How to Read Medical Statistics

Sorana D. Bolboacă

CONTENT

- Fundamental concepts of measurements
- Fundamental concepts of hypothesis testing and statistical inference
- Reading medical statistics by examples
- Theoretical exam by example

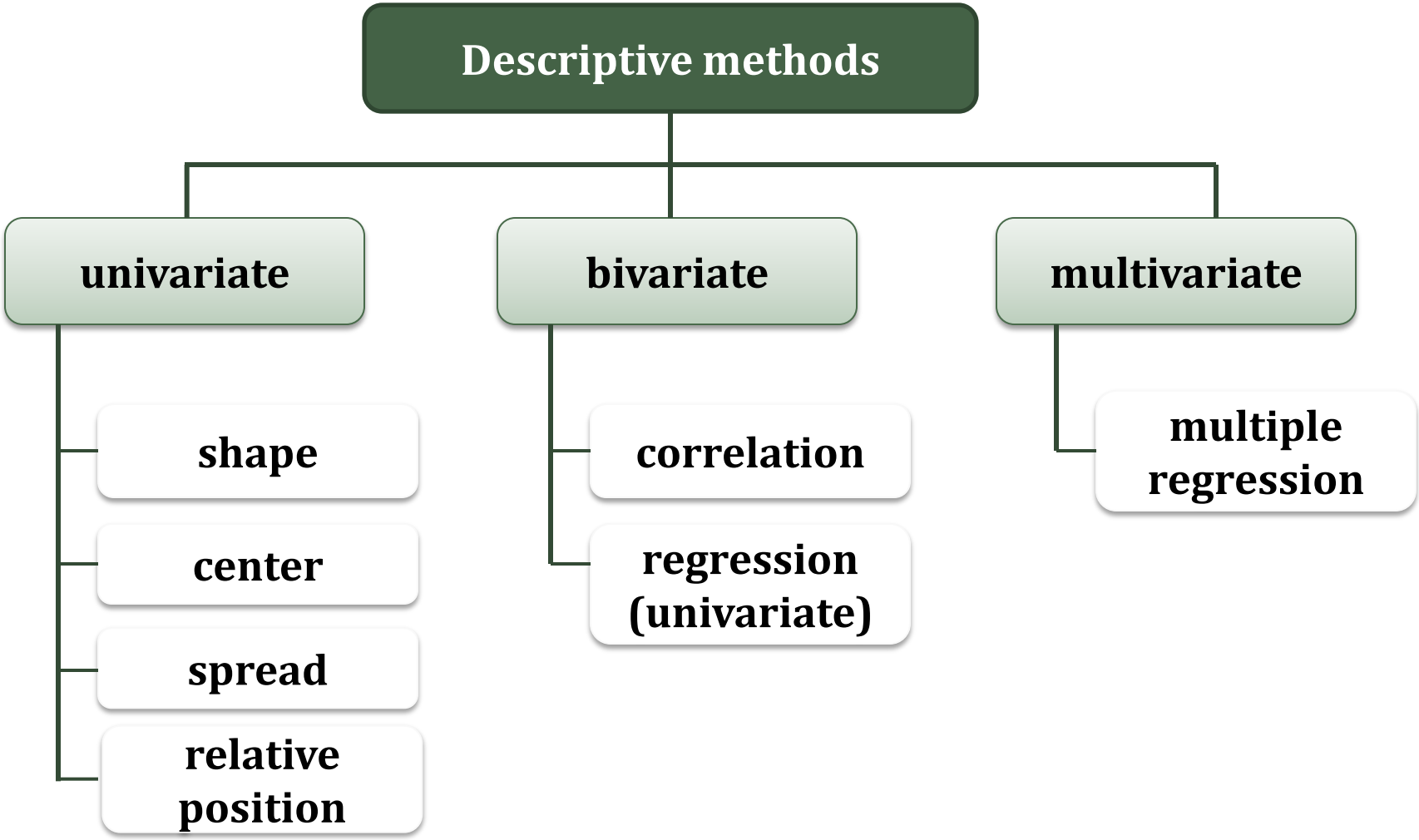
FUNDAMENTAL CONCEPTS OF MEASUREMENTS

- Scale of measurement
- Distribution & Central tendency & Variability & Probability
- Association (covariance, correlation)
- Point estimators
  - Sensibility, specificity, positive or negative predictive values

Fundamental Concepts of Hypothesis Testing

- Confidence intervals
- Statistical significance and type I error

TAXONOMY OF STATISTICS



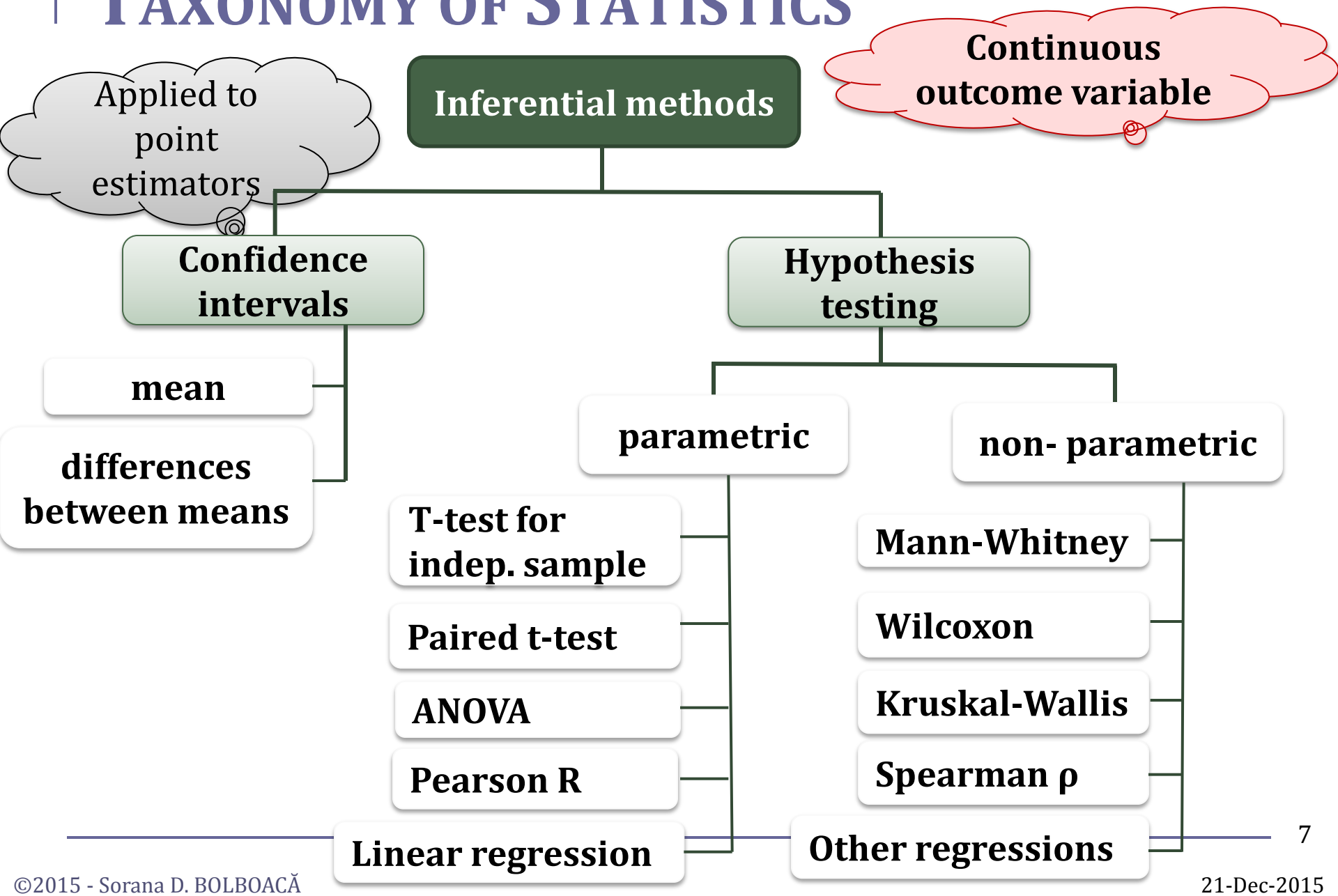
Quantitative outcome variable

Data follow a normal distribution?

- H_0: The observed distribution of data is not significantly different by normal distribution
- H_1: The observed distribution of data is significantly different by normal distribution
- Tests for normality:
  - Kolmogorov Smirnov test
  - Shapiro-Wilk test for *n < 50*

- $p<0.05$ H_0 is rejected with a risk of error equal with 5% ➔ data did not follow a normal distribution

TAXONOMY OF STATISTICS



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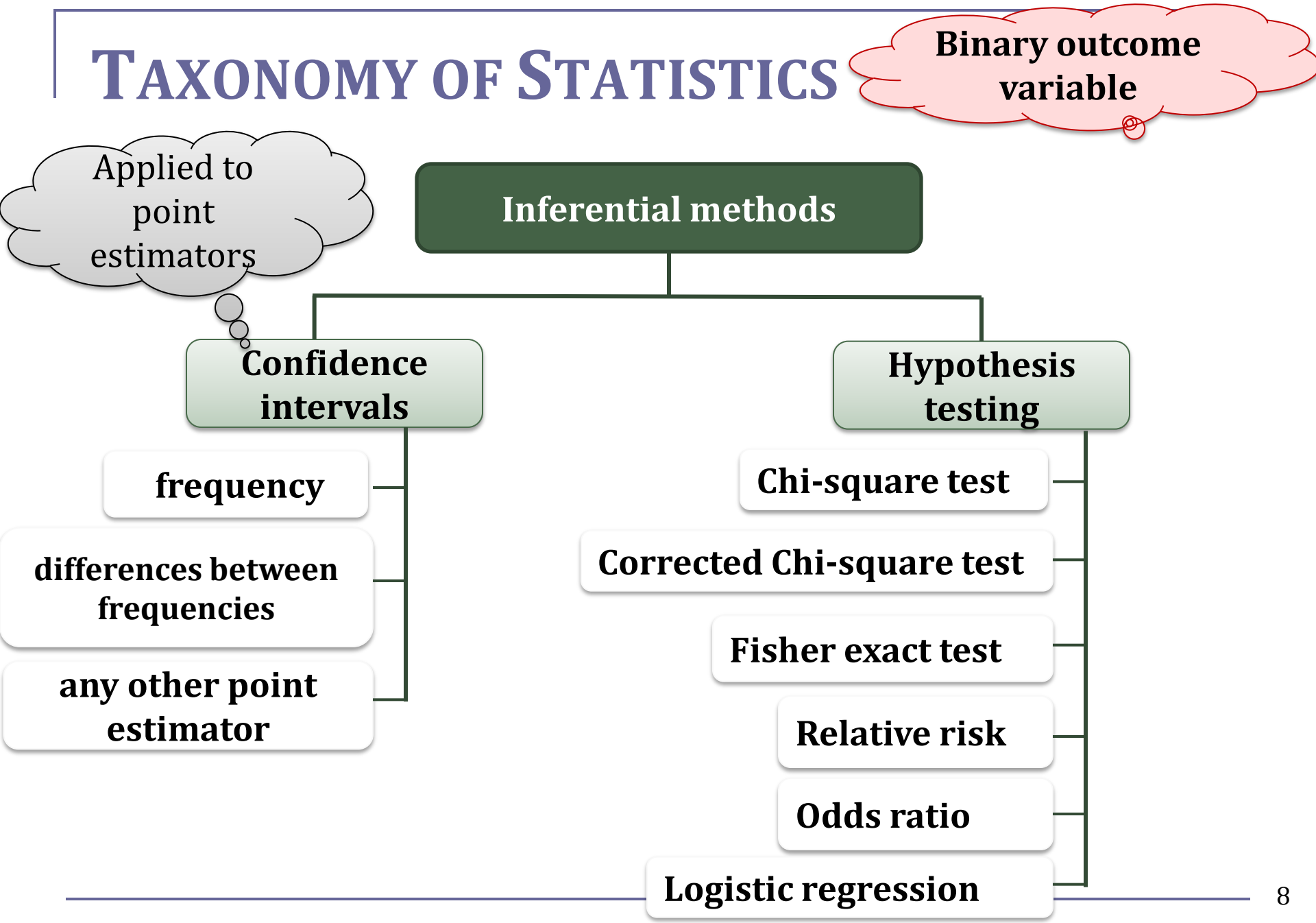

ARTILE FOR MEDICAL STATISTICS REVIEW

PLoS One. 2015 Apr 17;10(4):e0123579. doi: 10.1371/journal.pone.0123579. eCollection 2015.

Relationship between smoking and obesity: a cross-sectional study of 499,504 middle-aged adults in the UK general population.

Dare S[1], Mackay DF[2], Pell JP[2].

⊕ Author information

Abstract

BACKGROUND: There is a general perception that smoking protects against weight gain and this may influence commencement and continuation of smoking, especially among young women.

METHODS: A cross-sectional study was conducted using baseline data from UK Biobank. Logistic regression analyses were used to explore the association between smoking and obesity; defined as body mass index (BMI) >30 kg/m2. Smoking was examined in terms of smoking status, amount smoked, duration of smoking and time since quitting and we adjusted for the potential confounding effects of age, sex, socioeconomic deprivation, physical activity, alcohol consumption, hypertension and diabetes.

RESULTS: The study comprised 499,504 adults aged 31 to 69 years. Overall, current smokers were less likely to be obese than never smokers (adjusted OR 0.83 95% CI 0.81-0.86). However, there was no significant association in the youngest sub-group (≤40 years). Former smokers were more likely to be obese than both current smokers (adjusted OR 1.33 95% CI 1.30-1.37) and never smokers (adjusted OR 1.14 95% CI 1.12-1.15). Among smokers, the risk of obesity increased with the amount smoked and former heavy smokers were more likely to be obese than former light smokers (adjusted OR 1.60, 95% 1.56-1.64, p<0.001). Risk of obesity fell with time from quitting. After 30 years, former smokers still had higher risk of obesity than current smokers but the same risk as never smokers.

CONCLUSION: Beliefs that smoking protects against obesity may be over-simplistic; especially among younger and heavier smokers. Quitting smoking may be associated with temporary weight gain. Therefore, smoking cessation interventions should include weight management support.

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Introduction

Smoking and obesity are major public health challenges and the prevalence of both is increasing globally. Smoking increases the risk of cancer, respiratory and cardiovascular diseases, and is the leading preventable cause of death in developed countries [1]. Obesity is the fifth leading cause of death, globally, and accounts for 44% of cases of diabetes and 23% of ischaemic heart disease [2 3]. The Framingham Study showed that the life expectancy of obese smokers is around 13 years shorter than non-obese, never smokers [4].

The relationship between smoking and obesity is complex and not completely understood, and published studies have produced conflicting results. While some studies have shown no significant association between smoking status and body mass index (BMI) [10], others have suggested that smoking may be associated with lower BMI [11] and smoking cessation with increased BMI [12].

It is possible that the association reflects reverse causation due to overweight individual, who are trying to lose weight, being more likely to start smoking [13]. However, previous studies have also explored possible causal mechanisms. The most robust evidence, to date, supports a peripheral metabolic effect. Administration of nicotine to animal models has been associated with reduced weight, in the absence of reduced calorific intake, due to less efficient absorption and storage of calories and increased metabolic rate and thermogenesis [13–15]. Since nicotine

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Table 2. Smoking behaviour of obese and not obese participants.

	Not Obese (N = 377,220) N (%)	Obese (N = 122,284) N (%)	P value*
Smoking status			
Current	30,301 (8.1)	8,574 (7.0)	<0.001
Former	193,182 (51.4)	65,690 (54.0)	
Never	152,413 (40.5)	47,401 (39.0)	
Missing	1,324	619	
Current smokers			
Number of cigarettes (per day)			
<10	5,950 (21.3)	1,201 (15.3)	<0.001
10–20	18,369 (65.6)	5,130 (65.5)	
>20	3,662 (13.1)	1,499 (19.1)	
Missing	2,320	744	
Duration of smoking (years)			
<10	529 (1.8)	163 (1.9)	0.327
11–20	1,653 (5.5)	504 (6.0)	
21–30	8,210 (27.5)	2,202 (26.1)	
≥31	19,460 (65.2)	5,579 (66.0)	
Missing	449	126	

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Table 1. Characteristics of obese and not obese participants.

	Not Obese (N = 377,220) N (%)	Obese (N = 122,284) N (%)	P value*
Age (years)			
31–40	31,493 (8.3)	8,508 (7.0)	<0.001
41–50	105,116 (27.9)	32,691 (26.7)	
51–60	152,997 (40.6)	52,308 (42.8)	
≥61	87,614 (23.2)	28,777 (23.5)	
Hypertension			
No	293,635 (78.1)	69,271 (56.9)	<0.001
Yes	82,356 (21.9)	52,481 (43.1)	
Missing	1,229	532	
Diabetes			
No	363,790 (96.8)	107,486 (88.5)	<0.001
Yes	12,090 (3.2)	13,997 (11.5)	
Missing	1,340	801	

Smoking status

Obesity was most prevalent among former smokers and least prevalent among current smokers (Table 2). Univariate analyses confirmed that current smokers were less likely to be obese than never smokers (OR 0.91, 95% CI 0.89–0.93, $p<0.001$), and former smokers were more likely to be obese than both current smokers (OR 1.20, 95% CI 1.17–1.23, $p<0.001$) and never smokers (OR 1.09, 95% CI 1.08–1.11, $p<0.001$). The results remained statistically significant after ad-

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Table 3. Multivariate* binary logistic regression analysis of the association between smoking status and obesity stratified by gender, age and socioeconomic deprivation decile.

	Never smokers	Current smokers OR (95% CI)	P value	Former smokers OR (95% CI)	P value
Gender					
Female	1.00	0.83 (0.79–0.86)	<0.001	1.09 (1.07–1.12)	<0.001
Male	1.00	0.86 (0.83–0.90)	<0.001	1.21 (1.18–1.24)	<0.001
Age (years)					
31–40	1.00	0.92 (0.84–1.00)	0.064	0.99 (0.93–1.04)	0.604
41–50	1.00	0.84 (0.80–0.88)	<0.001	1.05 (1.02–1.08)	0.001
51–60	1.00	0.82 (0.78–0.86)	<0.001	1.16 (1.14–1.19)	<0.001
≥61	1.00	0.76 (0.71–0.82)	<0.001	1.28 (1.24–1.32)	<0.001
Socioeconomic deprivation decile					
1 (most affluent)	1.00	1.11 (0.99–1.26)	0.078	1.20 (1.14–1.26)	<0.001
2	1.00	1.03 (0.91–1.15)	0.676	1.23 (1.17–1.29)	<0.001
3	1.00	0.95 (0.85–1.07)	0.403	1.23 (1.17–1.29)	<0.001
4	1.00	0.87 (0.78–0.98)	0.016	1.15 (1.10–1.21)	<0.001
5	1.00	0.97 (0.88–1.08)	0.583	1.19 (1.13–1.24)	<0.001
6	1.00	0.93 (0.85–1.02)	0.146	1.13 (1.08–1.18)	<0.001
7	1.00	0.87 (0.79–0.95)	0.002	1.18 (1.12–1.23)	<0.001
8	1.00	0.84 (0.77–0.91)	<0.001	1.10 (1.05–1.15)	<0.001
9	1.00	0.76 (0.71–0.82)	<0.001	1.05 (1.01–1.10)	0.022
10 (most deprived)	1.00	0.62 (0.59–0.66)	<0.001	0.95 (0.91–0.99)	0.026

OR odds ratio, CI confidence interval.

*adjusted for levels of physical activity and alcohol consumption, and presence of hypertension and diabetes as well as gender, age, and socioeconomic deprivation decile as appropriate.

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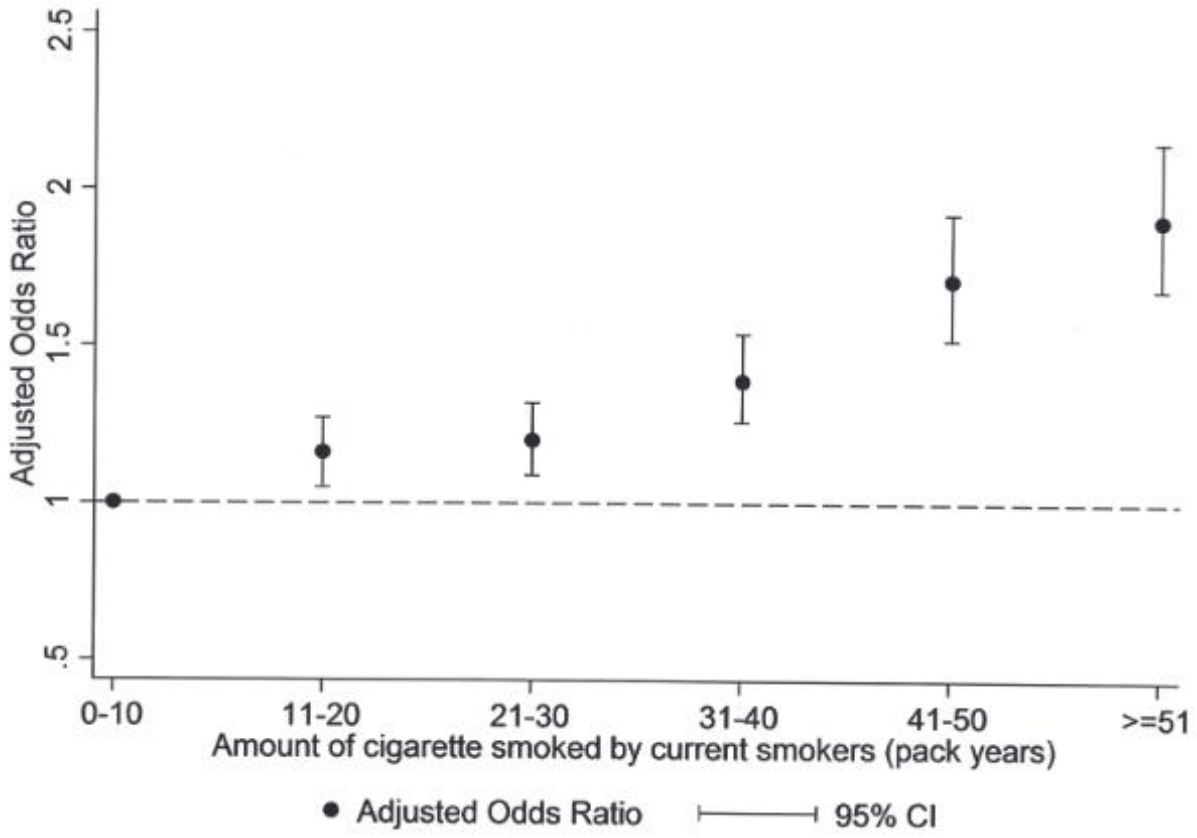


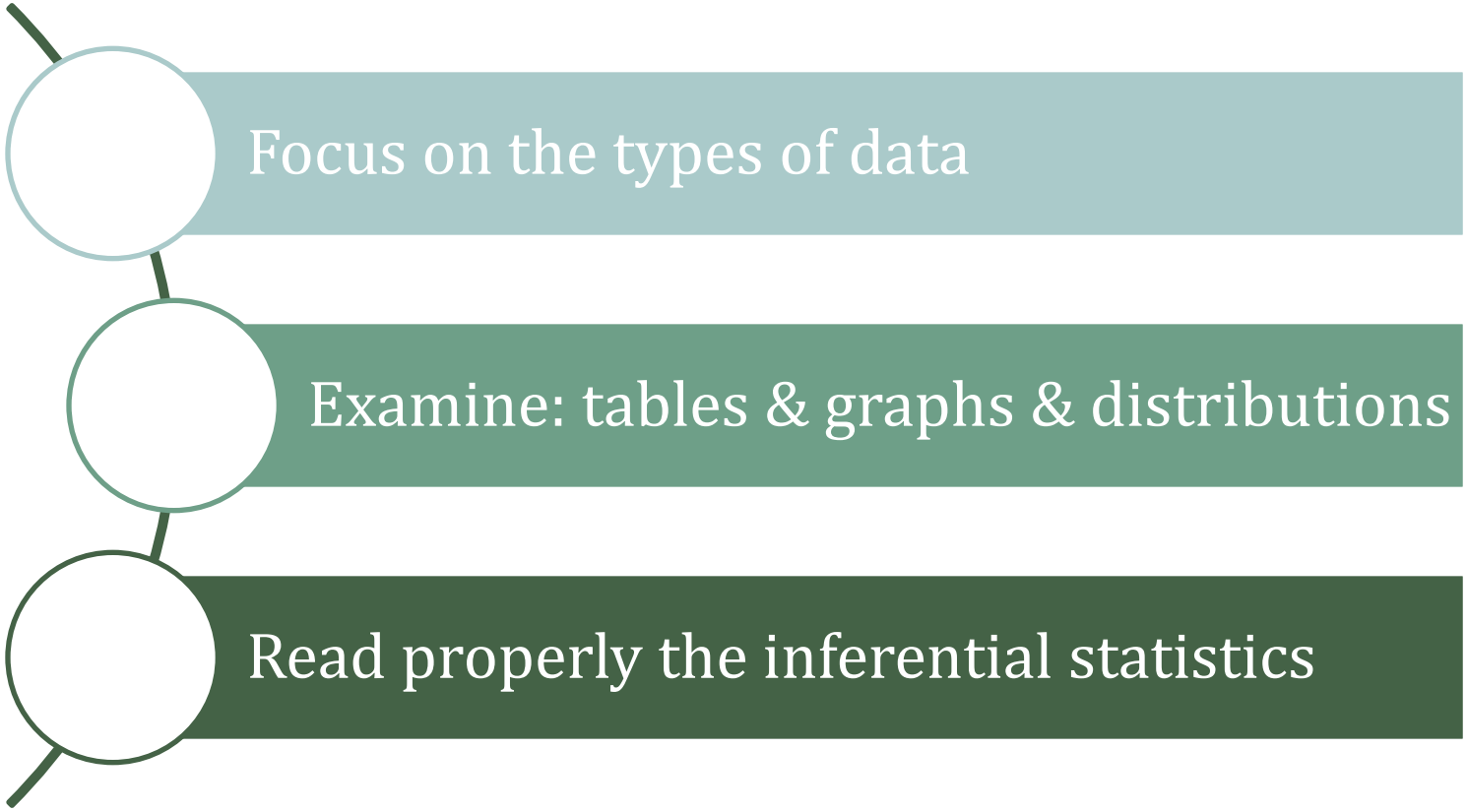
Fig 1. Forest plot of adjusted* odds ratio for obesity and lifetime consumption of cigarette smoked (pack years) among current smokers. * adjusted for levels of physical activity and alcohol consumption, and presence of hypertension and diabetes as well as gender, age, and socioeconomic deprivation decile.

doi:10.1371/journal.pone.0123579.g001

THE GAME PLAN

- To be able to understand, interpret and appropriately use the information published in the scientific literature
- Further (medical research methods) you should be able to decide if something was properly done!

STRATEGY!



THEORETICAL EXAM BY EXAMPLE

- Theoretical problems of medical statistics
- MCQ with 35 questions with 5 possible answers and just one correct answer
- The test is online between December 21, 2015 and January 7, 2016 8:00 p.m.
- To finalize your test you must answer all questions
- If more than one test is done, it will be considered just the first one!
- You will find the test **here**!

Merry Christmas

and a Happy New Year!

2016