever also count as being ill?*”

   Outbreak: More cases than expected if necessary comparison to a different time point. Increase in cases by time, place and person.
5. Game master: “*First of all we should agree on how we define “ill”. We need a case definition*”. Background: there is one card with runny nose and fever, so no gastroenteric symptoms. The case definition should be worked out together. The game master write the result step by step on the board/flipchart. The group can discuss how to take into account the symptoms of fever and hospitalisation in a gastroenteric outbreak. Suggestion: fever and hospitalisation are not enough on their own, but give a measure of severity. The case definition on the board or the flipchart should remain visible for the rest of the game.

   Case definition:
   - A person present at the wedding party
   - with one of the following symptoms: Vomiting, diarrhoea, abdominal pain

6. The game master says: "*We would like to describe the dynamics of the outbreak with a nice graph. First of all it looks nice and secondly it helps us decide which pathogen is involved and if we can expect more cases. For this we can create an x-y axis with time along the x-axis and number of ill persons, or cases, on the vertical y-axis. The healthy persons are not relevant here. The units of time is flexible and should be chosen in such a way that you can see the course of the outbreak. This can always be redefined at a later stage. A good choice is between half and a quarter of the median incubation time. Let's choose a day as unit of time and include up to 4 days after the wedding party on the x-axis. This way we have 5 "time periods" to fill.*"

   The game master draws a table like in the text box and asks the participants to let him/her know if they are in a given category. It's important to have the correct classification of half days. 0.5 days (12 hours) is in the group 0-1 days, 2.5 days is in the group 2-3 days, etc. The table results are then transferred to the diagram. The whole exercise can of course also be done in half days.

```
Epidemic curve (16 participants)
day 0-1 (without 1): 1
day 1-2 (without 2): 5
day 2-3 (without 3): 3*
day 3-4 (without 4): 1
day 4 :0
* the person with the cold does not count as a case in the sense of the case definition
```

```
Epidemic curve (26 participants)
day 0-1 (without 1): 1
day 1-2 (without 2): 9
day 2-3 (without 3): 5*
day 3-4 (without 4): 1
day 4 :0
* ignoring cold
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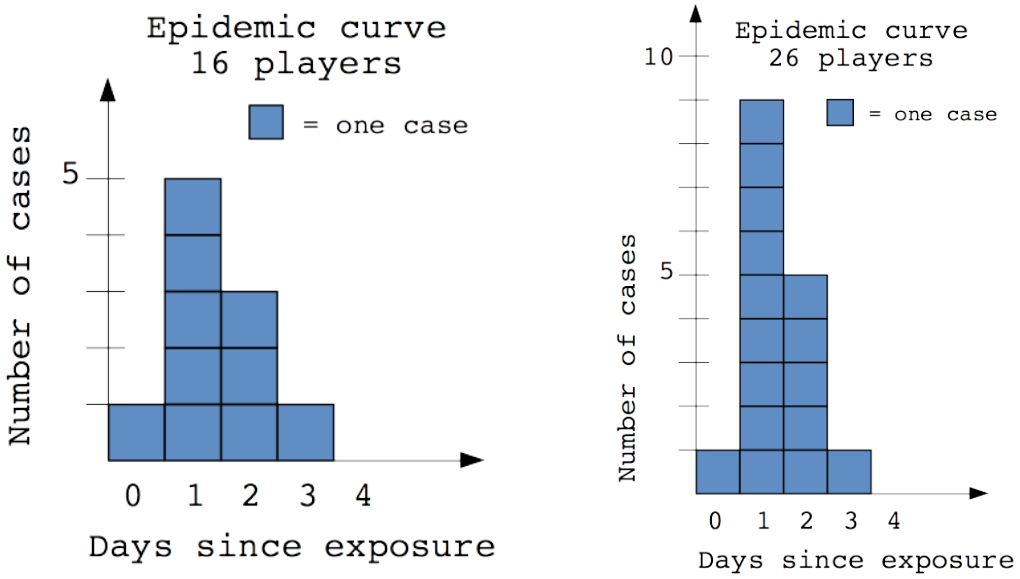


7. The game master asks: "*What can we see here? Discuss with your neighbour.*"

A 4-6 minute discussion follows. Points to address: Median incubation time 1-2 days, indication of a point source outbreak, no second wave > no person-to-person transmission, incubation too long for norovirus/toxin (*Staphylococcus aureus* or *Bacillus cereus*)

<<< Short 5 minute break, but no coffee break, or you will lose continuity>>

8. The game master says: “*The epidemic curve gives an overview of the outbreak dynamic. The peak indicates the median incubation time for the yet unknown pathogen. Now we want to explain the outbreak further. For this we need to compare the pattern of food items eaten and compare it with the pattern of illness*”.

9. The game master points to the case definition: “*Back to the case definition. We now classify all participants in the wedding part as “ill” or “not ill”. Who is ill? Please raise your hand. Who is not ill? Please raise your hand.*”
The game master writes the results on the board/flipchart. The number should match the epidemic curve.

```
Number of ill people
according to the case
definition:
- 16 participants: 10*
- 26 participants: 16*
* The person with cold
symptoms does not count as
“ill”.

Number of „not ill“ people
according to the case
definition:
- 16 participants: 6**
- 26 participants: 10**
** The person with cold
symptoms counts as “not
ill”.
```

10. The game master says: “*We’re now missing the exposure. With that we mean the food. What have you eaten? Who ate what?*” The game master writes the result on the board/flipchart.

```
Exposure:
16 participants
- Mousse: 9
- Potato salad: 9
- Hamburger: 10
26 participants
- Mousse: 15
- Potato salad: 14
- Hamburger: 15
```

11. The game master says: “*How can we now relate the numbers of the exposure and the disease status? Ask your neighbour.*” After 2-4 minutes of discussion answers are collected and

discussed. In case a participant suggests a 2 by 2 table, the participant should draw this on the board/flipchart. Otherwise the game master will do this.

Example:

Exposure	**Ill**	**Not ill**	Total
Yes	a	b	a+b
No	c	d	c+d
Total	a+c	b+d	a+b+c+d

The game master now draws the 2 by 2 tables for hamburger, mousse and potato salad. The participants should raise their hand depending on their exposure and disease status, to populate the 2 by 2 table cells. The 2 by 2 tables should always stay visible (e.g. take the page off of the flipchart). For a more interactive approach, players can stand up and rearrange themselves in the room according to an imaginary 2 by 2 table (“living table”).

16 participants:

Hamburger	**Ill**	**Not ill**	Total
Eaten	8	2	10
Not eaten	2	4	6
Total	10	6	16

Mousse	**Ill**	**Not ill**	Total
Eaten	5	4	9
Not eaten	5	2	7
Total	10	6	16

Potato salad	**Ill**	**Not ill**	Total
Eaten	7	2	9
Not eaten	3	4	7
Total	10	6	16

26 participants:

Hamburger	Ill	Not ill	Total
Eaten	12	3	15
Not eaten	4	7	11
Total	16	10	26

Mousse	Ill	Not ill	Total
Eaten	8	7	15
Not eaten	8	3	11
Total	16	10	26

Potato salad	Ill	Not ill	Total
Eaten	10	4	14
Not eaten	6	6	12
Total	16	10	26

<<<15 minute coffee break>>>

12. The game master now introduces the participants to the concept of relative risk. A suggestion: The game master says: “*Ideally we would now have a measure for each food item that tells us how big the risk is to get ill after eating it. So kind of a thermometer to measure fever, which indicates “Fever yes/no; if yes, how high”. This measure exists, it is called the relative risk. It describes how high the risk is of those who ate the food item relative to the risk to those who did not eat the food item. A relative risk bigger than one shows the risk of getting ill is bigger, a relative risk lower than one shows the risk of getting ill is smaller, compared to those without the exposure (those who did not eat the food item). Let’s start with the risk of among those eating the food item: It’s the number of ill persons who ate the food item over the total of those eating the food item. This is also called the “attack rate”. Calculate the risk of disease among those eating hamburgers with your neighbour. The fraction is enough*.”

16 participants

Hamburger	**Ill**	**Not ill**	Total	Risk of illness
eaten	8	2	10	8/10= 0.80

The game master says: "*Now calculate the attack rate among those not eating hamburgers with your neighbour*".

16 participants

Hamburger	**Ill**	**Not ill**	Total	Risk of illness
Not eaten	2	4	6	2/6 = 0.32

13. The game master says: „*Now we can calculate the relative risk for eating hamburgers: the risk of those eating hamburgers divided by the risk of those not eating hamburgers*."

16 participants

Hamburger	Risk of illness	Relative risk
Eaten	8/10 = 0.80	0.80 / 0.32 = 2.40
Not eaten	2/6 = 0.32	

In words: "*Those eating hamburgers have a nearly two and a half increase risk of becoming ill compared to those not eating hamburgers*."

14. The game master divides the participants in two groups and says: "*Can group one calculate the relative risk for mousse, can group two for potato salad?*"

16 participants

Mousse	Risk of illness	Relative risk
Eaten	5/9 = 0.56	0.56 / 0.71 = 0.78
Not eaten	5/7 = 0.71	

In words: "Those eating mousse only have 80% of the of the illness risk of those not eating mousse. Relative risks smaller than one are called "protective factors", as they decrease the risk of being ill, rather than increase the risk."

16 participants

Potato salad	Risk of illness	Relative risk
Eaten	7/9 = 0.78	0.78 / 0.43 = 1.81
Not eaten	3/7 = 0.43	

In words: “Those eating potato salad have a twofold increased risk of getting ill compared to those not eating potato salad.”

15. The game master says: “*Which food items would you prioritise for a food investigation? Which food items would you investigate later?*”

16. Proportion of cases exposed or etiological fraction. The game master says: “*We can derive further important epidemiological information from the 2 by 2 table. One of them is called the proportion of cases exposed. We can the proportion of all cases that ate this food item?*” The game master indicates in the 2 by 2 table the column “ill” and takes the participants through the calculation for hamburger.

16 participants:

Hamburger	**ill**	**Not ill**	Total
Eaten	8	2	10
Not eaten	2	4	6
Total	10	6	16

The proportion of cases exposed is: 8/10 = 80%, not to be confused with the attack rate, which is also 80%. Depending on the level of the group, the game master could go further and calculate the population attributable risk, where you subtract the risk in the unexposed from the risk in the exposed and divide the result by the risk in the exposed. It describes the proportion of illness in the entire study population that could be attributable to a given exposure. That level of detail however is unsuitable for non-statisticians and beginners in outbreak epidemiology.

The game master divides the participants in two groups and says: “*Group one can calculate the proportion of cases exposed for mousse and group two for potato salad*.”

Mousse	Ill
Eaten	5
Not eaten	5
Total	10

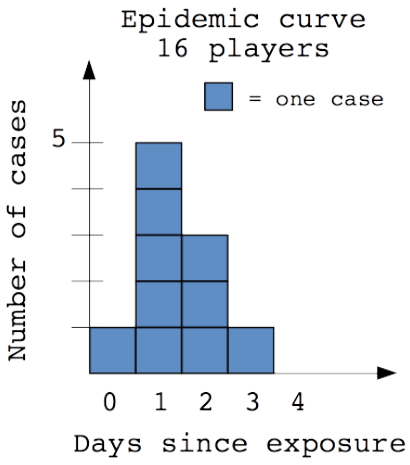
Proportion of cases exposed: 5/10 = 50%

Potato salad	Ill
Eaten	7
Not eaten	3
Total	10

The proportion of cases exposed: 7/10 = 70%

17. The game master summarises in a table: relative risk, proportion of cases exposed and shows also the epidemic curve:

Food item	Relative risk	Proportion of cases exposed
Hamburger	2.4	80%
Potato salad	1.8	70%
Mousse	0.8	50%



18. The game master asks: “*What was the probable vehicle of transmission? Where do you still need more information?*” Open discussion 5-10 minutes.
    Why are 50% of mousse eaters ill? It should be mentioned that with the given information we can’t distinguish between the causes “hamburger” and “potato salad”. Those who ate potato salad probably also all ate hamburgers and vice versa.
    A methodological solution is stratification. In the first step, we look only at those eating hamburgers. Within this group of hamburger eaters we can create a 2 by 2 table of disease status and potato salad consumption. (You can also do the same among the group of those not eating hamburgers.)
    Using the same principle of relative risks, we first look at those only eating potato salad and we can create a 2 by 2 table of disease status and hamburger consumption. (You can also do the same among those not eating potato salad.)
    The stratification should only be talked through in detail in exceptional circumstances as the participants can be overwhelmed by new information.

19. Stratification solutions with 26 participants:

Among all of those eating hamburgers

Potato salad	**Ill**	**Not ill**	Total
Eaten	9	3	12
Not eaten	3	0	3
Total	10	3	**RR=0.75**

The relative risk for potato salad is lower than one, which means if someone already has eaten hamburgers, there is no additional risk of getting ill when eating potato salad.

Among all of those eating potato salad

Hamburger	**Ill**	**Not ill**	Total
Eaten	9	3	12
Not eaten	1	1	2
Total	10	3	**RR=1.50**

The relative risk among those eating hamburgers is larger than one, which means that even after eating potato salad, eating a hamburger increases the risk of being ill. The relative risk here is different than the one without stratification, as by excluding those not eating potato salad the numerators and denominators are different.

>>> it was the hamburgers!

20. Confounder: The exposure “eating hamburgers” confounds the exposure “eating potato salad” on the outcome – it appears that “eating potato salad” is associated with being ill. The confounder “eating hamburgers” is associated with the exposure “eating potato salad” (both were food items at the wedding party, many people ate both), although “eating hamburgers” is not a consequence of “eating potato salad”, but they are independent from each other. The fact that many people ate both potato salad and hamburgers makes it look like eating potato salad is associated with being ill, when in fact “eating hamburgers” is confounding the association between “eating potato salad” and becoming ill. To disentangle the relationships, we can stratify by “eating hamburgers”, for example.