# Answers

**Page 4**

1. a) Quantitative
   b) Quantitative
   c) Categorical
   d) Categorical
   e) Quantitative
   f) Quantitative
   g) Categorical
   h) Quantitative

2. a) Ordinal
   b) Categorical (Dichotomous)
   c) Ordinal (A, M, E)
   d) Categorical
   e) Ordinal
   f) Ordinal
   g) Quantitative

3. a) Continuous
   b) Discrete
   c) Continuous
   d) Discrete (assuming it has been rounded to the nearest %).
   e) Discrete

4. a) Explanatory – time spent at the gym.
      Response – level of aerobic fitness.
   b) Explanatory – gender.
      Response – like/dislike action movies.
   c) Explanatory – suburb located.
      Response – price sold for.

**Page 5**

5. a) Height – Quantitative, Explanatory.
      Favourite music genre – Categorical, Response.
   b) Tax bracket – Ordinal, Explanatory.
      Amount donated – Quantitative, Response.

**Page 5 Q5 cont...**

   c) Time spent – Quantitative, Explanatory.
      Grade – Ordinal, Response.
   d) Dist. run per day – Quantitative, Explanatory.
      Resting heart rate – Quantitative, Response.

6. a) Vitamin C intake – Quantitative, Explanatory.
      Life expectancy – Quantitative, Response.
   b) Number of beers – Quantitative, Explanatory.
      % blood alcohol level – Quantitative, Response.
   c) No. cigarettes per day – Quantitative, Explanatory.
      Likelihood of contracting lung cancer – Ordinal, Response.
   d) Smoking – Ordinal, Explanatory.
      IQ Level – Ordinal, Response.

**Page 8**

7. This may be biased as
   • from 3pm to 5pm very few people with full-time jobs will be near the supermarket.
   • you may approach some people who do not live in Auckland.
   • you may only approach friendly looking people.
   • one suburb only.

8. This may be biased as
   • a significant section of the population either does not have a phone or has an unlisted number.
   • Dunedin people are unlikely to be representative of New Zealand as a whole.

**Page 8 Q8 cont...**

   • you have no control on who answers the questions. They may not be of voting age. A lot of teenagers will answer the phone.

9. This may be biased as
   • this form class may spend more (or less) time on the internet than other form classes.
   • the students are likely to underestimate the amount of time spent on the internet as that is what they think the Principal may want to hear.
   • the students may lie to impress each other.
   • may be a streamed class and therefore not representative of all students.

10. This may be biased as
   • different students may be more or less serious about filling in the questionnaire.
   • some racial groups (e.g. Chinese) will have less chance of being selected, yet may spend different amounts of time on the internet.
   • not all students have access to the internet at home.
   • bigger classes would be under represented.

**Page 9**

11. Population. All students in the school.
    Method of sampling. Systematic sampling. Select every nth member of the school roll by going through the form registers of the entire school. Each person selected is asked to complete a questionnaire no matter whether they regularly take books out of the school library or not. The school roll divided by 30 is how n is calculated.

**Page 9 cont...**

12. Population. All Year 12 students who attended last year's Year 11 school dance.

    Method of sampling. Systematic sampling. Give every 5th student in a Year 12 form class a questionnaire. If a person selected did not attend the Year 11 dance last year, then they are asked to give the questionnaire to the next person on the form register. Note: This method must be biased as any student who has left school has no chance of being selected.

13. Population. All teenagers living in the Wellington district.

    Method of sampling. Simple Random. Use random numbers to first select the page and then position on the page of about 100 phone numbers listed in the white pages. Ring the number and ask to speak to the teenager who is closest to the phone.

14. Population. All leaves on the sunny and shady sides of a pohutukawa tree.

    Method of sampling. Cluster Sample. Select one branch on the sunny side and measure every leaf. Then select a similar branch with the same diameter on the shady side of the tree and measure every leaf. Note: This method may be biased because you are less likely to select branches that are difficult to reach.

**Page 10**

15. Self Selected. Advantages: Manages itself, creates publicity and people feel empowered. Disadvantages: Responses dominated by people with strong opinions. No control over age. No statistical credibility.

**Page 10 cont...**

16. Cluster Sampling. Advantages: Easy to manage. Very quick. Respondents over 18.

    Disadvantages: All the respondents have something in common (i.e. they work for a newspaper) and hence they may have similar opinions.

17. Systematic Sampling. Advantages: Creates publicity with opportunity for pictures and quotes. Appears to be unbiased.

    Disadvantages: The time of day and location affect results.

18. Simple Random. Advantages: No bias in selection of phone numbers.

    Disadvantages: Unlisted numbers cannot be called. Lack of control on the age of respondents. Difficult to control which member of the household answers the question.

**Page 11**

19. Attempt at census. Advantage: Appears unbiased.

    Disadvantages: New people in district not on roll. Becomes self selected as only 17% returned.

20. Systematic (could use Cluster, but only 28 students in a form class). Take the first 3 on the roll in each form class. Advantages: Simple to manage. No bias.

    Disadvantages: One ethnic group may have few names in the As e.g. Chinese. Could have the roll by sex then alphabetical.

21. Need to sample entire school (not just customers) so Systematic (or Simple Random). Select the 15th student from an alphabetical list of each form class. Advantages: Manageable. No bias. All forms sampled in proportion.

    Disadvantages: May need a bigger sample if there are a lot of students who do not use the canteen.

**Page 12**

22. Difficult to sample 13 to 17 year olds as they are not on an available list. Ring a random sample of phone numbers asking for a 13 to 17 year old at each place. Advantages: No bias.

    Disadvantages: May need to ring a lot of numbers to get the sample size. Refusals may bias sample. Two teenagers may live in the one house.

23. Simple Random (or systematic) sample of people on the electoral roll. Visit each member of the sample. Advantages: No bias.

    Disadvantages: Difficult to manage, particularly as people may be out. Posted surveys may be better but still may get non returns. People refusing to answer may bias sample. People who have only just turned 18 may not be on the roll.

**Page 15**

24. a) i) $\dfrac{211}{420}$ (0.502)

    ii) 50 per 100 patients

    b) $\dfrac{120}{205}$ (0.585)

    c) $\dfrac{91}{215}$ (0.423)

    d) $\dfrac{0.423}{0.585}$ (0.72)

    e) The risk of having a heart attack for those taking the trialled drug is 0.72 the risk for those taking the placebo.

    f) $\dfrac{0.585}{0.423}$ (1.38)

    g) The risk of having a heart attack for those on the placebo is 1.38 times the risk of those taking the trialled drug.

    h) Drug. It is easier to interpret a relative risk greater than one as opposed to a relative risk less than one.

**Page 15 Q24 cont...**

i) $\dfrac{0.423 - 0.585}{0.585}$ x 100% = ⁻28%

j) There is a 28% decrease in the chance of a patient having a heart attack if they are taking the trialled drug.

**Page 16**

25. a) i) $\dfrac{150}{350}$ (0.429)

ii) 429 per 1000 shows

b) $\dfrac{70}{180}$ (0.389)

c) $\dfrac{80}{170}$ (0.471)

d) $\dfrac{0.389}{0.471}$ (0.83)

e) The risk of sexual content appearing in a comedy show is 0.83 times the risk of that of a drama show.

f) $\dfrac{0.471}{0.389}$ (1.21)

g) The risk of sexual content appearing in a drama show is 1.21 times the risk of that of a comedy show.

h) Makes little difference because in this study we are looking at two different genre of TV shows. One cannot be regarded as a treatment group and the other a non-treatment group.

i) $\dfrac{0.471 - 0.389}{0.389}$ x 100% = 21%

j) There is an increased risk of 21% in the chance of sexual content appearing on a drama show compared to that of a comedy show.

**Page 17**

26. a) Absolute Risk Wellington
AR = 0.0087

b) RR (Auck.) = 0.782
RR (Eastern) = 1.89

c) Resolved is likely to mean that an offender has been identified and is convicted (or warned).

d) Resolved rate 80.1%

e) AR (Well.) = 0.610

f) Pop. (Tasman) = 178 512

g) RR (Tasman) = 1.13
RR (Well.) = 0.843

h) Eastern region. In the Eastern region the Relative Risk of an assault is 1.89 times the average in New Zealand and 2.42 times as probable as being assaulted in Auckland. In addition the Relative Risk of a criminal being caught in the Eastern region is 0.927 compared to the New Zealand average. There is a greater probability of an assault and a reduced probability of the offender being caught.

**Page 18**

27. a) An obese female is seven times more likely to suffer from diabetes as a healthy female with a BMI of between 18.5 and 24.9.

b) Because the risk of contracting the four diseases is compared against a baseline group with a relative risk of 1 (healthy males and females with a BMI of between 18.5 and 24.9). The risk of contracting one of the four diseases if you are overweight or obese is always going to be greater than a healthy person with a normal BMI getting one of the diseases.

**Page 18 Q27 cont...**

c) For obese individuals the relative risk of contracting all of the four diseases is higher than if you are just overweight. The relative risk of getting diabetes is three times more for females if they are obese and 2.4 times more for males compared to just being overweight. Although your relative risk from other diseases increases when you are obese the risk from contracting diabetes is significantly more.

d) **Dangerous Diabetes Risk for Obese Females**

Figures reported from the International Association for the Study of Obesity reflect the high risk obese females have of suffering from diabetes. A female with a BMI in excess of 30 has seven times the risk of suffering from diabetes as a healthy female with a normal BMI (18.5 – 24.9). Although obese females have a higher risk of contracting/suffering from other diseases such as heart disease and cancer the risk of diabetes is up to three and a half times more.

**Page 19**

**28.** a) A particular crash may fulfill the conditions for two or more groups such as under 25 and male passengers.

b) A driver with a learner's licence has almost 11 times more chance of being involved in a fatal accident. The more experienced restricted licence holder is only 3.4 times as likely to be involved in a fatal accident.

c) Drivers with a blood alcohol level of 50 mg/100ml are almost 100 times as likely to be involved in a fatal accident as an unimpaired driver. If the driver had consumed cannabis and alcohol their relative risk was 118 times that of an unimpaired driver.

d) Having only male passengers increases the relative risk of an accident by 3 times, possibly because the driver is more likely to be young or they may be trying to impress their mates. Drivers on a benefit have 5 times the risk of being in an accident possibly because they are inexperienced or maybe they have not learnt to drive responsibly or maybe they are driving an old and not as safe car.

e) **Major Causes of Fatal Vehicle Accidents**

There are a large number of factors that appear to significantly increase the likelihood that a driver will be involved in a fatal accident. The major contributors are alcohol with and without cannabis and the inexperience of a driver.

**Page 23**

**29.** Coverage errors. A number of groups would be under represented as you would only expect mothers, elderly, unemployed etc. to be at home. To reduce coverage errors call after work hours , e.g. 5.30 - 8.30 pm.

**30.** Non-response errors. A large number of customers will ignore the internet survey and likely delete it rather than respond.
To reduce non-response errors offer those that complete the questionnaire a 10% voucher they can use next time they shop online at the store.

**31.** Coverage, response and non-response errors. A number of people interviewed may feel uncomfortable on commenting because of the sensitive subject of the street survey. Interviewer may select those people he feels comfortable interviewing. Likely to avoid threatening people etc. Interviewer may influence respondents answers or prompt respondents.
To reduce response and non-response errors rather than interview people give them an anonymous questionnaire to fill in and hand back. Interview every fifth person that walks by to avoid interviewer bias in selecting.
To reduce coverage errors undertake the street survey at different times and in high volume areas e.g. outside supermarkets on a Saturday morning.

**32.** Coverage and non-response errors. It is self selecting, usually only people with strong views will reply and only people who get the newspaper can take part.
To reduce non-response errors offering an incentive to anyone who replies, e.g. goes in the draw to win a 7 day holiday in the Gold Coast may help.

**Page 23 Q32 cont...**

This type of poll has little statistical validity and there are too many inherent non-sampling errors for results to be credible.

**Page 24**

**33.** Coverage and non-response errors. Likely that only younger people will text in. Also depends on the demographic of the radio station on what the coverage is likely to be. It is self selecting. A lot of people would just not bother. Some people could respond multiple times and this could distort the results.
To reduce non-response errors an incentive could be offered to those who reply, e.g. goes in the drawn for a holiday etc. This type of poll has little statistical validity and there are too many inherent non-sampling errors for results to be credible.

**34.** Non-response errors. Because people have to fill the survey in and post it back a lot will not complete the guest survey unless they have strong positive or negative views regarding their stay and the level of service.
To reduce non-response errors guests should complete it when checking out and an incentive could be offered for them to do so, e.g. a 10% discount the next time they stay at the hotel or at any of the same chain of hotels.

**35.** Non-response errors. Because people have to fill the survey in and post it back a lot will not complete it. Coverage is good as it targets those that may be directly affected by the planned arterial route but what about the opinions of others in the city? Should these be considered?
To reduce non-response errors council could go door to door in the suburb getting all residents opinions and views on the planned arterial route.

**Page 24 cont...**

36. Coverage, response and non-response errors. A number of people interviewed may exaggerate the amount of recycling they do to appear 'green' and care about the planet. Interviewer may select those people he feels comfortable interviewing. Likely to avoid threatening people etc. Interviewer may influence respondents answers or prompt respondents. Workers not included.
To reduce response and non-response errors rather than interview people give them a confidential questionnaire to fill in and hand back. Interview every fifth person that walks by to avoid interviewer bias in selecting.
To reduce coverage errors undertake the street survey at different times and in high volume areas e.g. outside supermarkets on a Saturday morning.

37. Coverage and non-response errors. Telephone polls have a high non-response rate and exclude people simply because many nowdays do not have a land line. Perhaps the poll should target those in the immediate vicinity of the sports stadium as they are going to be most affected by the proposed rock concerts by the associated noise and parking etc. Another form of survey or poll rather than a telephone one could perhaps be considered, eg. door to door. If a telephone one is used calling should be undertaken between 6 pm and 8 pm.

38. Coverage and non-response errors. Not everyone has access to the internet and not everyone uses nz.yahoo.com as their home page. People can respond to the poll more than once and this can distort results. People usually respond to these type of polls if they are interested and

**Page 24 Q38 cont...**

only have strong positive or negative views. Confusion over the meaning of "relatively well behaved". Response rate could be improved by offering an incentive to reply, e.g. prize draw, but results from such a poll lack credibility.

**Page 27**

39. $n \geq 400$
40. $n \geq 2500$
41. $n \geq 1112$
42. $n \geq 817$
43. $n \geq 494$
44. $n \geq 1600$

**Page 28**

45. a) Population – All Year 13 high school students.
    b) 95%
    c) 29.3% to 36.3%
    d) $n \geq 1600$

46. a) Margin of error = 3.45%
       18.0% to 24.9%
    b) $n \geq 3360$

47. Margin of error = 1.4%
    36.2% to 39.0%

48. a) Margin of error = 5.0%
       53.2% to 63.2%
    b) Yes increasing the sample size to 1620 gives a margin of error of 2.5%, because you are doubling the denominator in the margin of error formula, thereby halving the margin of error.

**Page 34**

49. Mode, because the data used is nominal (names of suburbs).
50. Median, because the data used is ordinal (1 to 5 star rating).

**Page 35**

51. Mean, because the data is continuous and symmetrical.
52. Median, because the data is continuous but negatively skewed.
53. Mode, because the data used is nominal (methods of giving up smoking).

**Page 35 cont...**

54. a) Mean = 4.5 (1 dp)
       LQ = 2.4
       Median = 4.3
       UQ = 6.2
       IQR = 3.8
       Std Dev. = 2.0 (1 dp)
    b) Mean = 111.7 (1 dp)
       LQ = 60
       Median = 107.5
       UQ = 155
       IQR = 95
       Std Dev. = 51.5 (1 dp)
    All 25 times as each data value has been multiplied by 25.

55. a) Mean = 3.52 (2 dp)
       LQ = 1.6
       Median = 3.3
       UQ = 5.2
       IQR = 3.6
       Std Dev. = 1.95 (2 dp)
    b) Mean = 25.6 (1 dp)
       LQ = 16
       Median = 24.5
       UQ = 34
       IQR = 18
       Std Dev. = 9.8 (1 dp)
    Every data value has been multiplied by 5 and then 8 added to it. All parameters have changed by this except the standard deviation and IQR which has only been changed by a factor of 5.

**Practice Assessment 1 – Evaluating a Statistically Based Report**

### ASH Year 10 Snapshot Survey
**Achievement**

Student identifies and comments on at least three different features and discusses the results of a survey with respect to its purpose. Features may include: measures and variables, sampling methods, survey methods, sampling and possible non-sampling errors and sample size.

Examples of Achieved answers:

*The purpose of the report was to monitor student smoking rates since 1999. The 2014 results are presented for all students aged 14-15 and also by gender, ethnicity, school's decile and District Health Board. The population was all 14-15 year old Year 10 students in New Zealand. The survey is part of an annual monitoring survey. Schools choose to take part and in 2014 only 283 out of 524 schools agreed to participate...*

*The report gives an accurate indication of student smoking rates for 14-15 year olds. As differences and trends it reported have been seen in earlier reports ...*

**Merit**

Student has identified and commented on a range of features in the report, with reference to statistical evidence and processes relevant to the purpose of the report.

Student identifies and comments on at least three different features and discusses the results of a survey with respect to its purpose. Features may include: measures and variables, sampling methods, survey methods, sampling and possible non-sampling errors and sample size.

Examples of Merit answers:

*The report is produced on behalf of ASH (action on smoking and health), for the national policy makers and health governing bodies in New Zealand. The purpose of the report was to monitor student smoking rates since 1999. The 2014 results*

*are presented for students aged 14-15 and also by gender, ethnicity, school's decile and District Health Board. The population was all 14-15 year old Year 10 students in New Zealand. The survey is part of an annual monitoring survey. Schools choose to take part and in 2014 only 283 out of 524 schools agreed to participate. Each school choosing to take part received survey packs and instructions for teachers. Response rates were low as only 54% of schools agreed to take part. Essentially the sampling method used is census style but with an element of self selection which can result in bias and the sample not being representative of the population and possibly exaggerate findings from the study.*

*Schools choose to take part and it could be that a school with a bad smoking problem chose not to participate. Students who also smoked may have not trusted the teacher supervising them and lied ...*

*Results have been tabulated in the report making for easy reading. Line graphs and bar graphs are used to display the data showing trends over the period 1999 - 2014. Data displays have been broken down by gender and ethnicity ...*

*The report is fit for its purpose providing a cumulative snapshot of student smoking for 14-15 year olds. In the conclusion it indicates that daily and regular smoking among Year 10 students has continued to decline to 2.8% and 6.1% in 2014 from about 15% and 44% respectively in 1999.*

**Excellence**

Student has identified and commented on a range of features in the report, integrating statistical and contextual information to assess the quality of the report with respect to its purpose.

Student identifies and comments on at least three different features and discusses the results of a survey with respect to its purpose. Features may include: measures and variables, sampling methods, survey methods, sampling and possible non-sampling errors and sample size.

*The report is produced on behalf of ASH (action on smoking and health),*

*for the national policy makers and health governing bodies in New Zealand. The purpose of the report was to monitor student smoking rates since 1999 so that policy makers can introduce measures to reduce student smoking. The 2014 results are presented for students aged 14-15 and also by gender, ethnicity, school's decile and District Health Board. The population was all 14-15 year old Year 10 students in New Zealand. The survey is part of an annual monitoring survey. Schools choose to take part and in 2014 only 54% of schools agreed to participate.*

*Essentially the sampling method used is census style but with an element of self selection which can result in bias and the sample not being representative of the population and possibly exaggerate findings from the study. As schools choose to take part it could be that a school with a bad smoking problem chose not to participate. There is no evidence of this happening and a comparison of the characteristics of the students returning questionnaires to the population showed they are similar (Table 2). The population of Year 10 students has 18% in low decile schools while the returned questionnaires had 16% in low decile schools ...*

*Results have been graphed in the report making for easy reading. Line graphs and bar graphs are used to display the data showing trends over the period 1999 - 2014. Conclusions are made about trends in the data over this period but although these involve small percentage shifts the conclusion is supported by the large sample size and the continuous nature of the trend (the trend has been happening each year).*

*Data displays have been broken down by gender and ethnicity. Differences between gender and ethnic groups have been noted and these appear valid as these differences have occurred each year. A bar has been added to each data point to show the interval that the researcher is confident the population result is in. These are shown on all the graphs.*

**Pages 41 – 44**

**Practice Assessment 2 – Evaluating a Statistically Based Report**

**Polls: Clinton Ahead in ...**

**Achievement**

Student identifies and comments on at least three different features and discusses the results of a survey with respect to its purpose. Features may include: measures and variables, sampling methods, survey methods, sampling and possible non-sampling errors and sample size.

*The report is of a poll conducted by NBC/WSJ and Marist Poll on the support Presidential Candidates are likely to have in these two states in the period 3rd to 5th October.*

*The polling was done by ringing random landlines supplemented by a mobile phone survey. In Florida they rang 1131 homes and randomly selected one adult per household. They reduced these responses to 979 registered voters and then to 700 'likely voters'. The statistical error in using a sample of 700 to predict for a population is ± 3.7%. It is difficult to determine which registered voters will actually vote in an election hence the term 'likely voters'. The potential error from incorrectly filtering the registered voters to this sample of 'likely voters' is in addition to the statistical error based on chance.*

*In Pennsylvania 1128 adults was reduced to 971 registered voters and this was further reduced to 709 'likely voters'. The margin of error on a sample of this size is ±3.7.*

*The conclusion that Clinton is ahead in Pennsylvania is probably correct as the difference is 12% and this is well outside the statistical error even taking into account non-statistical errors.*

*In Florida the conclusion may not be correct as the difference of 3% is less than the margin of error of ±3.7% and the errors are compounded by non-statistical errors.*

**Merit**

Student has identified and commented on a range of features in the report, with reference to statistical evidence and processes relevant to the purpose of the report.

The additional evidence the student could quote may include

*The report is a newspaper poll conducted by Marist Poll and funded by NBC News and the Wall Street Journal.*

*The sampling was done by randomly ringing landlines and mobile phones. This is a problem if a significant part of the population is not available to take phone calls (working or no phone).*

*The pollsters say they randomly selected an adult in each home by first asking for the youngest male. It is not clear what is meant by this phrase.*

*They have a further problem in identifying people who are likely to vote. In Florida they rang 1131 homes and filtered the responses to 979 registered voters ( 86.5%) and then to 700 'likely voters' (71.5%). They used a model to look at the answers to a series of questions to decide which respondents are 'likely voters'. This model puts a lot of emphasis in previous voting history and this is a problem for first time voters. This non-statistical error is the main reason polls over the same period can produce quite different results.*

*The conclusion that Clinton is ahead in Pennsylvania seems reasonable as the difference between the candidates is 12% and the margin of error (sampling error) is ±3.7% so it is unlikely that the difference between the candidates will be overtaken by non-sampling errors.*

*In Florida the result is not supported by the result and would be better characterised as being too close to call. The difference is 3% and it is less than the margin of error of ±3.7% and is compounded by the potential errors caused by the non-statistical errors.*

**Excellence**

Student has identified and commented on a range of features in the report, integrating statistical and contextual information to assess the quality of the report with respect to its purpose.

The additional evidence the student could quote may include

*The report is a newspaper poll conducted by Marist Poll which is based in a college in New York and it was funded by NBC News and the Wall Street Journal.*

*The sampling was done by randomly ringing landlines and mobile phones. This is a problem if a significant part of the population is not available to take phone calls (working or no phone). Many young people have no landline (naked broadband only) so they would have needed to be contacted by mobile phone. Adults in large household (more than two adults at home) may have a reduced chance of being selected as each household contacted contributed one response.*

*The pollsters say they randomly selected an adult in each home but have not described how they did this.*

*They have a further problem in identifying people who are likely to vote. In Florida they filtered 1131 adults to registered voters (86.5% of adults) but only 74.4% of adults in Florida are registered voters so it could be that the adult lied as to whether they were registered to vote. They then used a model to reduce their registered voters to 'likely voters' (71.5% of registered) but in Florida 89.1% of registered voters voted last time so their model may be incorrect. This model puts a lot of emphasis in previous voting history and this is a problem for first time voters. There are similar discrepancies in Pennsylvania. This filtering of responses to get their poll of 'likely voters' adds to the uncertainty in the result.*

*In Florida a State of Emergency was declared on the first day of polling because of Hurricane Matthew. This could have led many voters who had the ability to travel to leave town potentially biasing the result.*

*Another unknown problem is 'shy' voters who intend to support Trump (who is controversial) but are not prepared to say so on a phone.*

*The conclusion that Clinton is ahead in Pennsylvania seems reasonable (Difference 12% and the MOE is ±3.7%) so it is unlikely that the large difference between the candidates will be overtaken by non-sampling errors.*

*In Florida the result is not supported by the result and would be better characterised as being too close to call. The difference is 3% and it is less than the margin of error of ±3.7% and is compounded by the potential errors caused by the non-statistical errors.*