HIGH NOT ACHIEVED

Marker comments

PROBLEM – correct question format, asking about difference in means for [variable] between [groups] for the [population]. Population not clearly defined (as given in task sheet). Minimal research provided.

ANALYSIS – Difference in sample means not given (medians only yet question refers to the mean); groups and variable usually used throughout, but no units. Comments are minimally descriptive only – no attempt at relating these observations to their research.

CONCLUSION – CI interpreted (in Analysis section) but population not included, correct call with justification including population, sampling variation statement sufficient, no further evidence in final section of conclusion.

Low level of analysis comments along with CI interpretation missing population, means high NA rather than low ACH. If Analysis comments were stronger, could consider paper for a resubmission opportunity to correct the missing population in the CI interpretation or call it overall holistic ACHIEVE.

Problem

What is the difference between the mean blood alcohol level in mg/100ml of young drivers (high risk group) and the mean blood alcohol level in mg/100ml of older drivers (low risk group) for all crashes involving alcohol in New Zealand?

I am asking this question there is a lot of argument about whether or not younger drivers are more dangerous on the roads than older drivers (REF). I plan to find out, using real data, whether or not younger drivers have a higher blood alcohol level when driving (blood alcohol recorded at the time of crash). The driving age in 2011 up until the start of August was 15, but on the 1st of August, the driving age was put up to 16 years old, so there would have been drivers who were 15 years old even after the age was put up in 2011 (REF). The driving age in most other countries is 17 years (REF).

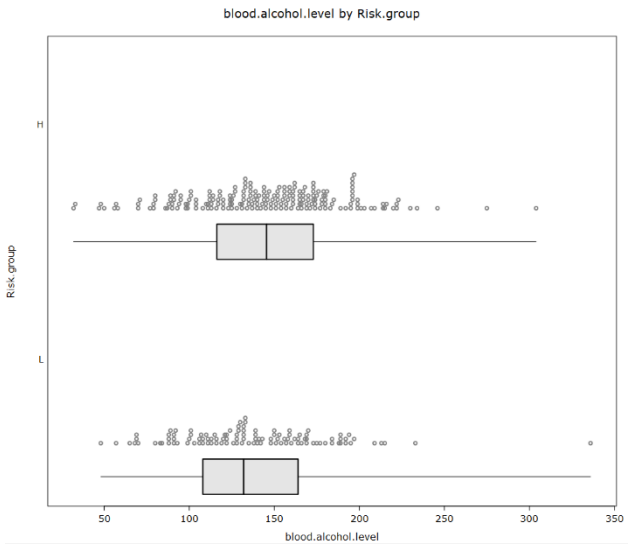
As a learner driver in the high risk age group, this report relates to me, as it effects how other drivers see me on the road, as not every high risk driver is intoxicated when they drive, and those that are, may not be quite so different to the low risk age group. I think that not all drivers of the high risk age group are more dangerous than those of the low risk age group.

Analysis

From this sample, the median of these drivers in the low risk age group is lower than that of the high risk age group. The median of the low risk age group is 132 and the median of the high risk age group is 145.0. This difference was expected from my research.

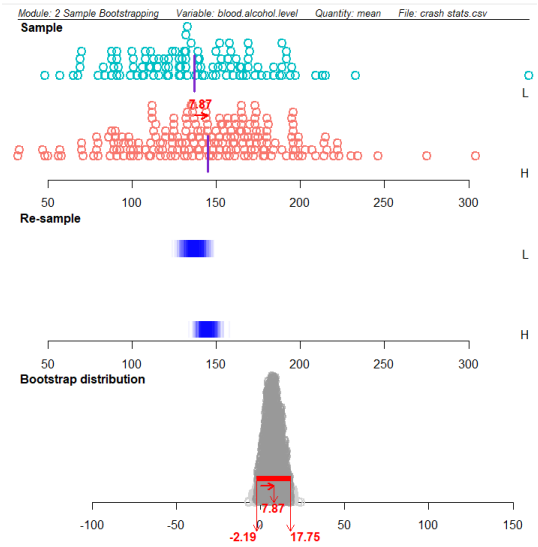
From this sample, the blood alcohol level for both these drivers in the low risk age group and the high risk age group has a similar spread. The IQR for these low risk drivers is 56 and the IQR for these high risk drivers is 56.8.

Looking at the box and whisker part of the graph, we can see that there is a large overlap between the high risk and low risk age groups, the upper quartile range of the high risk age group, only slightly higher than that of the low risk age group, and the lower quartile of the low risk age group, is only slightly lower than that of the high risk age group.



Summary of the distribution of Risk.group by blood.alcohol.level:

	Min	25%	Median	75%	Max	Mean	SD	Sample Size
H	32	116.2	145.5	173	304	144.8	44.12	206
L	48	108.0	132.0	164	336	137.0	42.80	111



Formal Statistical Inference/Conclusion

From my bootstrapping confidence interval I can be pretty sure that the mean blood alcohol level of high risk drivers is somewhere between 2.19 mg/100ml less and 17.75 mg/100ml more than the mean blood alcohol level of low risk drivers.

The confidence interval both negative and positive so I cannot make the call that the mean blood alcohol level for high risk drivers is higher than the mean blood alcohol level for low risk drivers for all crashes involving alcohol in New Zealand.

The reason I constructed a confidence interval was due to sampling variation. If I were to take a larger sample the graphs and summary statistics would be similar but not the same. I would expect my confidence interval to be narrower and I may be able to make the call.

Each of the age groups have a range of 10 years from the lowest age to the highest age in that group. The high risk age group being 15 – 24 years, and the low risk group being 50 to 59 years. This factor leaves no room for bias. However, the number of data that we have for the high risk age (206) group is a lot higher than for the low risk age group (111). From this, one could assume that it is because the higher risk factor that there were more crashes that involved a driver of the high risk age group than that of the low risk age group in 2011. However, without having the entire population of data in front of us, this limitation means that we could not fairly make a call.

Another limitation of this data is that there is no data of the people who have died due to a car crash. We know this because the researchers interviewed the drivers in person to find out more data about their case. While this is rather morbid, it should be considered as a factor in this report.

I think that while there seems to be a slightly higher mean of blood alcohol level of the drivers in the high risk age group, there is not enough of a difference between the two means (low risk and high risk) to say that the younger drivers are more dangerous drivers (due to blood alcohol level at the time of crash).

From this report we can definitely say that not all drivers of the high risk age group are more dangerous on the roads than the drivers of the low risk age group.

ACHIEVE

COMMENTS

PROBLEM – Research presented a typical example of a "research-dump" by a lower-level student. That said, it is all relevant to the context. Question correct with clear variable, groups, population.

ANALYSIS – Difference in sample medians given, descriptive comments in context (variables, groups, units) and quantified. Explaining what features mean not linked to research but sensible comments made. Some repeated ideas. Unusual value acknowledged but no reasons given. Shape description not detailed enough for further evidence.

CONCLUSION – Standard conclusion containing correct confidence interval interpretation, correct call and reference to sampling variation.

To reach MERIT, more of a link between analysis relevance statements and research as well as a stronger conclusion relating back to the context.

Problem

I think that the more severe crashes will involve a higher driver median blood alcohol level for a just a few reasons:

- One New Zealand reseach paper stated "Miller has estimated from published studies that a blood alcohol concentration above 100 mg/100 mL increases the risk of involvement in any crash by 13 to 18 times and the risk of a fatal crash by as much as 50 to 90 times." (REF)
- The general fact that the more alcohol you consume, the greater the impact on your brain, such as increasing your reflex response time, delaying messages from your eyes to your brain and lack of balance.
    - Euphoria (BAC = 0.03% to 0.12%)
        - Overall improvement in mood and possible euphoria
        - Increased self-confidence
        - Shortened attention span
        - Impaired judgment
        - Impaired fine muscle coordination (http://en.wikipedia.org/wiki/Short-term_effects_of_alcohol)

I would like to look at driver blood alcohol level and the severity of the crash.

Investigative question: What is the difference between the median blood alcohol level in mg/100ml of drivers involved in serious crashes and the median blood alcohol level in mg/100ml of drivers involved in major crashes for all crashes involving alcohol in New Zealand in 2011?

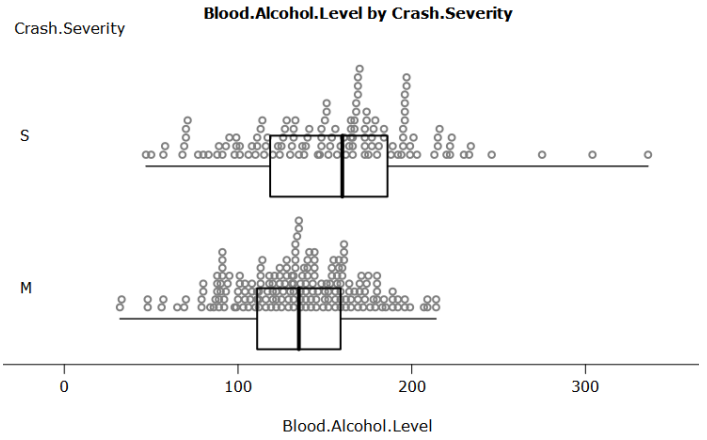
Analysis

Summary of Blood Alcohol Level by Crash Severity

	Min	1st Qu	Median	Mean	3rd Qu	Max	Std Dev	Sample Size
Minor	32	111.0	135	133.7	159	214	36.142	189
Serious	47	119.2	160	154.5	185	336	50.703	128

Overall comparison: The blood alcohol levels for the severe crashes sample is more spread out than the minor crashes sample. Both samples have a lower range around 50mg/100mL to 100mg/100mL but only the serious sample goes past 225mg/100mL, and reaches over 300mg/100mL. The serious crashes sample has many values higher than the minor crashes sample.

Centres: The median for the minor crash blood alcohol level is 25mg/100mL lower than the median for serious crash blood alcohol, (135mg/L for minor compared to 160mg/l for serious). This difference seems reasonable to me because it makes sense the more alcohol someone has had, the more likely they could be to have a high impact crash causing serious injury due to the fact their ability to drive could be significantly impaired by the alcohol.

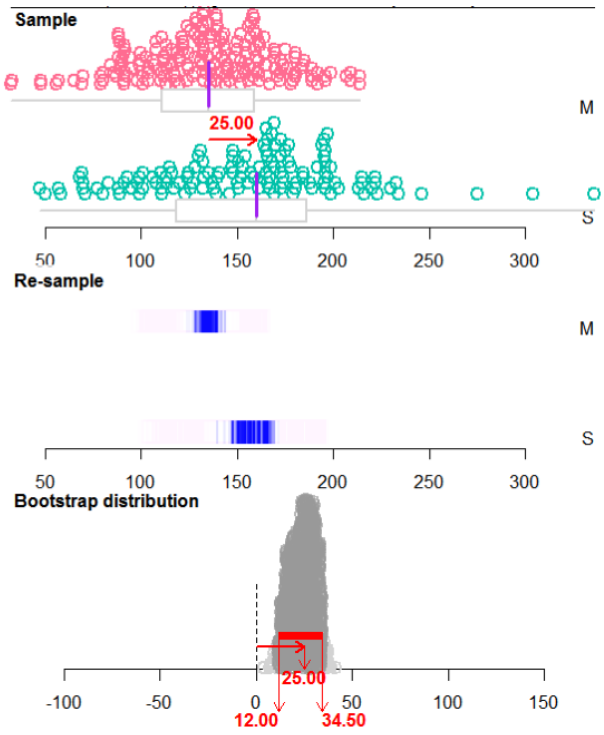


Spread: From my sample I notice that the blood alcohol levels for the serious crashes are more spread out than that of the minor crashes. The IQR for the serious crashes is 65.8 mg/100ml and the standard deviation for the minor crashes is 48 mg/100ml. This is a difference of 17.8 mg/100ml. This suggests there is more variation in the blood alcohol levels for serious crashes. It makes sense that the IQR for serious crashes is more spread out because there are lots of reasons for serious crashes other than alcohol and there would also be lots of serious crashes that happen due to the driver having had lots of alcohol.

Shift and Overlap: I notice that for this sample of drivers the serious crashes are shifted further up the graph than the minor crashes. This is shown by the lower quartile, median and upper quartile for the serious crashes being higher than those of the minor crashes. The lower quartile is 8.2 mg/100ml higher, the median is 25 mg/100ml higher and the upper quartile is 26 mg/100ml higher. Having said that, there is still quite a bit of overlap of the middle 50%'s. This overlap goes from 119.2 mg/100ml to 159 mg/100ml. This is an overlap of 39.8 mg/100ml. It makes sense that there is a reasonable amount of overlap between the middle 50%'s because there are lots of contributing reasons for crashes such as weather, distractions, engine troubles, tiredness, etc. This means it is likely there would be a number of both serious crashes and minor crashes for drivers with similar blood alcohol levels in the alcohol related crashes from 2011, due to these other factors.

Unusual I think it is unusual to find people with blood alcohol levels as high as 300mg/100mL and greater. Otherwise it seems like normal data.

Shape The minor crash sample is left skewed while the severe crash data is more right skewed. Most of the data is between 100mg/100mL and 200mg/100mL. I think this would be similar back in the population because at different points of alcohol consumption you will become less and less able to drive.



Formal Statistical Inference/Conclusion

From my bootstrapping confidence interval I can be pretty sure that the median blood alcohol level of drivers in serious crashes for all crashes involving alcohol in New Zealand is between 12 mg/100ml and 34.5mg/100ml higher than the median blood alcohol level of drivers in minor crashes for all crashes involving alcohol in NZ.
The confidence interval is entirely positive so I can make the call that the median blood alcohol level for serious crashes is higher than the median blood alcohol level for minor crashes for all crashes involving alcohol in New Zealand.
The reason I constructed a confidence interval was due to sampling variation. If I were to take another sample the graphs and summary statistics would be similar but not the same. Each sample would produce a different confidence interval but due to my confidence interval being well above zero I am pretty sure I would still be able to make the same call.

MERIT

COMMENTS

PROBLEM – Introduction includes a small amount of relevant research; hypothesis given, but direction of trend not clear; justification for hypothesis opinion rather than referenced; investigative question about difference in medians, population clearly defined.

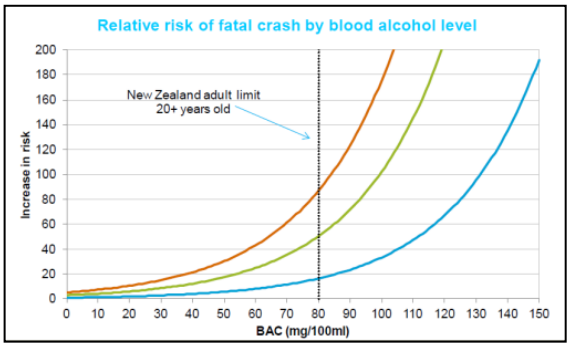
ANALYSIS – Descriptions in context and quantified throughout. Further comments in purple in the text

CONCLUSION – CI interpreted, sample→ population inference clear; correct call; correct call and justification; commented on sampling variability including the variability of the estimates in context; comments relating findings back to context.

Contextual comments show linking between data and research but are lacking insight, some personal interpretation of information rather than based on referenced material. For EXCELLENCE research needs to be integrated better throughout report – clearly referenced and using research to support specific comparative analysis comments.

Problem

We often see in the media many advertisements trying to convince drivers that if they have consumed alcohol they should not be driving. This is because alcohol reportedly means you have a much higher risk of crashing because your decision making skills and awareness of what is around you is much worse after having drinking alcohol than when you have had no alcohol. The Ministry of Land Transport in a detailed report on http://www.transport.govt.nz/research/Documents/Alcohol-drug-crash-statistics-2011-(1).pdf looking at the effect alcohol and drugs have on driving based on crash statistics from the year ending December 31, 2011, has concluded that when your blood alcohol concentrate levels are 100mg per 100 ml your relative risk of having a fatal crash is much greater. For drivers aged between 15- 19 you are about 170 times more likely, for people aged between 20-29 you are about 105 times more and for those aged 30+ you are about 35 times more likely. A detailed summary is shown in the graph.



As Year 13 students many of us are starting to turn 18 so will legally be allowed to drink alcohol soon. On top of this many of us already have our licenses. I want to investigate this possible connection between your Blood Alcohol Level and how severe a crash you are likely to have to give information to students who are transitioning into this new world and may face the social pressures that are around them to drink and drive.

I believe that there will be a strong connection between whether you have a serious injury crash or a minor injury crash and how high your Blood alcohol levels are. I think this because the amount of advertisements we see in the media to do with stopping people from drink driving must mean that there is a high level of danger involved with drinking and driving. Otherwise the government would not spend money on trying to advertise this fact.

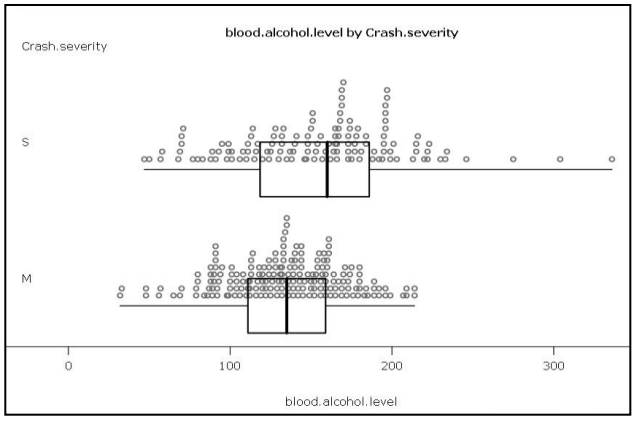
My variables I have chosen to examine are the crash severity in terms of if was a minor injury crash (M) or a serious injury crash (S) compared to how much alcohol was found in their blood at the time of the crash measured in milligrams of alcohol per 100 milliliters of blood. I have chosen these variables because I feel these are the best to express whether alcohol levels actually impact crashes severally.

What is the difference between the median Blood Alcohol Level for drivers who have had a Minor injury crash compared to the median Blood Alcohol Level for drivers who have had a Serious injury crash in New Zealand in 2011 in crashes where drugs and alcohol were deemed a factor?

Analysis

Summary of blood.alcohol.level by Crash.severity

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std.dev	Sample.Size
M	32	111.0	135	133.7	159	214	36.142	189
S	47	119.2	160	154.5	185	336	50.703	128



Overall Visual Comparisons: When I initially look at these samples my first impressions is that the serious injury crash severity BAL is more spread out than the minor injury crash BAL. For the minor injury crash there are less outliers at the top part of the spectrum. For both groups there are BAL's that are reasonably low though

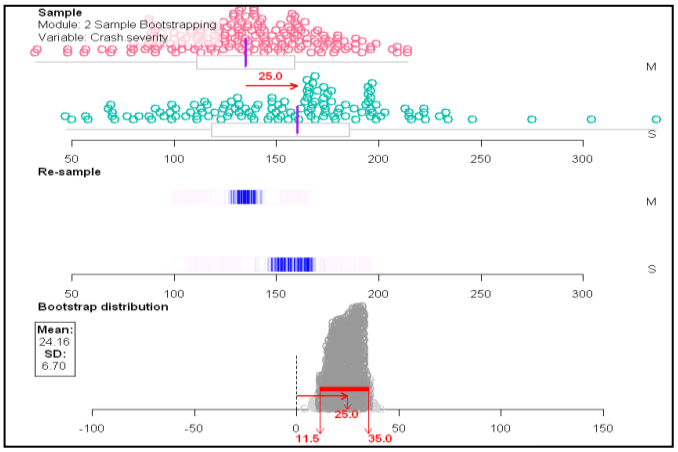
Centers: The median Blood Alcohol Level for these minor injury crashes (M) are 25 milligrams of alcohol per 100 milliliters lower than the Median BAL for these serious injury crashes (S). This being that for M it is 135 mg/100ml and for S it is 160 mg/100 ml. Both these median figures are well over the legal limit in New Zealand for 20+ year olds, which is 80 mg/100ml. I do not find it surprising that these crash statistics show that the median BAL for serious and minor crashes are both over the legal limit because the government would enforce a limit that is safe and reasonable.

Link to legal limit not explaining difference in median BALs at all, so not really useful.

Middle 50%- Shift and overlap, spread: The middle 50% of these serious injury crashes (S) BAL's overlaps the middle 50% of these minor injury crashes (M) BAL's. The lower quartile for M is a BAL of 111mg/100ml, which is 8.2mg/100ml below the lower quartile for S, which is a BAL of 119.2mg/100ml. The upper quartile for these Minor injury crashes is 159 mg/100 ml which is a mere 1 mg/100ml less than the median for the serious injury crashes (160 mg/100ml). The middle 50% for these serious injury crashes is more spread out than the middle 50% of the minor injury crashes. The inter-quartile range for S being 65.8 mg/100ml, and the inter-quartile range for M being 48 mg/100 ml. This means that there is a bit more range in the variation of BAL for S than there is for M. From my research, this makes sense because it is possible to have a serious injury crash even without the influence of strong intoxication. This may be why the data for the serious injury crashes BAL's vary more.

Comment explaining the why the difference in spreads is only weakly linked to students research; no reason provided for why there is an overlap in BAL for the two groups. Student may have been better to split SHIFT/OVERLAP and SPREAD and written as separate paragraphs.

Shape: The distribution for the serious injury crashes BAL's is right skewed, compared to distribution of the minor injury crashes, which is left skewed. Most of the data for S is between 32mg/100 ml and 220 mg/100 ml. With a few outliers ranging up to BAL's as big as 336mg/100 ml, these outliers are the majority of what is pulling the distribution out and causing it to be right skewed. This is similar in the case of the minor injury crashes just less severe. Most of the data in this case is between about 79mg/100ml and 200mg/100ml, with a few outliers in the bottom half. This is what causes the distribution to be left skewed in the minor injury crashes case. I believe that this makes sense in the context because in the minor injury crashes although there was alcohol in their blood that is not necessarily what caused the crash, and people with this much alcohol in their blood probably do get away with driving a lot of the time without a crash. It also makes sense in the case of the serious injury crashes being right skewed because not many people would consider driving with as much alcohol in their systems as the few outliers that did drive, resulting in a crash.

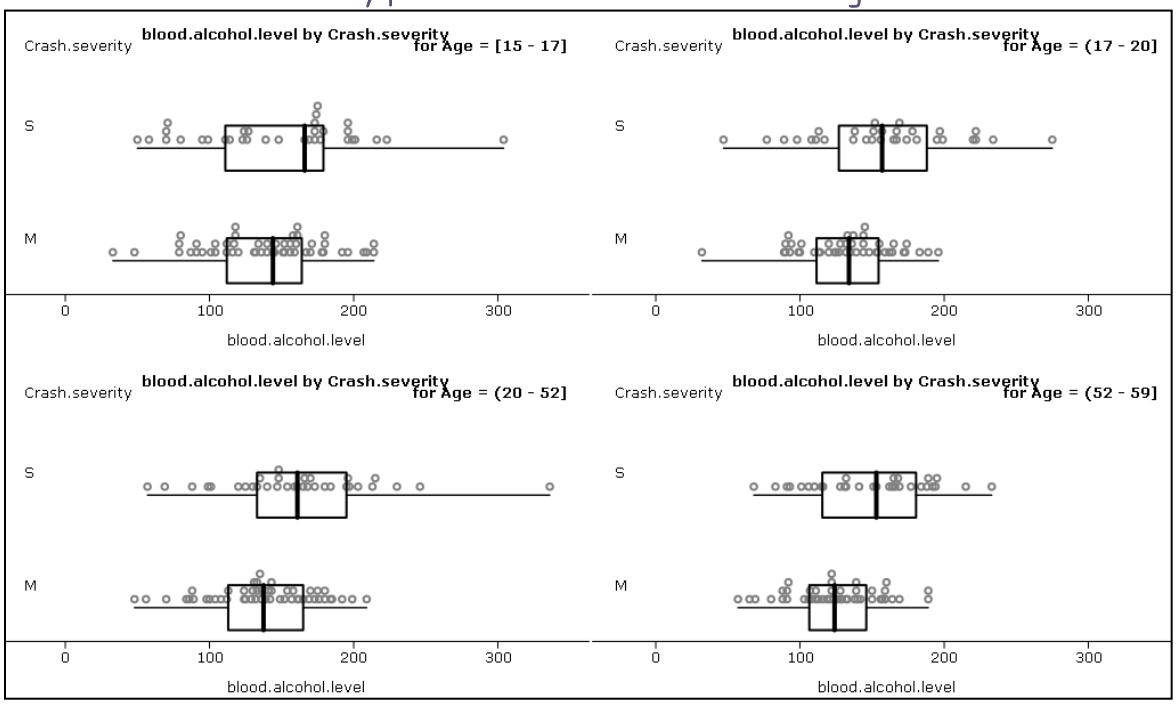


Reasons given for WHY seeing these shapes not directly linked to research, but sensible comments.

Unusual or interesting: Something I found quite interesting is the fact that there are a small but still significant number of crashes that are happening when the drivers BAL is under the legal adult limit in New Zealand which is 80mg/100 ml. This limit is different for those drivers aged under 20. Their legal limit is zero. Because of this I thought it would be interesting to look at how many of these crashes still crashed, when they were under the legal limit per what age group they are in. In other words, are the people who are crashing whose BAL's are under 80mg/100ml under 20 years old? In order to see this I constructed the graph on the following page which breaks up the data into the age groups (15-17), (17-20) (20-52) and 52-59).

As you can see there is quite a mixed variation in the age groups of the crashes that were under the legal adult BAL. There were 21 people all together and out of these 21 people there were 10 that were over 20 so at the time of their crash were under the legal limit. Out of these 10 crashes, 4 of them were serious injury crashes. One limit of this data is though that we do not know if the drugs or alcohol in the drivers system was the cause of the crash. If we did know this we may be able to further analysis whether we think the BAL for adult drivers should be lower.

Adding another variable here hasn't really provided much further statistical insight.



Conclusion

From these samples I can make the call that there is a difference in the median Blood Alcohol Level for drivers who have had a Minor injury crash compared to the median Blood Alcohol Level for drivers who have had a serious injury crash out of the crashes in New Zealand 2011 where drugs or alcohol were deemed a factor**.** That is that I can make the call that the median BAL for these serious injury crashes is higher than the median BAL for these Minor injury crashes. From these samples I am pretty sure that the median BAL for serious injury crashes out of crashes in New Zealand in 2011 where drugs or alcohol was deemed a factor is somewhere between 11.5 and 35.0 mg/100mL more than the median BAL for these minor injury crashes – the confidence interval is entirely positive.

I am basing this conclusion on the bootstrap confidence interval I calculated, which involved re-sampling (1000 times) from my original random sample of 317 drivers who crashed in NZ in 2011 and drugs or alcohol were deemed a factor. This process is based on the assumption that my original sample was representative of all the 1409 crashes in NZ in 2011 where alcohol or drugs were deemed a factor. I believe that this was the case because it fits in with the 'Relative Risk of fatal crash by blood alcohol level' statistics I found at the start of this investigation. Both these statistics and my statistics showed that if you drink alcohol your risk of having a crash is much higher.

If I were to take another sample, the results may be different as that sample will contain a different makeup of drivers, but I would expect that there would be a difference between the median BALs where the median BAL would be higher for the drivers in a serious injury crash.

One thing I am interested and surprised about though is the fact that as seeming by these results you get to a certain point when you are so intoxicated you are almost definitely going to have a serious injury crash. Once your BAL gets past about 220 it looks like if you crash you will almost definitely come under the serious injury crash category. This is interesting and I hope will convince some of the students I have done this investigation for to not, in the future, get drunk before driving.

EXCELLENCE

COMMENTS

13

Lovely paper overall, student has consistently used context, and statistics throughout along with research to support explanations of features. Further comments added in purple throughout student response.

Introduction

New Zealand has one of the highest drink-driving death rates for all OECD countries; and this has often been linked to the somewhat blaze 'drinking culture' that is alive and encouraged by society. In a recent study of 27 OECD countries[1], New Zealand placed 26th (or second worst) in terms of Youth Death Rates; and a large contributing factor towards this is New Zealand's 26th placing in traffic deaths. There are many influences towards the high youth traffic death rate being an unsavoury reality- the lack of driving experience, overconfidence and lower seat belt use[1] but unfortunately excessive alcohol use is a key component.

The reason that alcohol is widely discouraged to use when/before driving is that once absorbed into your bloodstream, it enters all vital organs, including the brain[2]. The result is slowed reactions, dulled judgement and vision, all of which impair your ability to drive.

There are obvious costs to a nation with a high percentage of drink-drivers: ostracism (for the drink-driver); long-term financial costs; legal charges - ranging from manslaughter to excess blood or breath alcohol penalties - including imprisonment, loss of licence and/or disqualification and fines; loss of insurance cover; injury; and the biggest cost of all, Death.

There are two ways of assessing the alcohol limit for driving [REF]:

- Breath testing measures the number of micrograms of alcohol (mcgs) per litre of breath.
- Blood testing measures the number of milligrams of alcohol (mgs) per 100 millilitres(mls) of blood.

Although the measures appear different, they're essentially the same. They both measure the same level of alcohol for drink driving purposes. The maximum levels are:

Drivers under 20 years - zero.
The legal drink drive limit for drivers under 20 years of age is a blood alcohol concentration (BAC) of zero.

Drivers over 20 years - 400mcg breath or 80mg blood.
The legal drink drive limit for drivers 20 years and over is 400mcg for breath and 80mg for blood. This level is very similar to that of other OECD countries.

However, the legal limits are often broken and many road crashes with alcohol as a contributing factor occur many times every year in New Zealand. As this is a serious problem taking the lives of many people my own age, I am investigating into the factors behind this. Using the definitions 'minor' and 'serious' it can assumed that serious injury crashes are more damaging than minor injury crashes. [5]

Serious injuries: Fractures, concussion, internal injuries, crushing's, severe cuts and lacerations, severe general shock necessitating medical treatment, and any other injury involving removal to and detention in hospital.

Minor injuries: Injuries of a minor nature such as sprains and bruises. There is no further medical coding.

From the information I have gathered so far; my hypothesis is that the higher the blood alcohol level the more likely the injury crash will be classified as 'serious' rather than 'minor'.

Data: Of the 1409 serious or minor crashes that occurred in 2011 in New Zealand that had alcohol included as a factor; we have the data for 317 of the drivers involved. This is a fairly large percentage of the actual population so I feel confident in stating that my findings from this investigation are likely to be accurate.

Purpose: The purpose of my investigation into New Zealand Crash Statistics is to investigate the relationship between crash severity and blood alcohol levels for the most (people aged 15 to 24) and the least (people aged 50 to 59) likely groups to be involved in an injury crash . This is to see whether blood alcohol levels have any effect (although *not* causation) on the severity of a crash. Further on in my investigation, I have divided my variables and have investigated Risk Level and Blood Alcohol Levels. The reason for this is that 'Risk Level' is based on age, which is the focus of the Ministry of Transport's commissioned study into alcohol related crashes. Risk Level has two categories- High risk and Low risk. 'High' is for all drivers between the ages of 15 and 24, regardless of experience. By the Ministry of Transport's judgement, 'Low' risk are drivers between the ages of 50 and 59 (old enough to have extensive experience on the roads, young enough to not have age- related judgement impairments such as slower reaction times). Gender is not used as a factor in determining risk. I have used Risk Level as a variable because age is the one of the most common cited factor for drunk-driving related crashes; and if so how the Ministry of Transport needs to aim their advertisements at the youth age group.

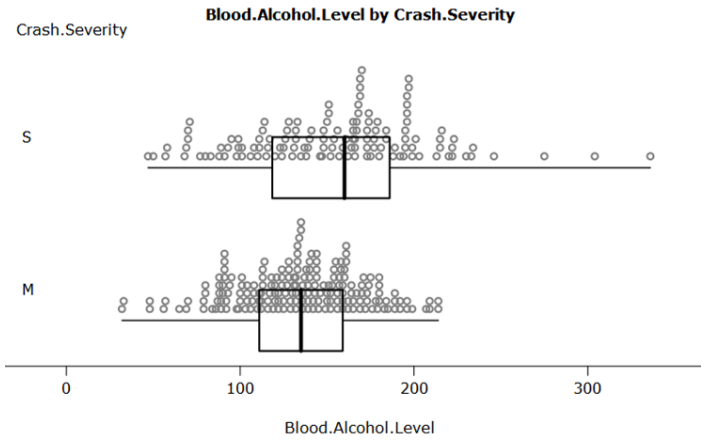
Question: What is the difference between the median blood alcohol levels of people in New Zealand who have had minor injury crashes in 2011 and the median blood alcohol level of people in New Zealand who have had serious injury crashes in 2011 (when alcohol is a factor in the crash)?

Nice relevant research points given in the introduction; question is correct with population clearly defined.

Analysis

Summary of Blood Alcohol Level by Crash Severity

	Min	1st Qu	Median	Mean	3rd Qu	Max	Std Dev	Sample Size
Minor	32	111.0	135	133.7	159	214	36.142	189
Serious	47	119.2	160	154.5	185	336	50.703	128



Overall, it appears that these drivers who have had serious injury crashes have slightly higher medians of blood alcohol levels these drivers who have had minor injury crashes, although there is overlap between the two.

Medians: The blood alcohol level median for these drivers involved in serious injury crashes is 160 micrograms per 100 millilitres of blood, which is twice the legal limit. This is 25micrograms per 100 millilitres of blood more than the median blood alcohol level for these drivers who were involved in minor injury crashes. The median amount of blood alcohol levels for drivers who were involved in minor injury crashes is still 59% more than the legal limit of 80 micrograms per 100 millilitres of blood. Overall, this confirms my research which states that the higher the blood alcohol levels, the more likely a crash is to be serious injury rather than minor injury [REF].

Link to research here explaining the difference in the two medians is not strong (only MERIT level)

Shift/Overlap/spread: The middle 50% for these drivers involved in minor injury crashes is between 111.0 and 159.0mg per 100ml of blood, which gives an IQR of 48.0mg. The middle 50% for people involved in serious injury crashes is in-between 119.2 and 185.0mg of per 100ml of blood; which gives an IQR of 65.8mg. Visually, we can tell that the middle 50% of blood alcohol levels for people involved in minor injury crashes is smaller (more condensed) than the middle 50% of people involved in serious injury crashes, though there is overlap. The overlap for the middle 50% is in-between the values of 111.0 and 159.0; which is a considerable amount considering the NZTA states than an extra 40mg on top

of the legal limit triples your risk of being involved in a crash (serious or minor). It is expected that there would be overlap between the two as, from my research [REF] there are many more influences in car crashes than simply the blood alcohol level; such as the people in the vehicle, the location and the general demeanour and driving ability of the driver.

Explanation of why there is an overlap in BAL of the two groups is well linked to research (strong EXCELLENCE). It would have been good if overlap comment and spread comment were done separately, and discussion around why there are more differences in BAL of serious crashes than minor crashes.

Shape: For serious injury crashes; there is a right-skewed uni-modal shape; with the minimum value 47mg of alcohol per 100ml of blood, and the maximum value being 336mg of alcohol per 100ml of blood. The shape is right- skewed because it reaches its peak at 143mg and tapers off to either side; however the tapering is drawn out to the right because of the smaller number of people's BAL values over a longer distance. Most people are inside the value's 70mg and 220mg; however because of a few unusual values with exceedingly high blood alcohol levels the shape for serious injury crashes is right-skewed. From my research [1]; this shape is expected because of the few people who have blood alcohol levels well over the legal limit. When your blood alcohol level is over 200mg per 100ml of blood; your relative probability of being in a crash is at a likelihood of 40% [6], and the prospect of excessive speed to be a factor is increased to 70%. With one of the values having a blood alcohol level of 336mg; it is not surprising that this person was involved in a serious injury crash (compared to a minor injury crash) as this amount is more than 4 times the legal limit and this amount has been known to cause blackouts, intense lack of judgment for speed and even death [6]. As anyone with a television knows; the greater the speed, the greater the mess (the larger the chance an injury crash will be serious rather than minor). It nearly appears that there are two modes, but this is more likely a peculiarity in the sample than something which would reoccur in the population.

For minor injury crashes there is a slightly left-skewed uni-modal shape. The minimum value is 32mg and the maximum value is 214mg. The shape grows from the minimum value to form a peak at 135mg, and then gradually tapers down to the maximum value. However; there is a slight left skew as the numerical values between the minimum value and the first quarter (79mg) is larger than the numerical value between the third quarter and the maximum value (55mg). A possible explanation for this is that when an injury crash occurs; New Zealand police are required to test alcohol levels. Alcohol is determined 'as a factor' if the level is over 30mg per 100ml of blood, even though this is below the legal limit and is roughly equivalent to one standard drink [REF]. Therefore there will be a reasonable amount of values between 0.30mg and 0.80mg whose blood alcohol levels will suggest that they are legally safe to drive and another factor (people in car, weather etc.) could have been more prominent and contributing to the crash; but alcohol levels were still recorded. This is still true for serious injury crashes; but this scenario is more probable for minor injury crashes because alcohol is more dangerous to reaction times than external factors (weather/people); and delayed reaction times are critical towards the level of severity of crashes [6].

The descriptions of the distributions of BAL for each group is very detailed. The link back to the context with references is well done (strong EXCELLENCE)

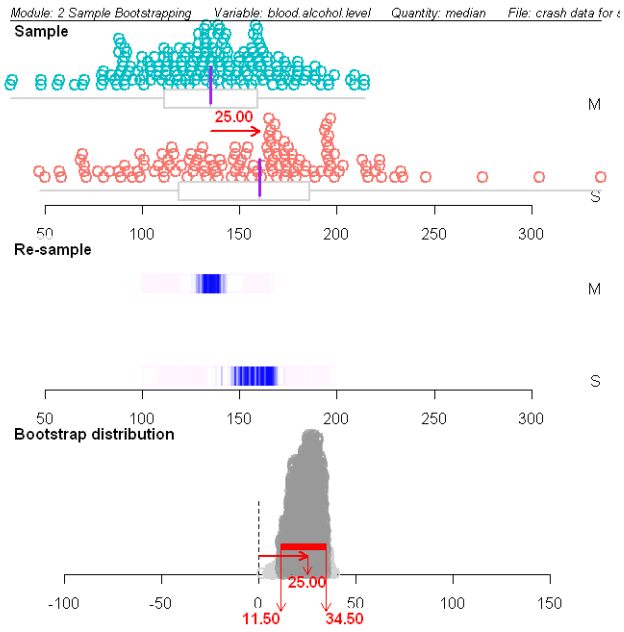
Unusual Values: There are three unusual values; all of which in the serious injury crashes group. The reason I consider them unusual is because of the excessively high blood alcohol level; one so high that it is unlikely the people in question would be able to recite the alphabet: Male 83, with blood alcohol level of 304mg (High Risk Group); Male 193 with blood alcohol level of 274mg (High Risk Group) and Female 274 with blood alcohol level of 336mg(Low Risk Group). Of the unusual values; Male 83 and Male 193 were somewhat expected- they're young (17 and 20 respectively and therefore classified as High Risk) and had limited driving experience (Male 83 had his full but was only seventeen so would have been driving for a maximum of 2 and a bit years; Male 193 only had his Learner's license). Because of their comparatively high blood alcohol level; it is not surprising that they were in a serious injury crash compared to a minor injury crash. Female 274 was 52 at the time of her crash; and because of her age is classified as Low Risk. However her blood alcohol level was 4 times the legal limit. She is an unusual value because someone with this level of intoxication is highly unlikely to make it past their front gate when driving- let alone be 15 kilometers from their home, and her case should be treated as an exception not a rule to the capabilities of people with incredibly high blood alcohol levels.

Unusual values clearly identified, but how far away from other drivers' BAL not given (to visually say why eye

drawn to these as unusual). Drivers investigated further to see other factors influencing why they may have been unusual but not linked to research (low EXCELLENCE)

Formal Statistical Inference/Conclusion

It's a fairly safe bet that the median blood alcohol levels of people in New Zealand who have had minor injury crashes in 2011 is between 11.5mg/100ml and 34.5mg/100ml more than the median blood alcohol level of people in New Zealand who have had serious injury crashes in 2011 (when alcohol is a factor in the crash). I am confident to make the call that the median blood alcohol level is higher in serious injury crashes than minor injury crashes because my confidence interval is entirely positive.



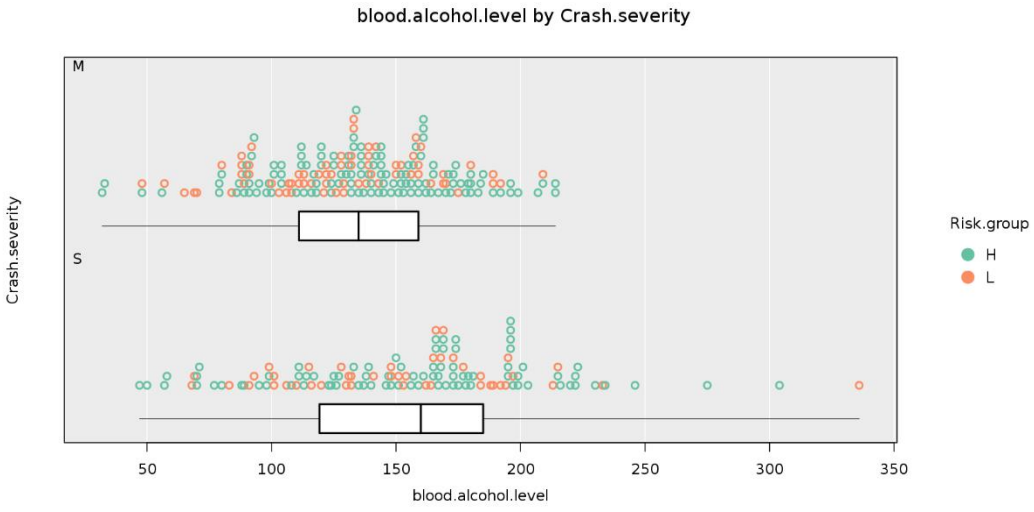
The reason for constructing the confidence interval is sampling variation. This variation means that if I was to take another sample from the original population of all serious and minor crashes where alcohol or drugs were recorded as a factor in NZ in 2011, the graphs and summary statistics would be slightly different, meaning that the new sample would have a slightly different confidence interval. Also, if I was to repeat the bootstrapping process, I would also get a slightly different confidence interval, because the bootstrapping process involves random resampling with replacement. The random aspect of this will cause the different confidence interval. However, looking at the confidence interval I got, it is well above zero, meaning 95% of the medians created by bootstrapping are well above zero, so even with a different sample or by repeating the bootstrapping, I am pretty sure I would still be able to make the same call.

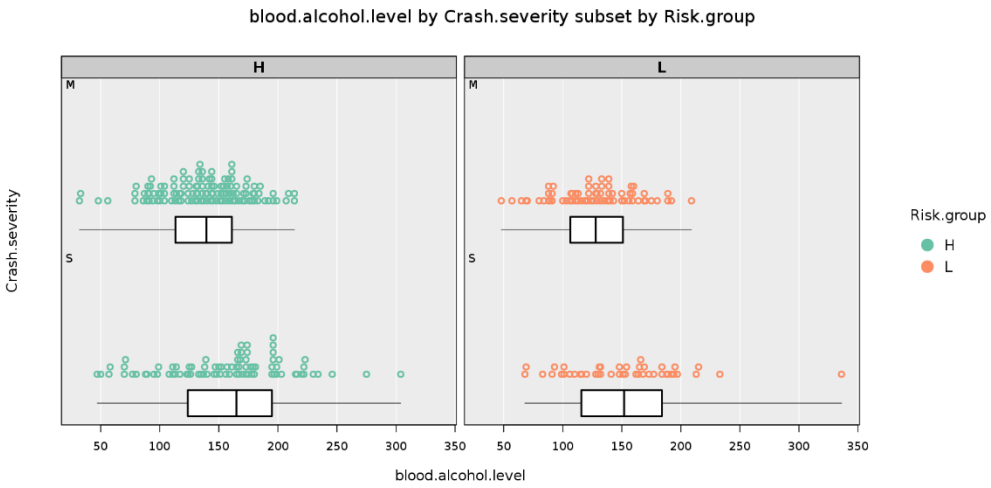
Above all correct.

Risk groups

The purpose of this report has been to examine the differences between the BAL of serious and minor crashes. My statistical inference from the blood alcohol/ crash severity has shown it is likely that the median blood alcohol level is higher in serious crashes compared to minor; this does not have a factor on the age of the driver, which is why I have added risk level. NOTE: High Risk is from ages 15-24, Low Risk is classified as ages 50-59.

From the graph on the right, and below we can see that there is not really a trend for the high risk (younger) drivers to have higher blood alcohol levels, or to be more involved in the serious crashes compared to the low risk (older) drivers. I am surprised by this as, from my research [REF], I thought young drivers would have higher BAL and be overrepresented in the severe crashes. This is because there is a youth 'binge-drinking' culture in New Zealand, and people in the High Risk age group are more likely to drink to get drunk. However, I am slightly surprised in the relatively small difference between the medians; as it is comparable to only half of one standard drink.





However, there are other factors to consider, and that is that we are unsure to as whether the driver with blood alcohol levels above the legal limit was in fact the cause of the crash- it's possible they could have had a high blood alcohol level and been bowled down by a sober driver with road rage. Again, as stated by my research in the introduction we do not know whether the driver was wearing a seatbelt; which can be crucial from transforming a minor injury to a serious one, or even to death.

Coding by another variable has not added huge amounts to this analysis, but linked to research as to why student expected to see something. Potentially could have run separate bootstrap analysis for comparing M&S between H&L (or vice versa) to see if difference in median BALs. (low EXCELLENCE)

What can be done to lower these deathly statistics? Since the under-20 blood alcohol level has been reduced to zero there has already been a decrease [6] in the number of alcohol related crashes for this age group. However; it is the not the fear of fines that will eventually help New Zealand's appalling drink driving level, instead it is changing the culture that we are in to be confident to speak up and say "*You're drunk, don't drive tonight."* This has already begun to take effect the Ministry of Transport's Legend ad campaign; and hopefully will continue so the youth of our country will be safer, more responsible drivers and be educated about the risks of alcohol while driving.

Nice link back to the emotive reason for this report, but no further statistical evidence towards grade.

Linky links

1) https://blogs.otago.ac.nz/amc/
2) http://www.nzta.govt.nz/traffic/ways/car/driving-safely/alcohol-drugs.html
3) http://www.iihs.org/ratings/frontal_test_info.html
4) http://www.stats.govt.nz/browse_for_stats/health/injuries/summary-of-injury- datasets/ministry-of-transport.aspx
5) http://www.ndaa.org/pdf/toxicology_final.pdf
6) http://www.transport.govt.nz/news/newsevents/ZeroBACdriversunder20/