# What is the data telling us?

Students look at the data presented by the Australian Bureau of Statistics and extract the   
5-number summary from histograms to create box plots.

The histograms in this lesson vary from traditional histograms. They reflect how the data is presented by the Australian Bureau of Statistics.

## Visible learning

### Learning intention

* To compare the benefits of representing data in histograms with the benefits of representing data in box plots.

### Success criteria

* I can interpret visual data to find the median.
* I can determine quartiles from datasets displayed as histograms
* I can find the 5-number summary from a histogram.
* I can represent data displayed as a histogram in a box plot.

### Syllabus outcomes

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly **MAO-WM-01**
* compares and analyses datasets using summary statistics and graphical representations **MA5-DAT-C-01**

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## Activity structure

Please use the associated PowerPoint *What is the data telling us* to display images in this lesson.

### Launch

1. Use slides 3–5 of the *What is the data telling us* PowerPoint for a slow reveal graph activity ([slowrevealgraphs.com](https://slowrevealgraphs.com/)). For each slide, students will discuss in a Think-Pair-Share ([bit.ly/thinkpairsharestrategy](http://www.bit.ly/thinkpairsharestrategy)), what they notice and what they wonder ([bit.ly/noticewonderstrategy](http://www.bit.ly/noticewonderstrategy)) about the graph displayed.
2. Discuss with the class what we have learnt from this data. Encourage students to talk about statistics they have found as well as the shape of the data. Record points on the board as these will be referred to later in the lesson.
3. Inform students that the graph is from the 2021 Australian census data. When data is presented in a graph, we need to be able to extract the information from it to be able to compare data and make informed decisions.

### Explore

1. During this section, students will work in visibly random groups of 3 ([bit.ly/visiblegroups](https://bit.ly/visiblegroups)) on vertical non-permanent surfaces ([bit.ly/VNPSstrategy](https://bit.ly/VNPSstrategy)).
2. Issue each group with a copy of Appendix A ‘Defence force service by age.’
3. Ask students to find the lowest score for each dataset and the highest score for each dataset.
4. Allow students time to check their answers with surrounding groups.

Teachers can discuss with students that their answers give a range of ages and that we can use the middle of this range, called the class centre, as our score to represent the group.

1. Ask students to find the median of Graph 1 – currently serving in the regular service. Have students record the process they used on their vertical non-permanent surfaces.

Ideally, students would use cumulative frequency to find the exact 5-number summary however, cumulative frequency is not in the syllabus at this at this level?

1. Students are to do a gallery walk ([bit.ly/DLSgallerywalk](https://bit.ly/DLSgallerywalk)) noticing the different methods used to find the median.

Methods that students may use include: a visual estimation of the middle, creating a frequency table, balancing the columns from the outside in or smoothing the histogram by combining columns.

1. Bring the class back together and ask them to consider the methods used. Prompting questions could include:

* Which method do you think is the easiest?
* Which method do you think would be the fastest?
* Which method do you believe was the most accurate?

1. Pose the question: ‘From the different methods you saw on the gallery walk, which method would you now use to find the lowest quartile and the highest quartile’?
2. Have groups return to their vertical non-permanent surfaces and find the 5-number summary for each dataset.
3. Have groups construct 3 box plots using their 5-number summaries from each dataset.

Advise students to use the middle value in the age range for their 5-number summaries, example 30–34 would become 32.

1. Students are to do another gallery walk, this time providing feedback using the Two stars and a wish ([bit.ly/2starwish](https://bit.ly/2starwish)) method.

### Summarise

1. Brainstorm with students any information they can determine from the 3 box plots.
2. Facilitate a classroom discussion around which graphs, the histograms from Appendix A or the box plots they created, were more useful in understanding the data and why.
3. Have students write notes to their future forgetful selves ([bit.ly/notesstrategy](https://bit.ly/notesstrategy)) outlining the usefulness of each graph.

### Apply

1. Distribute Appendix B ‘Long-term health conditions’ to students and have them extract the 5-number summaries from each dataset and construct parallel box plots.
2. During the Covid pandemic, people of an older age were prioritised for vaccinations. Write a letter to the editor or a comment to an online newspaper article supporting or objecting to this decision.

## Assessment and differentiation

### Suggested opportunities for differentiation

**Explore**

* Concrete manipulatives such as centicubes could be used to construct histograms that students can use to determine the median and quartiles.
* Students may benefit from explicit teaching of finding the 5-number summary from a histogram before attempting the task independently.

**Apply**

* **Further practice with smaller histograms, where students can rule a line from the vertical axis, like in this example ‘Finding Median from Histogram (3:45)’ (**[bit.ly/histogrammedian](https://bit.ly/histogrammedian)**), may be useful.**
* **Students could record their support or objections using video or voice recording.**

### Suggested opportunities for assessment

**Explore**

* Students are provided with various opportunities to provide and receive peer feedback on their understanding and processes.
* Teachers could observe student’s participation levels during discussion around finding the median and the creation of the box plots.
* Students are to explain and justify their strategies, demonstrating their working mathematically skills.

**Apply**

* Students will demonstrate their working mathematically skills by choosing a position and justifying it, using data.
* Students’ letters to the editor or comment replies could be collected and used as summative assessment for this unit of learning.

## Appendix A

### Defence force service by age

Graph 1: currently serving in the regular service

Data from the table below is represented as a histogram.   
Age Currently serving in the regular service.

15-19 3005 
20-24 11 708 
25-29 11 540 
30-34 9627 
35-39 7677 
40-44 5281 
45-49 4543 
50-54 3984 
55-59 2154 
60-64 764 
65-69 0 
70-74 0 
75-79 0 
80-84 0 
85 + 0 
   
Source: Australian Bureau of Statistics, Service with the Australian Defence Force: Census 2021.

Graph 2: currently serving in the reserves service

Data below is displayed as histogram.

15-19 404 
20-24 2102 
25-20 3036 
30-34 3447 
35-39 3335 
40-44 2555 
45-49 2427 
50-54 2525 
55-59 2559 
60-64 2186 
65-69 0 
70-74 0 
75-79 0 
80-84 0 
85 + 0.

Graph 3: previously served and not currently serving

Data below is presented as a histogram.

Age Previously served and not currently serving.

15-19 748
20-24 3986
25-29 9726
30-34 16 718
35-39 19 385
40-44 22 522
45-49 30 305
50-54 40 368
55-59 44 262
60-64 44 999
65-69 47 679
70-74 81 758
75-79 45 821
80-84 39 601
85 + 48 396
 
Source: Australian Bureau of Statistics, Service with the Australian Defence Force: Census 2021.

## Appendix B

### Long-term health conditions

Graph 4

The following data is presented as three separate column graphs. 

Count of people with one or more selected long-term health conditions(a) by age(b), 2021 Census                  
 0-4 years 5-9 years 10-14 years 15-19 years 20-24 years 25-29 years 30-34 years 35-39 years 40-44 years 45-49 years 50-54 years 55-59 years 60-64 years 65-69 years 70-74 years 75-79 years 80-84 years 85 years and over
One condition 48,010 140,434 188,694 221,454 261,141 287,476 291,959 302,851 292,423 316,015 340,369 365,384 391,595 382,434 362,778 262,231 175,072 161,207
Two conditions 1,292 6,697 15,327 26,863 44,018 54,351 55,764 60,913 64,602 80,229 100,148 121,686 150,388 166,251 178,709 144,942 106,911 111,248
Three or more conditions 194 343 693 1,534 3,730 6,063 8,580 12,567 17,817 28,021 41,901 59,780 82,324 97,440 115,201 105,812 86,967 103,175
                  
Source: Australian Bureau of Statistics, Health: Census 2021.                  


Source: Australian Bureau of Statistics (2021) [*Health: Census*](https://www.abs.gov.au/statistics/health/health-conditions-and-risks/health-census/2021), ABS Website, accessed 26 February 2024.

## Sample solutions

### Appendix A – defence force service by age

|  |  |  |  |
| --- | --- | --- | --- |
| Category | Currently serving in regular service | Currently serving in reserve service | Previously served and not currently serving |
| Minimum | 15–19 (17) | 15–19 (17) | 15–19 (17) |
| Lower quartile | 25–29 (27) | 30–34 (32) | 50–54 (52) |
| Median | 30–34 (32) | 35–39 (37) | 65–69 (67) |
| Upper quartile | 40–44 (42) | 50–54 (52) | 75–79 (77) |
| Maximum | 60–64 (62) | 60–64 (62) | 85+ |

### Appendix B – long-term health conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Category | One condition | Two conditions | Three or more conditions |
| Minimum | 0–4 (2) | 0–4 (2) | 0–4 (2) |
| Lower quartile | 30–34 (32) | 45–49 (47) | 60–64 (62) |
| Median | 50–54 (52) | 65–69 (67) | 70–74 (72) |
| Upper quartile | 65–69 (67) | 75–79 (77) | 75–79 (77) |
| Maximum | 85+ | 85+ | 85+ |

Graph 5 – long term health conditions

3 parallel box plots graphing long tern health conditions.
Box plot one has a 5-number summary of 2,32,52,67,85
Box plot 2 has a 5-number summary of 2,47,67,77,85
Box plot 3 has a 5-number summary of 2,62,72,77,85

## References

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Australian Bureau of Statistics (2021) [*Health: Census*](https://www.abs.gov.au/statistics/health/health-conditions-and-risks/health-census/2021), ABS Website, accessed 26 February 2024.

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