Mathematics Stage 4   
(Year 8) – sample solution

How healthy are young people?

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# Sample student logbook

## Research

1. **State the subtopic you were assigned to research.**

Type 1 diabetes

1. **Identify the sources of your data and the type of data they contain.**

|  |  |  |
| --- | --- | --- |
| Subject | Source | Type |
| Type 1 diabetes among children aged 0–14  Population groups | AIHW National (insulin-treated) Diabetes Register 2020.  [https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx (120](https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx%20(120) KB) | Categorical nominal for each of the categories they fit in. |
| Type 1 diabetes among children aged 0–14  Age, sex, year | AIHW National (insulin-treated) Diabetes Register 2020.  [https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx (120](https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx%20(120) KB) | Numerical continuous as age is continuous measure. |
| People registered with the NDSS with type 1 diabetes | National Diabetes Services Scheme (NDSS) September 2023.  [https://www.ndss.com.au/wp-content/uploads/ndss-data-snapshot-202309-type1-diabetes.pdf (164](https://www.ndss.com.au/wp-content/uploads/ndss-data-snapshot-202309-type1-diabetes.pdf%20(164) KB) | Numerical continuous as age is continuous measure. |

1. **Explain how the sources of your data sets could impact your data analysis.**

My data was collected from a variety of sources that are seen to be trusted and reliable as they are the data sources the government uses to make decisions.

As type 1 diabetes affects all people, I purposely selected data that would represent the age of people so we can see how many young people it affects compared to overall. It was hard to find data just for young people with diabetes so some of my data shows the larger groups of ages for people with diabetes.

My first data source has the data broken into age brackets of 5 years and only includes young people from 0–14. My other sources don’t show me the ages that relate to young people as they have age brackets for 0–20. This doesn’t really show me the state of young people but could be used to make people think more young people suffer from type 1 diabetes, because if people think more people have it they might care about it more and do more research or make better support services.

I also wanted to show the breakdown of groups of children suffering with type 1 diabetes to help with the allocation of support services or funding if we wanted to improve the health of young people with this disease. People could take these graphs and compare them to the breakdown of the population into the same groups to see if one type of group suffers more than another.

The student shows a highly developed understanding of data classification by stating where their data has been sourced. The student has justified their decision to create a bias through their chosen data.

## Data visualisation and analysis

1. **Display your data sets graphically.**

|  |  |
| --- | --- |
| Population group | Persons |
| Major cities | 2 054 |
| Inner regional | 649 |
| Outer regional | 257 |
| Remote and very remote | 36 |
| Group 1 (most disadvantaged) | 593 |
| Group 2 | 671 |
| Group 3 | 604 |
| Group 4 | 590 |
| Group 5 (least disadvantaged) | 535 |
| Indigenous | 151 |
| Non-Indigenous | 2 761 |

Source: AIHW National (insulin-treated) Diabetes Register 2020.  
<https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx>

|  |  |
| --- | --- |
| Age | Number |
| 0–4 | 411 |
| 5–9 | 2 001 |
| 10–14 | 4 482 |

Source: AIHW National (insulin-treated) Diabetes Register 2020.  
<https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx>

|  |  |
| --- | --- |
| Age | Number |
| 0–20 | 15,316 |
| 21–39 | 35,131 |
| 40–59 | 40,401 |
| 60+ | 44,575 |

Source: National Diabetes Services Scheme September 2023  
People registered with the NDSS with type 1 diabetes  
<https://www.ndss.com.au/wp-content/uploads/ndss-data-snapshot-202309-type1-diabetes.pdf>

|  |  |
| --- | --- |
| Year | Number per 100,000 |
| 2013 | 144.3 |
| 2014 | 143.7 |
| 2015 | 143.1 |
| 2016 | 141.3 |
| 2017 | 141.7 |
| 2018 | 143.1 |
| 2019 | 144.1 |
| 2020 | 144.1 |

Source: AIHW National (insulin-treated) Diabetes Register 2020.  
Type 1 diabetes among children aged 0–14 Age, sex, year  
<https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx>

1. **Why did you choose to represent the data using these data displays?**

I decided to use sector graphs to represent the breakdown of groups of people that have Type 1 diabetes as it shows it as a percentage of a whole. A column graph is another graph that would suit the data, but it shows the number of people with diabetes, and I wanted to hide that so people don’t focus on that as it may not affect a lot of people and help people with type 1 diabetes more.

A histogram was the best choice to represent the data of the number of children with type 1 diabetes for each age group as it is grouped data and age is a continuous variable. This means there is a relationship between the numbers on that axes, so we do not have spaces between the columns to highlight that relationship. I wanted to show how big the numbers were, so I used the full number on the axes, so people just think wow that’s big rather than thinking of it compared to how many people are in Australia aged 0–14, or in general.

The line graph was the best to represent the change over time of people with diabetes over the years as we are dealing with continuous and discrete numerical data. I made the scale go from 100 to 150 to show there is little change in the number of children with diabetes. I used per 100,000 as that is how the data was sourced, but it could cause confusion with the number of people it is referring to. Some people may mistake it to be around 140,000,000 rather than as the fraction of 140/100,000, which pushes my agenda to have more people caring about type 1 diabetes.

1. **What information can you conclude from the data displays? How do they help you to address the driving question?**

We can conclude from these graphs that a typical young person with diabetes may be non-indigenous, from a poor neighbourhood in a major city. Relating to the driving question, we could argue that it doesn’t matter if you are poor or wealthy you can still be impacted by disease such as diabetes.

The ABS say that: ‘Over two-thirds (69%) of Australians live in major cities, one in five (20%) live in inner regional areas, one in ten (9%) in outer regional areas and around one in forty (2.3%) live in remote or very remote areas (1.5% remote and 0.8% very remote).’ Which looks similar to our sector graph for geographical locations of people with type 1 diabetes, so no matter where you live, disease impacts your overall health.

These graphs are all negatively skewed, so as we get older more people realise they have Type 1 diabetes. I would use this to show the lack of resources as this is a disease that people are usually diagnosed between 0–14 years old according to the National Library of Medicine. I would also use the graphs to argue that maybe young people aren’t told enough about type 1 diabetes so they don’t know they have it and that’s why more people register with the NDSS in the 21–39 age bracket. You can see that many people are affected by Type 1 diabetes so we should be thinking what we can do to help them, so their health is improved.

From this graph we can conclude that the rate of Type 1 diabetes in children has not improved over time. So, is the overall health of young people getting better if one of the major diseases that affects young people hasn’t improved?

The student shows a highly developed understanding of data visualisation as evidenced by their choice of appropriate graphs, accurately displaying the data with relevant headings. The student has justified their decision to create bias through graph choices, scales and number representations. The student could, however, improve the column headings in their tables to provide more information or provide a caption for the table to help explain what data is presented in the table.

1. **Conduct your statistical analysis, using the best measures to represent your data. These could include distributions and measures of centre and spread.**

|  |  |  |  |
| --- | --- | --- | --- |
| Data set | Centre | Spread | Skewness |
| Number of children (0–14) with type 1 diabetes (histogram) | Ages 10–14 | 14 | Negatively skewed |
| Number of children (0–14) with type 1 diabetes (line graph) | 143.2 children per 100,000 | 3 | N/A |
| Sector graphs | Non-indigenous  Low socioeconomic area  Major city | N/A | N/A |
| People with type 1 diabetes registered with NDSS (histogram) | Ages 40–59 | N/A  Life expectancy for a person | Negatively skewed |

1. **What measures did you choose to use to represent the data? Why?**

|  |  |  |
| --- | --- | --- |
| Data set | Centre | Spread/Distribution |
| Number of children (0–14) with type 1 diabetes (histogram) | As the data is negatively skewed in this graph, we should not go to the mean for this data. Due to the driving question asking about the health of young people, I am going to focus on the mode. As the age bracket 10–14 has the most people with type 1 diabetes, this shows it greatly affects early teenagers. | The range is 14, as it goes from 0 to 14. This doesn’t really tell me anything except that my data is appropriate to use to help answer the driving question. Though the fact that it is negatively skewed shows the older children are the more likely to have type 1 diabetes. |
| Number of children (0–14) with type 1 diabetes (line graph) | This data has little change so I would use the mean to give a measure of centre that represents the whole data, as I also don’t think it will change much in future years. The mean was found to be 143.2 children per 100,000. By using the median, I wouldn’t get much change in this value. | The range of the data is 3, which further shows that there is little change in the number of children per 100,000 that have diabetes so the measure of centre is quite reliable to believe over others that have a larger range. |
| Sector graphs | For the categorical data we can only use the mode as it’s the only measure of centre we have. This also helps us connect the proportions with the population of Australia like I did in my justification for using a sector graph. The mode for each is non-indigenous, from a low socioeconomic area, and in a major city. | The are no measures of spread for categorical data. |
| People with type 1 diabetes registered with NDSS (histogram) | Since the final age bracket does not have an end of the bracket. The median gives me a measure of centre in the 40–59 bracket and the mode gives me the 60+ bracket. Given that the focus is on people accessing support I will select the younger age bracket to show that this support may be needed for a long time. | The range is hard to determine as the final age bracket is 60+, but it is assumed it may be the lifespan of a person. |

1. **How do the measures of centre and spread help us to address the driving question?**

When looking at the summary statistics for each of the data sources collected, each bit of data helps us. The sector graphs show us what a typical person with a disease can be categorised as in Australia. This shows that it considers all people when looking at overall health.

The number of people with type 1 diabetes mainly affects young people, showing that the average age of people with the disease are 10–14. This doesn’t improve in their lifetime as people aged 40–59 are most involved with the NDSS for type 1 diabetes. So, we can assume their quality of life may not improve as time goes on.

We can also see the average of 143.2 children per 100,000 hasn’t improved over time as the data has a small range of 3, so there isn’t much variation or evidence of a trend of things improving or not. So, it highlights that some diseases affecting young people in Australia aren’t improving.

1. **What conclusions can you draw from your data, data displays and analysis?**

I conclude that some diseases affecting the health of young people, like Type 1 diabetes, are not improving over time and show that the support for these people may be directed at the wrong place to help people know they are suffering with diseases that may affect their life, or know it is there until a later age.

The student shows a highly developed understanding of data analysis as evidenced by their justifications for their chosen measures of centre and spread. The student has clearly explained how their analysis supports their viewpoint and relates to the driving question.

## Bringing it all together

For this sample solution, the student worked in a group of 3, where the other 2 students researched the amount of sleep young people get and the amount of time young people spend on social media.

Return to your group and discuss what you found. Then answer the following questions (only one person in each group needs to submit this section).

1. **Group member’s names and topics.**

Nicholas Jonas – type 1 diabetes

Miley Cyprus – amount of sleep

Demi Lovadio – social media use

1. **What position did you take to the driving question How healthy are young people? Support with evidence from your group’s analysis.**

We believe that the health of young people isn’t good. Our data shows that young people:

* aren’t getting support for diseases that greatly affect them
* are more likely to have sleep issues
* are using more social media.

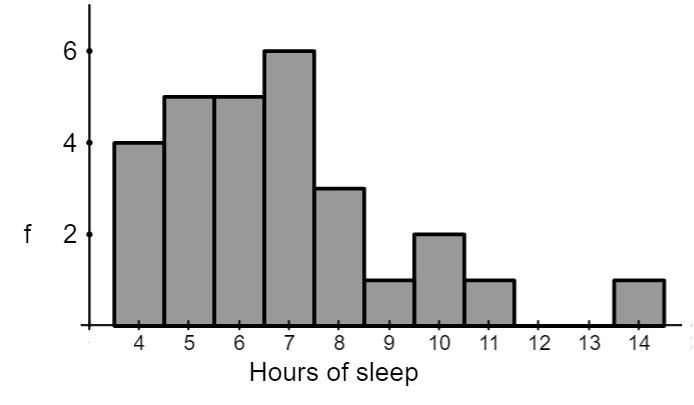
This can be seen in our data when looking at the measures of centre and spread and data displays for each of the data collected, and each bit of data helps us.

The number of people with type 1 diabetes mainly affects young people, showing that the average age of people with the disease are 10–14 and that this doesn’t improve in their lifetime as people involved with the NDSS for type 1 diabetes is negatively skewed, which shows more people access their help as time goes on. So, we can assume their quality of life may not improve.

We can also see the average of 143.2 children per 100,000 hasn’t improved over time as the data has a small range of 3, so there isn’t much variation or evidence of a trend of things improving or not. So, it highlights that some diseases affecting young people in Australia aren’t improving.

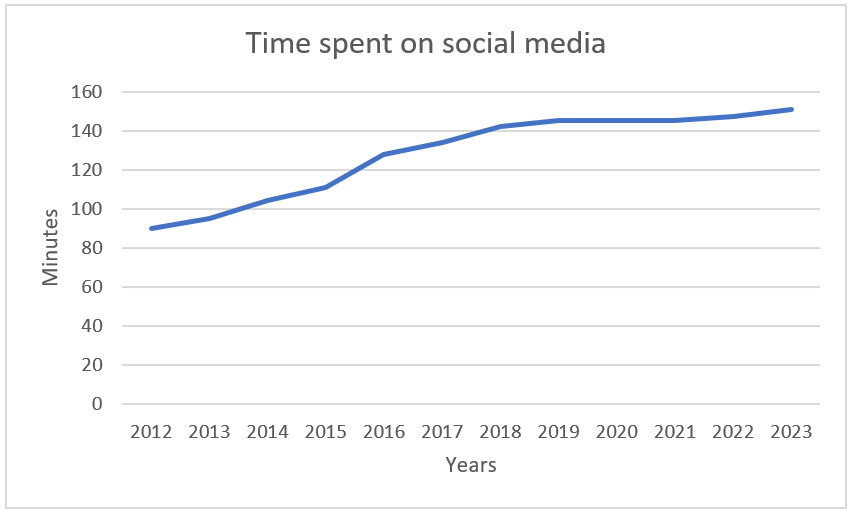
Young people are averaging 7 hours of sleep a night. The amount recommended is 10 hours of sleep a night for a teenager. The data is seen as more positively skewed when placed on a histogram which shows most of the data sits at the lower end of the range which was between 4 and 12 hours.

**Hours of sleep of teenagers per night**



More young people are using social media much more which was seen in the line graph in 2024 compared to back in 2012.

This means they may be spending more time online rather than outside doing sports. They on average spend nearly 2.5 hours a day on social media platforms, which at times makes them feel less connected.



1. **Does each team member’s individual data complement or contradict that of the other group members? How or why do you think this?**

When we looked at the data around sleep and social media use, the more amount of time people spent on social media complemented the number of hours sleep people had at night. The more time people were on social media, it appeared the less they slept.

Though, in the same data people who were on social media more were seeing more positive things, such as reels, which made them happy. This can be seen in the sector graph when people were asked if they felt social media had a positive, neutral or negative impact on their connection to friends.

When we also consider the data on the type 1 diabetes the access to information that may be available when on social media more has not led to more people knowing they have type 1 diabetes or more people knowing where they can get help with the number of people with the NDSS.

1. **How reliable is your group presentation to help inform future decisions?**

Our data may not be as reliable to use when making decisions as some of it was primary data which only used a small number of people or people from a select group, which may not be an accurate representation of the whole population of young people in Australia. The questions asked may not have related to the driving question as much and forces us to make assumptions. For example, asking people if they mainly had a positive interaction when connecting with friends, rather than maybe focusing on the content shown to young people on social media and how that might look at their self-esteem.

1. **How have you used data collection, data analysis and data displays to persuade your audience of your position in relation to the driving question?**

Since we decided that the health of young people is bad we avoided using any data that showed the opposite. This can be seen in some of the analysis and graphs of people when Demi investigated social media use, so only selecting the data that shows negative things such as just the amount of time they spent on social media and the measures of centre for that.

Only including data collection, data displays and analysis that aligned with our position felt the right thing to do to help drive our position to the question. Including most of the data about Type 1 diabetes, and only looking at the shape of the data set and the range was worthwhile as it showed more the type of people getting help who suffer from diabetes. Placing this side by side with the people who have Type 1 diabetes showed that young people aren’t getting the access to care that may benefit their lives.

Sleep can really affect mood so showing the measures of centre would be our focus there, paired with the histogram which shows the majority of young people are getting under 7 hours which is less than the recommended amount of sleep.

1. **What could your group modify in their data collection, data analysis or data displays to strengthen your response to the driving question?**

In our data collection we could have asked only the people that may have given us the response we wanted. This would have given us stronger data and affected our measures of centre, spread and the shape of the data. For the research in Type 1 diabetes this may have been harder, but we could have deleted some of the data if it didn’t align with the idea of the health of young people being bad.

For our analysis we could have picked measures of centre that did not accurately represent the data. Like if we used the mode for the people registered with the NDSS which showed 60+ aged people were most of the people registered with the scheme. This could have pushed our idea that young people aren’t getting the help they need even further being a larger age then the median we used to represent the data.

The data displays chosen could also be different as some hide information. If we changed some of our histograms into sector graphs then they would hide the number of people we interviewed and lead people to believe our data is more accurate. We could also change the scales or the groups when we had grouped data. Like in the sleep histogram, we could have used uneven groups of 4–6, 7–8, 9–10, 11–12 and 13–14, which would have shown a graph that was more positively skewed.

The students provided a developed and informative response to their group’s data analysis towards their driving question. Greater use of chosen or modified graphs to support their position that the health of young people is bad, would have strengthened their stated justifications and explanations. Also including more of each member’s data analysis, such as the distribution of data, measures of centre or the range.

### Bibliography

* <https://www.ndss.com.au/wp-content/uploads/ndss-data-snapshot-202309-type1-diabetes.pdf>
* <https://www.aihw.gov.au/getmedia/f27a66db-9d85-467a-bdd3-d41c340754ee/NDR2020-supplementary-tables.xlsx.aspx>
* <https://aifs.gov.au/research/research-reports/families-regional-rural-and-remote-australia#:~:text=Over%20two%2Dthirds%20(69%25)%20of%20Australians%20live%20in%20major,and%200.8%25%20very%20remote>
* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5556582/#:~:text=Type%201%20diabetes%2C%20a%20chronic,be%20diagnosed%20at%20any%20age>

# Marking guidelines

## Individual marking rubric

Table 1 – individual assessment marking guidelines

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Data collection | Some data is collected with little consideration of appropriateness.  Data is classified as either numerical or categorical. | Some relevant data is collected.  Basic understanding of collection processes.  Limited consideration of data reliability. | Adequate collection of relevant data.  A clear understanding of data collection processes.  Some consideration of the reliability and appropriateness of the data sources.  Data is correctly classified as continuous, discrete, nominal or ordinal. | Effective and varied data collection.  A strong understanding of data collection processes and the impact of using a sample over a census.  Data is reliable and sources are appropriate. | Extensive and comprehensive data collection.  A clear and thorough understanding of the data collection process including justification of the source of the data and data collection methods.  All data is reliable, diverse and relevant to the task. |
| Data visualisation | Data displays are evident. | Basic visual representations of the data are evident; however, some graphs are inappropriate or unclear.  An attempt is made to link the visual representations and the claim. | Data is adequately represented using suitable graphing techniques.  The visuals generally support the claim and are mostly clear. | Effective use of a variety of graphical techniques to represent data.  The visuals clearly support claims and are easy to interpret. | Justifies why they selected the data display for each set of data.  The visuals strongly and clearly support claims, enhance understanding and engagement. |
| Data analysis | Attempts to analyse data or trends. | Some attempt to analyse data but lacks depth or contains inaccuracies.  Some attempt to interpret data trends or measures of centre and spread. | Adequate analysis with correct applications of basic techniques.  Measures of centre and spread are generally correct and contribute to reasonable interpretations. | Strong analysis with accurate use of appropriate techniques.  Measures of centre and spread are well used to interpret and justify conclusions. | Comprehensive and insightful analysis, with thorough and accurate applications of techniques.  Measures of centre and spread are expertly used to draw sophisticated, justified conclusions. |

**Comment:** the student provided strong reasoning and justifications for the types of data collected, how they chose to represent their data and were able to calculate and analyse different measures of centre and spread. The student related their analysis to the driving question and was deliberate and strategic in how they presented their graphs and analysis to ensure a focus that would encourage further support and funding for Type 1 Diabetes in young people. Using technology to check, or a buddy to read through written responses, will help to improve spelling and grammar to ensure the student’s message is communicated clearly and is easy to read.

## Group marking rubric

Table 2 – group assessment marking guidelines

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Criteria | Working towards developing | Developing | Developed | Well developed | Highly developed |
| Drawing conclusions | Conclusions are made but lack clarity or are unsupported by the data.  Some attempt is made to link the data to the overall position on the driving question. | Basic conclusions are made using informal mathematical reasoning.  Data is used from one group member to attempt to support the overall position on the driving question. | Adequate conclusions are drawn from the data using informal mathematical reasoning to justify results.  Data is used from multiple data sources to provide some justification to support the group’s overall position on the driving question. | Clear, well-justified conclusions are drawn from the data using formal and informal mathematical reasoning to justify results.  Data is used from multiple data sources to provide a strong connection to support the group’s overall position on the driving question. | Insightful, compelling conclusions are drawn using concise, formal mathematical reasoning to justify results.  Data is used from all data sources to thoroughly justify and strongly support the group’s overall position on the driving question. |
| Presentation | Presentation contains minimal visual aids and text.  Minimal attempts are made to engage the audience.  Everyday use of language. | A basic presentation containing only high-level information.  Limited use of visual aids and audience engagement.  Some appropriate mathematical language is used. | The presentation is clear and organised.  Visual aids are used effectively and audience engagement is adequate.  Mostly appropriate mathematical terminology is used to communicate reasoning and justify position on the driving question. | The presentation is well-structured and engaging.  Visual aids are used effectively to enhance understanding. Audience engagement is strong.  Mathematical terminology is clearly and effectively used throughout the presentation to communicate reasoning and justify position on the driving question. | The presentation is highly polished, professional and engaging.  Visual aids are expertly used to support the message and audience engagement is excellent.  Precise mathematical terminology is clearly and effectively used throughout the presentation to communicate reasoning and justify position on the driving question. |

**Comment:** the students’ analysis was informative. Their logbook provided a clear analysis incorporating the data gathered from each member of the group towards the driving question. Justifications and reasoning were provided on the type of graphs used, the use of the data gathered and how the data related to each other. A greater use of chosen or modified graphs to support their position that the health of young people is bad, would have strengthened their stated justifications and explanations. Also including more of each member’s data analysis, such as the distribution of data, measures of centre or the range. Stating how they could have modified either their chosen data collection, analysis or data displays to support their position on the driving question of all group members would have assisted the group in moving up into the well-developed criteria.

The group presentation was not included in this sample solution.

References

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Australian Institute of Family Studies (AIFS) (2011) [*Families in regional, rural and remote Australia*](https://aifs.gov.au/research/research-reports/families-regional-rural-and-remote-australia#:~:text=Over%20two%2Dthirds%20(69%25)%20of%20Australians%20live%20in%20major,and%200.8%25%20very%20remote), AIFS website, accessed 15 October 2024.

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Freeborn D, Dyches T and Roper SO (2017) ‘[Lessons Learned From a Life With Type 1 Diabetes: Adult Perspectives](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5556582/#:~:text=Type%201%20diabetes%2C%20a%20chronic,be%20diagnosed%20at%20any%20age)’, *Diabetes Spectr*, 30(3):188–194, doi: 10.2337/ds16-0032, accessed 15 October 2024.

National Diabetes Services Scheme (NDSS) (2023) [*Type 1 Diabetes [PDF 164 KB]*](https://www.ndss.com.au/wp-content/uploads/ndss-data-snapshot-202309-type1-diabetes.pdf), NDSS, accessed 15 October 2024.

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