

No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

3

91584



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Level 3 Mathematics and Statistics (Statistics), 2015

91584 Evaluate statistically based reports

2.00 p.m. Thursday 19 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Evaluate statistically based reports.	Evaluate statistically based reports, with justification.	Evaluate statistically based reports, with statistical insight.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Pull out Resource Booklet 91584R from the centre of this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–STATF.

If you need more room for any answer, use the space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL

10

ASSESSOR'S USE ONLY

QUESTION ONE

ASSESSOR'S
USE ONLY

Refer to Report 1 in the resource booklet to answer the following questions.

- (a) Identify and describe the explanatory and response variables for the study.

The explanatory variable is the colour of the car.
The response variable is the risk of crashing. //

C

- (b) (i) Explain whether this study is an observational study or an experiment.

This study is an observational study because the crashers cannot be controlled and are instead recorded and observed by researchers in New Zealand. //

C

- (ii) Give an implication of using the type of study identified in part (i) for the specific relationship investigated.

The relationship investigated was an observational study to determine the relationship between risk of car crash and car colour in car crashes which could not be controlled. //

NS

No link made to a causal claim cannot be made to an observational study.

- (c) For this study, the researchers collected sample data on cars on Auckland roads.

- (i) Explain why the researchers compared the percentage of crashes to the percentage of colours of cars on

Clear description given but not linking the data of colour and crashes together for similarities or differences with an example from tables.

This is done to reduce the ~~possibility~~ possibility of bias towards a higher number of car colours. For example, if Auckland Roads were to have 50% ^{white} ~~blue~~ cars, then the 25.6% of car crashes containing white cars would be biased against white cars. The ratio and relative risk must be considered / the distribution of car colours.

- (ii) The researchers used cluster sampling to obtain their sample.

Discuss ONE example of how clusters may have been determined to ensure a representative sample.

Cluster sampling may have been determined to ensure a representative sample by reducing the risk of having an overwhelming amount of an age-type's (young) drivers. This would be more ~~over~~ reassuring than random sampling as there are now more younger drivers.

No relevant example of cluster described.

ASSESSOR'S
USE ONLY

- (d) The report states that researchers found “a significant reduction in the risk of serious injury in silver cars compared with white cars” and that “factors that could affect the results were taken into account in the analysis.”

A potential issue with a statistical study is extending the results inappropriately.

Discuss ONE potential issue with extending the results of this study to all cars on New Zealand roads in 1998 – 1999.

ASSESSOR'S
USE ONLY

3x C

A4

QUESTION TWO

ASSESSOR'S
USE ONLY

Refer to Report 2 in the resource booklet to answer the following questions.

[For parts (a) – (d), assume that the sample obtained is representative of all New Zealand drivers.]

- (a) The report states that “59% of the survey respondents rated changing the radio/iPod/MP3 player while driving as distracting.”

Construct a confidence interval using this survey percentage.

C.I. ✓

Inference back to the population ✓

$$MoE = \pm \frac{1}{\sqrt{1000}} = \pm 0.0316 (4dp) \quad \begin{array}{ccc} 55.84\% & 59\% & 62.16\% \\ 0.5584 & 0.59 & 0.6216 \end{array}$$

With 95% confidence, I ~~can~~ ^{infer} conclude that the percentage of ~~survey~~ ^{NZ} drivers that ~~rated~~ ^{rated} changing the radio/iPod/MP3 player while driving as distracting was between 55.84% and 62.16%. Therefore, I can make the claim that over half of drivers in New Zealand would rate changing the iPod/MP3 player/radio as distracting. //

- (b) The report states that 20% of survey respondents had sent texts while driving.

Discuss ONE potential issue with a survey question that asks respondents for this particular survey if they have sent texts while driving.

Due to the act of texting while driving being illegal, many respondents may fear admitting the truth and risk being punished. This is an issue as the question trusts their honesty and the respondents are likely to have an urge to be dishonest to ~~remain~~ ^{appear} ethically and morally correct. //

Link to being untruthful made but no discussion to the 20% being under representative.

- (c) Suppose 234 respondents were aged 18–24, and 288

Can a claim be made that a higher percentage of NZ drivers aged 18–24 admit to talking on a mobile phone while driving (without a text) than NZ drivers aged 25–34, based on the survey percentages?

Construct a confidence interval and interpret this in context.

MoE: 18-24, 25-34

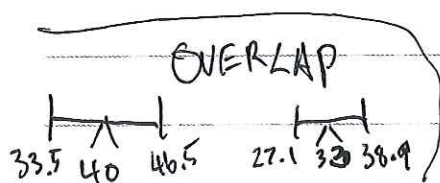
$$\frac{1}{\sqrt{234}} = 0.0654 \quad \frac{1}{\sqrt{288}} = 0.0589$$

$$0.0654 \pm 0.0589$$

$$0.0622 \text{ (4dp)}$$

$$\times 1.5 = 0.093225$$

$$= 9.3\% \text{ (1dp)}$$



The claim (that a higher percentage of NZ drivers aged 18–24 will admit to talking on a mobile phone while driving than NZ drivers aged 25–34) cannot be made as the two confidence intervals ~~intersect~~ overlap which means there is a possibility of the opposite occurring. //

- (d) The headline for this report is "Txting a top distraction for young drivers".

Evaluate what statistical evidence, if any, has been presented in the report to support this claim.

Statistical evidence includes: ~~50%~~

- 50% of the 18–24 group sending texts while driving, compared to 20% within/among all respondents.
- The sample is representative of the population of NZ drivers which means that there will be a similar trend throughout all young people in NZ. //

Incorrect statistical comparison made to justify.

Margin of error calculated for two subgroups.

Uses two Confidence Intervals with incorrect m.o.e. used.

ASSESSOR
USE ONLY

NS

- (e) It is not clear in the article whether or not the survey of over 1000 New Zealand drivers involved only AA Insurance customers.

ASSESSOR'S
USE ONLY

Describe ONE potential issue with using a random sample of AA Insurance customers to make generalisations about all New Zealand drivers.

AA insurance customers may not be able to represent the entire NZ population as there are many other insurance companies in New Zealand. ~~The~~ Making a generalisation may result in a slight bias towards socioeconomic status and affordability when it comes to car insurance or texting and calling. ~~Some socioeconomic areas in New Zealand will have little need to call or text and other insurance companies will hold different statistics which will change the overall generalisation of NZ drivers.~~

Link made to AA customers and other insurance customers only.

3xc
1xj

A4

QUESTION THREE

ASSESSOR'S
USE ONLY

Refer to Report 3 in the resource booklet to answer the following questions.

- (a) The report states that "The data have been adjusted for population demographics."

Explain why this was done.

No link made to being representative to reflect proportions of the population demographics.

The data was weighted according to 2013 Census data because it is necessary in order to ensure accurate results with minimal bias. Smokers in 2013, for example, will affect the data for smokers in 2014 where "never smokers" may change to "current smokers" and must be weighted accordingly. //

- (b) Figure 1 uses vertical lines (error bars) to represent the 95% confidence interval for the percentage of current smokers in New Zealand.

- (i) Give ONE reason why the vertical lines for "never smokers" are shorter than those for "current smokers".

Larger m.o.e implies larger sample size. contradiction

This is because there are more ~~per~~ current smokers engaging in risky drinking than ex-smokers and never smokers and the margin of error is considerably larger. //

- (ii) The 95% confidence interval for the percentage of current smokers in New Zealand that engaged in risky alcohol consumption in the last four weeks is approximately (44%, 62%).

Use the margin of error associated with this confidence interval to estimate the number of people in the sample who were current smokers.

44% \downarrow 62%
93%
9% MOE

$$\begin{aligned}\frac{1}{\sqrt{n}} &= 9\% \\ \sqrt{n} &= \frac{1}{0.09} \\ n &= \left(\frac{1}{0.09}\right)^2 \\ n &= 123 \text{ current smokers} // \end{aligned}$$

M.O.E found ✓
Sample size calculated ✓

- (c) The report states that "After adjusting for confounding variables, current smokers and ex-smokers were more likely than never smokers to report engaging in risky alcohol consumption in the last four weeks."

Identify ONE potential confounding variable that may have needed to be taken into account, and discuss how this variable may have been confounding.

One potential confounding variable is the family members and influence on children that current smokers and ex-smokers may have had. A child of a smoker that engages in risky drinking is likely to be influenced and follow suit in the future. Relatives have similar experiences. This may have resulted in large numbers of current smokers being related, ~~and~~ therefore creating a bias. //

Speculation that is not based on the report.

- (d) A potential non-sampling error for surveys is to consider how people behave when surveyed.

Fully describe how the behaviour of people when surveyed could be a potential non-sampling error for this survey, and discuss how it could cause bias.

Behavioural traits include drunkenness or the defensiveness that comes with doing something that is morally incorrect to society such as engaging in risky drinking and smoking.

Bias caused by larger number of dishonest respondents denying such actions. //

No clear statement made to interviewer being untruthful.

ixj

N2

Extra paper if required.
Write the question number(s) if applicable.

ASSESSOR'S
USE ONLY

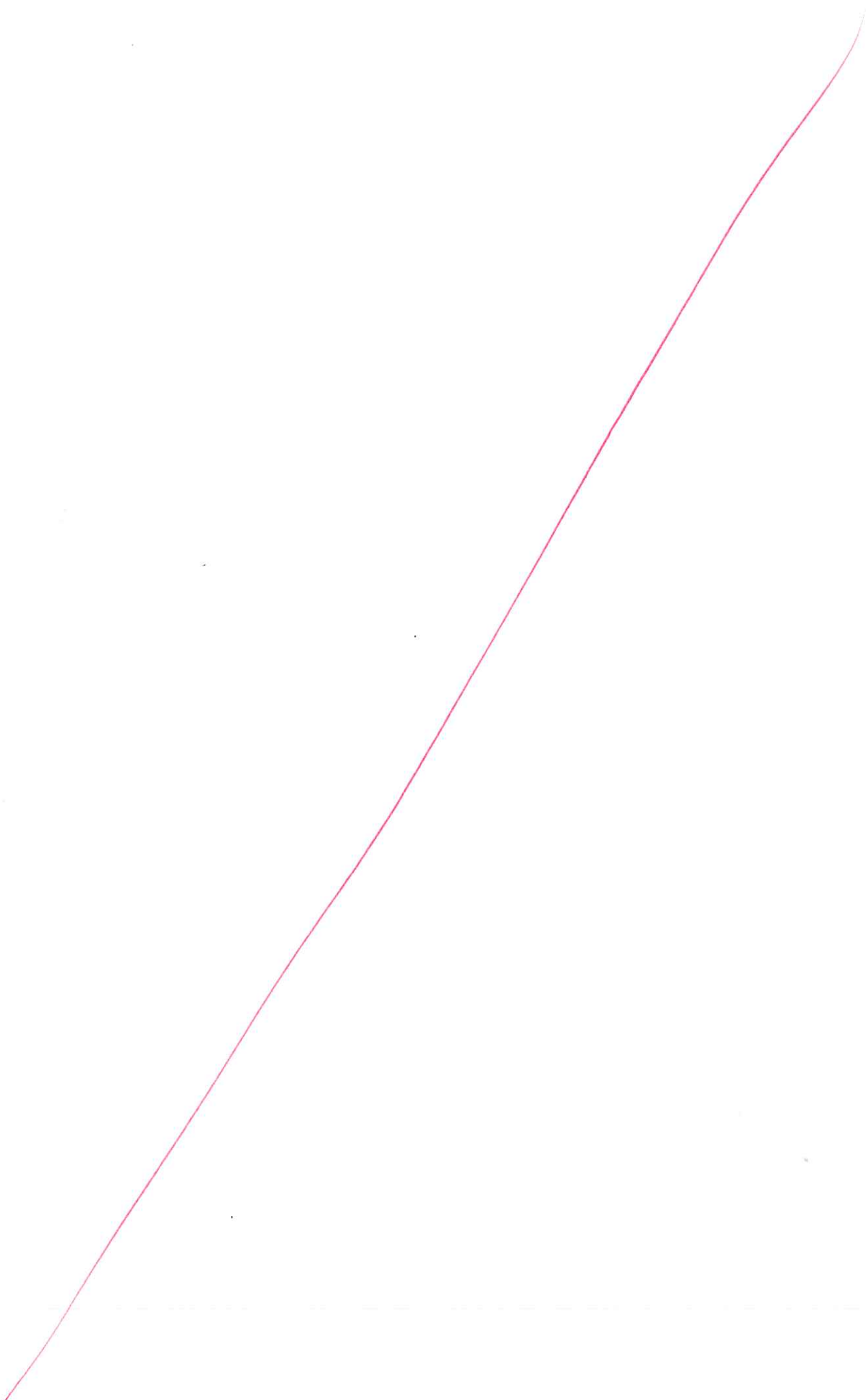
QUESTION
NUMBER

Extra paper if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

ASSESSOR'S
USE ONLY

91584



91584



915840



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

3

SUPERVISOR'S USE ONLY

Level 3 Mathematics and Statistics (Statistics), 2015

91584 Evaluate statistically based reports

2.00 p.m. Thursday 19 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Evaluate statistically based reports.	Evaluate statistically based reports, with justification.	Evaluate statistically based reports, with statistical insight.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Pull out Resource Booklet 91584R from the centre of this booklet.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–STATF.

If you need more room for any answer, use the space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL

11

ASSESSOR'S USE ONLY

QUESTION ONE

Refer to Report 1 in the resource booklet to answer the following questions.

- (a) Identify and describe the explanatory and response variables for the study.

explanatory variable is the colour of the car
and the response variable is risk of ~~serious~~
~~injury~~ the number of cars that crashed //

c

- (b) (i) Explain whether this study is an observational study or an experiment.

This is an observational study where the
researcher is unable to control the explanatory
variable and therefore can only allocate the
responses into groups based on observed
values. and //

c

- (ii) Give an implication of using the type of study identified in part (i) for the specific relationship investigated.

Because the researcher is using the past as
a source of data, they are unable to
control the explanatory variable and as a
result they cannot claim a causal relationship. //

ns

Statement made is general
NOT specific to variables.

(c) For this study, the researchers collected sample data on the distribution of car colours for all cars on Auckland roads.

- (i) Explain why the researchers compared the percentage of colours for cars involved in crashes to the percentage of colours of cars on Auckland roads.

In order to see ~~if~~ what colours of cars were more popular or what colour car is there most of on the roads in order to see if this could be a possible reason //

please
see
extra
paper
😊

ASSESSOR'S
USE ONLY

marking 10
C 10

- (ii) The researchers used cluster sampling to obtain their sample.

Discuss ONE example of how clusters may have been determined to ensure a representative sample.

- (d) The report states that researchers found “a significant reduction in the risk of serious injury in silver cars compared with white cars” and that “factors that could affect the results were taken into account in the analysis.”

A potential issue with a statistical study is extending the results inappropriately.

Discuss ONE potential issue with extending the results of this study to all cars on New Zealand roads in 1998 – 1999.

Extending the results inappropriately results in the claim being inaccurate because we can only make claims that are representative of the data that is collected from our samples. Although the claim might be applicable to Auckland cars/roads, there is likely to be different results in different parts of New Zealand, so the claim ~~wouldn't~~ wouldn't be valid.

Only identifies Auckland as being different to other parts of NZ.

4 x c

A4

QUESTION TWO

ASSESSOR'S
USE ONLY

Refer to Report 2 in the resource booklet to answer the following questions.

For parts (a) – (d), assume that the sample obtained is representative of all New Zealand drivers.

- (a) The report states that “59% of the survey respondents rated changing the radio/iPod/MP3 player while driving as distracting.”

Construct a confidence interval using this survey percentage and interpret this confidence interval.

$$M.O.E = \frac{1}{\sqrt{1000}} = 0.0316 \times 100 = 3.16\%$$

$$C.I = 59\% \pm 3.16\% = (55.84\%, 62.16\%)$$

$$C.I = (55.84\%, 62.16\%)$$

I can estimate with 95% confidence that the number of survey respondents that rated changing the radio/iPod/MP3 player while driving as distracting is between 55.84% and 62.16% //

CI ✓

Inference to sample NOT back to the population. X

- (b) The report states that 20% of survey respondents

Discuss ONE potential issue with a survey question that asks respondents for this particular survey if they have sent texts while driving.

There is no way of telling whether the respondents are likely to ^{be} telling the truth or not. Since texting while driving is illegal, it's likely that many respondents lied during this survey. //

No link made to the 20% being under representative

- (c) Suppose 234 respondents were aged 18–24, and 288 respondents were aged 25–34.

Can a claim be made that a higher percentage of New Zealand drivers aged 18–24 will admit to talking on a mobile phone while driving (without a hands-free kit) than New Zealand drivers aged 25–34, based on the survey percentages presented in the report?

Construct a confidence interval and interpret this interval as part of your answer.

$$\frac{1}{\sqrt{234}} = 0.06 \quad 0.06 \times 100 = 6\%$$

$$\frac{1}{\sqrt{288}} = 0.05 \times 100 = 5\%$$

Incorrect margin of error calculation for two sub groups.

$$MOE = \frac{1.5 \times 0.06\% + 0.05\%}{2} = 0.1275 \times 100 = 12.75\%$$

$$288 - 234 = 54$$

$$C.I = 54 \pm 12.75\% = (41.25\%, 66.75\%)$$

Since the confidence interval does not contain 0, the claim

can be made that a higher percentage of NZ drivers aged 18–24 will admit to talking on the phone while driving than NZ drivers aged 25–34 with 95% confidence.

- (d) The headline for this report is "Txting a top distraction for young drivers".

Evaluate what statistical evidence, if any, has been presented in the report to support this claim.

There is no statistical evidence to support this claim, although the claim can be made that a higher percentage admitted to using mobile phones while driving. There is not statistical evidence that confirms it as a 'top' distraction.

No evidence extracted from the report to link to young drivers.

- (e) It is not clear in the article whether or not the survey of over 1000 New Zealand drivers involved only AA Insurance customers.

ASSESSOR'S
USE ONLY

Describe ONE potential issue with using a random sample of AA Insurance customers to make generalisations about all New Zealand drivers.

It is possible that the results may have been extended inappropriately out to make generalisations about all New Zealand drivers when the data the survey has is only relevant to AA insurance customers. This is an issue because we can only ~~also~~ make claims that are relevant to the data that ~~has~~ been is specific to the sample taken, otherwise the ~~results~~ claims made will be invalid. //

Information is only relevant to AA customers with no justification given to differences between subgroups.

3x c

A4

QUESTION THREE

ASSESSOR'S
USE ONLY

Refer to Report 3 in the resource booklet to answer the

- (a) The report states that "The data have been adjusted data."

No link made to the sample being representative

Explain why this was done.

In order to make the 2014 data more accurate. //

NS

- (b) Figure 1 uses vertical lines (error bars) to represent 9

Link has been made to R o T < 30% only.

- (i) Give ONE reason why the vertical lines for the shorter than those for "current smokers".

Because the values for "never smokers" and "Ex-smokers" are below 30% or below the margin of error is likely to be much smaller than the margin of error for the "current smokers" value. //

C

- (ii) The 95% confidence interval for the percentage of current smokers in New Zealand that engaged in risky alcohol consumption (44%, 62%).

Incorrect margin of error using $n = 2594$.

Use the margin of error associated with this of people in the sample who were current smokers.

$$MOE = \frac{1}{\sqrt{2594}} = 0.0196 \times 100 = 1.96$$

$$53\% \pm 1.96 = (51.04\%, 54.96\%)$$

I can estimate with 95% confidence that the number of people in the sample who were current smokers is between 51.04% and 54.96%. //

NS

- (c) The report states that "After adjusting for confounding ex-smokers were more likely than never smokers to consume alcohol in the last four weeks."

Identify ONE potential confounding variable that may have been confounded and discuss how this variable may have been confounded.

Identifies 'Age' as a potential confounding variable and justifies.

Not enough evidence to clearly describe HOW the variables interact.

One confounding variable is the ability to buy/source alcohol. This is confounding because it affects both the explanatory variable ^{and response variable} because if they can't buy/smoke, they can't buy alcohol so are unlikely to engage in risky alcohol consumption. Whereas an individual who is old enough (over 18) to ~~be~~ have a nearly unlimited supply of ~~alcohol and~~ cigarettes is more likely to also have an unlimited supply of alcohol and therefore engage in risky alcohol consumption. //

- (d) A potential non-sampling error for surveys is to consider how people behave when surveyed.

Fully describe how the behaviour of people when surveyed could be a potential non-sampling error for this survey, and discuss how it could cause bias.

People's behaviour during the survey could create bias because it may cause the researcher to make a moral judgment on the person's character in relation to how likely they are to engage in risky alcohol consumption, regardless of whether they smoke or not. ^{creating bias in the survey} Also, if the respondent is not taking the questions seriously they may give an inaccurate answer which overstates or understates the actual value and so their response is inaccurate, which could create bias in the survey. //

No link to interviewer/interviewee (Face to face) is made clearly

2x0
1xj

A3

Extra paper if required.

Write the question number(s) if applicable.

ASSESSOR'S
USE ONLYQUESTION
NUMBER

Q1C The researchers compared the colour of cars that crashed to the ~~ex~~ colour of cars on Auckland roads in order to see if ~~a~~ there was a larger number of a colour, ~~car~~ which could be the reason why it was involved in more crashes - because it was a more popular car as opposed to being ~~not~~ unsafe. And also to see ~~the~~ how different the percentage of the colour of cars that crashed were in comparison to the ~~percentage~~ percentage of that car that was on Auckland's roads.

Comparison made to link the two data sets clearly but missing an example to justify.

Extra paper if required.
Write the question number(s) if applicable.

ASSESSOR'S
USE ONLY

QUESTION
NUMBER

91584

