Alcohol related car crashes

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1. Background

Blood-alcohol content (BAC) refers to the amount of alcohol contained in a person's blood.

When alcohol is consumed and absorbed into the bloodstream, it travels directly to the brain, affecting many cognitive functions.

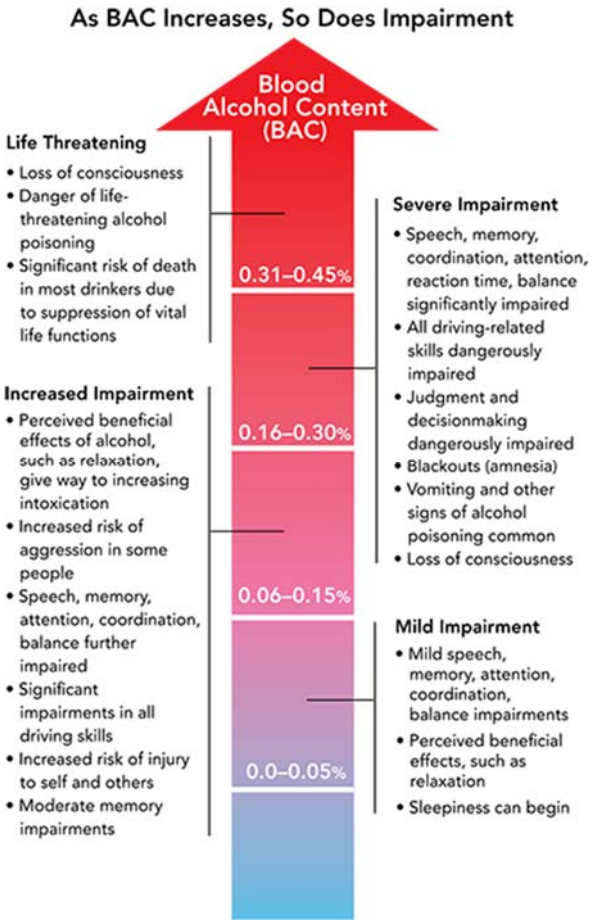
At a blood-alcohol level of .05, the person may begin to exhibit loss of small-muscle control - such as being able to focus the eyes - and lowered alertness.

At the legal level of .08, the person will usually exhibit:

- Poor muscle coordination
- Loss of balance
- Slower reaction time
- Slurred speech
- Loss of vision and hearing

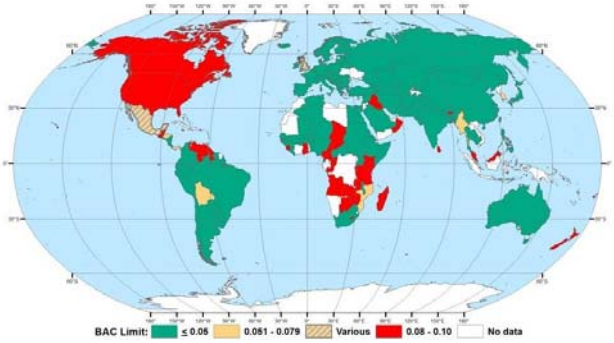
- Difficulty in detecting danger
- Impaired judgment, self-control
- Impaired reasoning and memory

Information processing, decision making, and hand-eye coordination are impaired in some people with blood-alcohol content levels as low as .04.



All of these impairments result in an increased risk of injuries in general, and particularly those related to the operation of a motor vehicle.

The legislated maximum Blood Alcohol Concentration (BAC) levels allowed to drive vary around the world.



2. A case-study

An observational study was carried out to investigate the association between alcohol consumption and car accidents.

Information on 196 drivers and their BAC (in ‰) was collected, as well as information on the prevalence of car accidents, and basic demographics. The data are shown in the Excel file *"Data_car_accidents"* (sheet: *"Data_196_subjects"*).

1. Identify demographic characteristics of the drivers that are risk (or protective) factors of car accidents.

2. Obtain the model relating BAC and car accidents (both, not adjusted and adjusted for confounders). Interpret the not-adjusted and adjusted odds ratios. Is there a significant association between BAC and car accidents?

3. Is there any other potential confounder (not included in the file *"Data_car_accidents"*) that should have been considered in the study? How would you include it in the analysis?

4. Plot the unadjusted (crude) and adjusted models. Comment on the similarities or differences between the two.

5. What is the probability that a 40 yr male whose BAC is >1‰, causes a car accident? What will be the probability, 10, 20, 30 and 40 years later? Is this change linear?

6. We obtain information on a new set of drivers (17 subjects). Evaluate the predictive performance of the model by calculating the accuracy, sensitivity, specificity and precision of the model using this new dataset. Consider the threshold value for the probability as equal to 0.5. The data for the 17 subjects is in the Excel file *" Data_car_accidents"* (sheet: *"Data_17_subjects"*).