Math 107

Introduction to Hypothesis Tests
(Sections 4.1-4.4)

Does drinking beer make you more attractive to mosquitos?

OPEN ACCESS Freely available online

PLoS one

Beer Consumption [redacted] Human Attractiveness to Malaria Mosquitoes

Thierry Lefèvre[1]*, Louis-Clément Gouagna[2,3], Kounbobr Roch Dabiré[3,4], Eric Elguero[1], Didier Fontenille[2], François Renaud[1], Carlo Costantini[2,5], Frédéric Thomas[1,6]

1 Génétique et Evolution des Maladies Infectieuses, UMR CNRS/IRD 2724, Montpellier, France, **2** Caractérisation et Contrôle des Populations de Vecteurs, IRD/UR 016, Montpellier, France, **3** Institut de Recherche en Science de la Santé, Bobo-Dioulasso, Burkina Faso, **4** Laboratoire de Parasitologie et d'Entomologie Médicale, Centre Muraz, Bobo-Dioulasso, Burkina Faso, **5** Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale, Yaoundé, Cameroun, **6** Institut de Recherche en Biologie Végétale, Université de Montréal, Montréal, Canada

Abstract

Background: Malaria and alcohol consumption both represent major public health problems. Alcohol consumption is rising in developing countries and, as efforts to manage malaria are expanded, understanding the links between malaria and alcohol consumption becomes crucial. Our aim was to ascertain the effect of beer consumption on human attractiveness to malaria mosquitoes in semi field conditions in Burkina Faso.

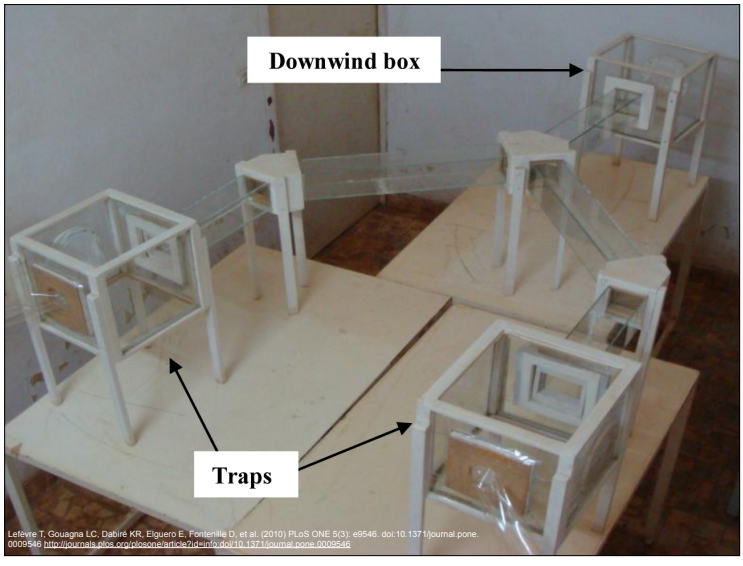
Background

"Malaria and alcohol consumption both represent major public health problems. Alcohol consumption is rising in developing countries and, as efforts to manage malaria are expanded, understanding the links between malaria and alcohol consumption becomes crucial. Our aim was to ascertain the effect of beer consumption on human attractiveness to malaria mosquitoes in semi field conditions in Burkina Faso."

Lefèvre T, Gouagna LC, Dabiré KR, Elguero E, Fontenille D, et al. (2010) PLoS ONE 5(3): e9546. doi:10.1371/journal.pone.0009546 http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0009546

Methodology

- Study performed in Burkina Faso, Africa
- 25 volunteers consumed a liter of beer
- 18 volunteers consumed a liter of water
- Attractiveness of mosquitos to volunteer tested before and after consumption
- Mosquitos released and caught in traps as they approached the volunteers

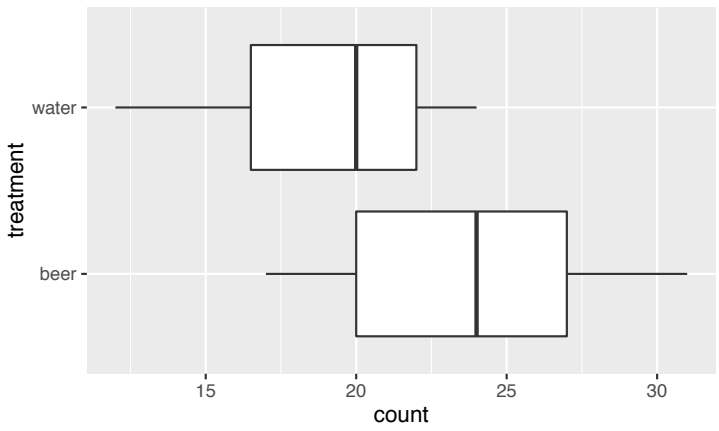


Lefèvre T, Gouagna LC, Dabiré KR, Elguero E, Fontenille D, et al. (2010) PLoS ONE 5(3): e9546. doi:10.1371/journal.pone.0009546 http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0009546

Your Turn

- Is this an experiment or an observational study?

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20



Your Turn

- What's the parameter in this situation?
- What's the statistic?

Your Turn

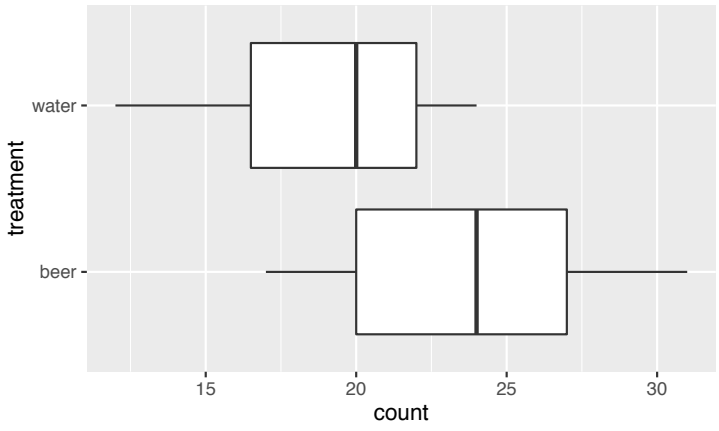
- Is a mean difference of 4.4 mosquitos enough evidence that beer consumption increases human attractiveness to mosquitos? Or was this due to random chance?
- If not, why?
- How could this be determined?

Logic of hypothesis testing

Framework

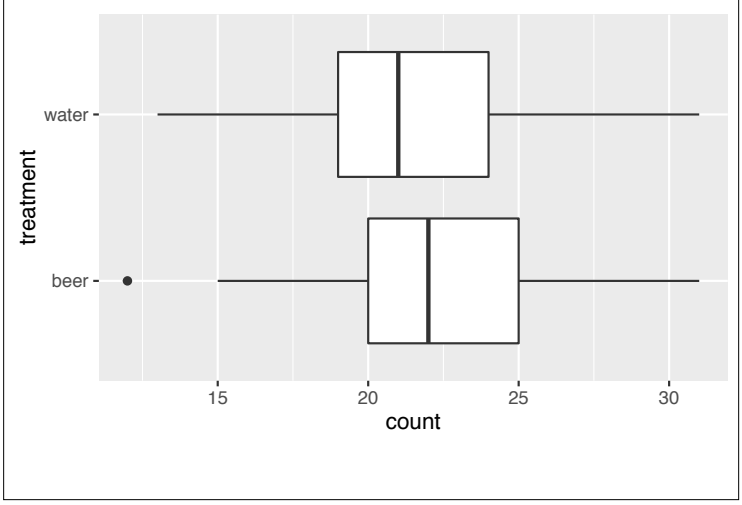
1. Formulate two competing hypotheses
2. Calculate a statistic summarizing the relevant information to the claims
3. Look at the behavior of the statistic assuming that the “initial claim” is true
4. Compare the observed statistic to the distribution created in step 3 to determine whether it is “extreme”

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20

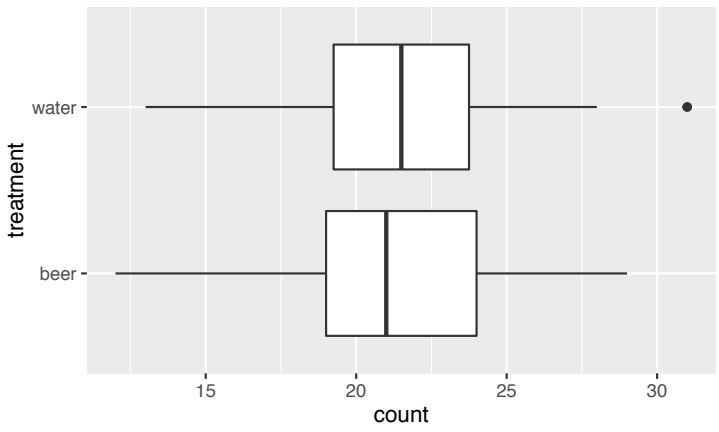


Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20

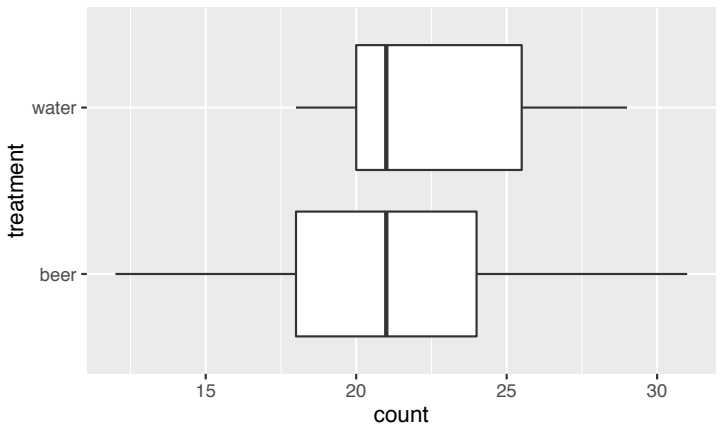
Beer			Water	
27	21	20	13	24
20	20	24	19	15
19	22	31	28	23
26	16	22	21	18
25	21	20	19	24
23	18	15	27	24
22	12	29	20	21
27	24		21	20
17	28		31	19



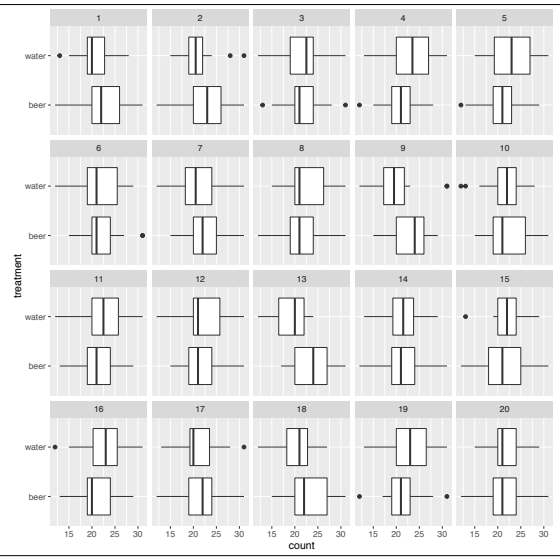
Beer			Water	
21	19	19	19	31
21	24	17	20	28
24	16	15	23	15
29	24	20	21	18
20	24	22	23	13
25	28	18	21	19
26	20	27	22	24
12	27		31	20
20	21		27	22



Beer			Water	
24	28	23	20	27
13	22	21	24	21
19	15	21	20	27
16	31	23	18	20
27	15	25	26	20
19	22	18	21	19
20	31	24	21	28
17	12		24	19
24	20		29	22



Compare the observed to behavior under the null hypothesis



Radomization (i.e. permutation) tests

Beer			Water	
27	26	24	21	12
19	28	29	19	24
20	20	21	13	24
20	27	21	22	21
23	19	18	15	19
17	25	27	22	18
21	31	20	15	16
24	24		22	23
31	28		20	20

Diff: 4.4

Mean: 23.6 Mean: 19.2

Beer			Water	
27	21	20	13	24
20	20	24	19	15
19	22	31	28	23
26	16	22	21	18
25	21	20	19	24
23	18	15	27	24
22	12	29	20	21
27	24		21	20
17	28		31	19

Diff: 0.5

Mean: 22 Mean: 21.5

Beer			Water	
21	19	19	19	31
21	24	17	20	28
24	16	15	23	15
29	24	20	21	18
20	24	22	23	13
25	28	18	21	19
26	20	27	22	24
12	27		31	20
20	21		27	22

Diff: -0.5

Mean: 21.6 Mean: 22.1

Beer			Water	
24	28	23	20	27
13	22	21	24	21
19	15	21	20	27
16	31	23	18	20
27	15	25	26	20
19	22	18	21	19
20	31	24	21	28
17	12		24	19
24	20		29	22

Diff: -1.4

Mean: 21.2 Mean: 22.6