

SECONDARY August 2008

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For more activities refer to the Schools Corner section of the Statistics New Zealand website:

www.stats.govt.nz/schools-corner

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Curriculum links

Mathematics curriculum links: (mathematics in the New Zealand curriculum 1992)

Level 7

- Collect data, present it visually, and discuss prominent features of the data.
- Calculate sample statistics, including mean and standard deviation and verify these by reference to a data distribution.

National Ethnic Population Projections in New Zealand

In this edition we are focusing on New Zealand's age demographic by ethnic group as it appears in 2006 and how it is projected to appear in 2026. In particular, the activities and questions support internally assessed Unit Standard 12332 – Demonstrate knowledge of measures and displays used to compare data sets.

In this activity, students are asked to consider the back-to-back age population pyramids for four New Zealand ethnic groups in 2006 and in 2026. Students will identify key features of the data and in particular compare and contrast the 2006 and 2026 age demographics with reference to measures of centre and measures of spread. Later they will be asked to consider the 2006 data solely, allowing for comparison across the four ethnic groups: European and Other, Māori, Pacific and Asian.

An underlying goal of this activity is to establish students' understanding of the link between a histogram and a box and whisker plot. Students will learn how to approximate key statistics from the population pyramids in order to draw approximate box and whisker plots. Specifically, they will be asked to comment on features that histograms and box and whisker plots have in common and the important information that has been lost along the way.

The web activity works to further this understanding. Students are required to select their own groups for comparison of weekly income. They will compare data sets by drawing histograms and box and whisker plots and commenting on notable features of the distributions as they appear in the displays. They will also calculate measures of centre and spread to write a detailed comparison of the data sets.

It is expected students will already be familiar with the following ideas: mean, median, range, minimum, maximum, lower quartile, upper quartile, interquartile range, standard deviation.

Did you know?

Over the next two decades:

- New Zealand's Māori, Asian and Pacific populations are projected to grow.
- The 'European or Other (including New Zealander)', Māori, Asian and Pacific populations are projected to age, which is reflected in rising median ages and increasing proportions of people in the older ages.

Teachers page

Teacher's tips and solutions

PART ONE: Making sense of the information

| | |
|----|---|
| 1 | European or Other as shown by the higher scale on the horizontal axis compared with the other ethnicities. |
| 2 | Approximately 18,000 |
| 3 | Approximately 50,000 |
| 4 | The population pyramids in 2026 for these ethnic groups overall are thicker than in 2006. |
| 5 | The wider base of the pyramid tapering at the higher ages. |
| 6 | All four graphs are thicker at the top (over 65) end of the pyramid in 2026 than in 2006. |
| 7 | Draw a horizontal line through each side of the pyramid at the point where it appears that half the shading is above the line and half is below the line. |
| 8 | Immigration to New Zealand of young Asian adults at around age 21 especially for tertiary study. These people may decide to remain in New Zealand hence the spike in 20 year time at age 41. Example feature for comment: The relatively small proportion of Asian children in 2006 as shown by the dip towards the base of the pyramid. In comparison, the base of the 2026 pyramid is thicker and there is even a bump which forms the third highest peak on the distribution. |
| 9 | Increased deaths and fewer women at child bearing age thus lowering the momentum for population growth. In 2026 the base of the pyramid is smaller as compared to 2006. More specifically in 2006, the number of newborn children forms a small peak but in 2026 it appears to be part of a dip. |
| 10 | This exercise is designed to encourage students to think critically about what the population pyramid's shape means. |

PART TWO: Mix and Match

Answers 1.1, 1.2

European or Other: B, G, J

Māori: A, F, L

Asian: D, H, I

Pacific: C, E, K

Answer 2 and 3

Please note: It is intended that Part Two will provide the impetus for an in depth class discussion and debate regarding the pros and cons of histograms versus box and whisker plots. The primary objective is for students to realise that specific detail displayed on a histogram such as troughs, spikes, holes, bumps, frequency and distribution shape are lost or less apparent on a box and whisker plot.

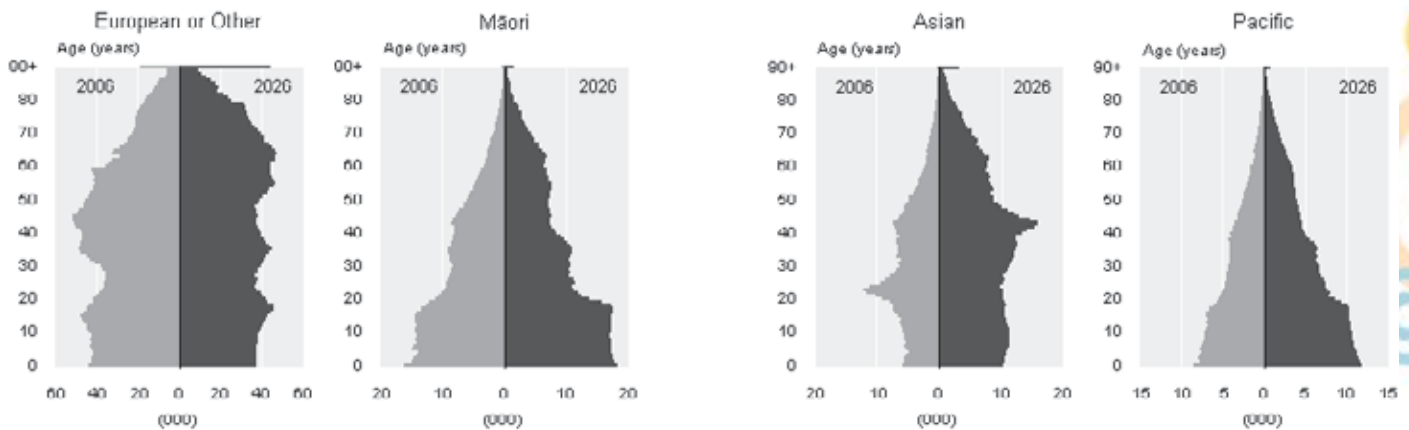
PART THREE: Drawing Comparisons

Some possible statements include:

- The Māori and Pacific groups have a similar median age of about 22 years. The Asian median age looks to be about five years greater than this and the European or other median age is the greatest at about 38 years.
- The interquartile range of ages for the European or Other ethnic group looks to be about 40 years in comparison to the interquartile range of ages for the other three groups which all appear to be around 30 years.
- All groups range from 0 to 90+ years.
- The European or Other ethnic group plot is quite symmetrical with the median centred in the middle of the box and the whiskers of similar length. The other ethnic groups appear skewed right as the bulk of their population are aged less than about 40 years of age.
- The European or Other median age is similar to the upper quartile age for the Pacific population. This shows that 75% of the Pacific population fall into the same age bracket as 50% of the European or Other group.
- The box and whisker plot for Māori and Pacific people are similar indicating the age distribution of Māori and Pacific people in New Zealand are comparable.

Activity Page 1

PART ONE: Making sense of the information



| | |
|----|--|
| 1 | Which ethnic group do the majority of New Zealanders identify with? How can you tell? |
| 2 | Approximately how many newborn Māori children are expected in 2026? |
| 3 | Approximately how many 45-year-old European or Other people are there in 2006? |
| 4 | Statistics New Zealand released the following statement: "New Zealand's Māori, Asian and Pacific populations will continue to grow." Compare the 2006 and 2026 pyramids for these ethnicities. What features of the distributions show population growth for these ethnic groups between 2006 and 2026? |
| 5 | What feature of the display supports the following statement: "Māori, Asian and Pacific populations have a more youthful structure compared with the European or other population" |
| 6 | "All four ethnic groups are expected to age over the next two decades". (Source: National Ethnic Population Projections: 2006 (base) – 2026.) How is this shown on the pyramids? |
| 7 | The median age for all four ethnic groups has increased over the two decades. How could a median be approximated from the graphs? |
| 8 | Consider the back-to-back pyramids for the Asian population. A "spike" at about age 21 appears on the 2006 graph and a similar shaped "spike" appears at about age 41 on the 2026 graph? What might account for this? Compare one other feature of the 2006 and 2026 distributions for the Asian population. |
| 9 | The European or Other population is said to have an older age structure than the other estimates in 2006. How might this impact on future population growth? What features of the 2026 distribution, compared with the 2006 distribution, reflect the projected impact? |
| 10 | Compare and contrast the two sides of the back-to-back population pyramid for the Māori ethnic group. Give two features that are the same in 2006 and 2026. Give two features that are different in 2006 and 2026 |

PART TWO: Mix and match

Refer to Activity Page 2 Mix and match:

The minimum, lower quartile, median, upper quartile and maximum have been estimated from the distributions. These estimations have been used to draw comparative box and whisker plots that correspond to each of the population pyramids.

- 1.1 Find the comparative box and whisker plots that best correspond to the population pyramid for each of the four ethnic groups
 - 1.2 Find the comparison of centre statement and comparison of spread statement that matches each box and whisker plot
- For each ethnicity, compare the back-to-back population pyramid with its corresponding back-to-back box and whisker plot. What do they have in common? What is different?

For each ethnic group comment on and provide at least one specific example for each of the following:

- 2 What information/significant features from the population pyramid have been lost by drawing a box and whisker plot?
- 3 What features of the population pyramid have been retained in the box and whisker plot?

PART THREE: Drawing comparisons

- 1 Draw approximate 2006 box and whisker plots for the four ethnic groups on the same graph.
- 2 Make at least three statements comparing the centre and the spread for the 2006 Age Group Distributions of Ethnic populations.

Use the words in the table to help you:

| | | | |
|-----------|----------------|---------------------|-------------|
| Median | Lower quartile | Upper | Range |
| Minimum | Maximum | Interquartile range | Lower 25% |
| Upper 25% | Middle 50% | Skewed low | Symmetrical |
| Centre | Spread | Evenly positioned | Skewed high |

| Population pyramid | Box and whisker plot | Comparing averages | Comparing spread |
|--|--|---|---|
| <p>European or Other Age (years) 2006 2026 90+ 80 70 60 50 40 30 20 10 0 60 40 20 0 20 40 60 (000)</p> | <p>A</p> <p>90+ 80 70 60 50 40 30 20 10 0 2006 2026</p> | <p>E</p> <p>It is projected the median age will rise slightly over the 20 year period. In 2006 the average age is approximately 22 years. In 2026 it is expected to be about 23 years.</p> | <p>I</p> <p>The 2006 plot is skewed high. The 2026 plot appears less skewed as the lower and upper quartile ages are projected to be higher in 2026 compared with 2006.</p> |
| <p>Māori Age (years) 2006 2026 90+ 80 70 60 50 40 30 20 10 0 20 10 0 10 20 (000)</p> | <p>B</p> <p>90+ 80 70 60 50 40 30 20 10 0 2006 2026</p> | <p>F</p> <p>The 2006 median age is 23 years. It is projected to rise by two years to 25 in 2026.</p> | <p>J</p> <p>The median age is evenly positioned in between the upper and lower quartiles, on both plots. Furthermore the box is centred between the whiskers.</p> |
| <p>Asian Age (years) 2006 2026 90+ 80 70 60 50 40 30 20 10 0 20 10 0 10 20 (000)</p> | <p>C</p> <p>90+ 80 70 60 50 40 30 20 10 0 2006 2026</p> | <p>G</p> <p>The 2006 median age is 38 years rising to a projected 43 years of age in 2026.</p> | <p>K</p> <p>The distribution of ages over the 20 year period is similar. Both plots show long whiskers at the upper end of the plot indicating that 25% of the population are aged over about 40 years of age and approximately 75% are aged less than 40 years.</p> |
| <p>Pacific Age (years) 2006 2026 90+ 80 70 60 50 40 30 20 10 0 15 10 5 0 5 10 15 (000)</p> | <p>D</p> <p>90+ 80 70 60 50 40 30 20 10 0 2006 2026</p> | <p>H</p> <p>In 2006 the median age is about 29 years. There is a projected increase of about seven years bringing the average age to about 36 years in 2026.</p> | <p>L</p> <p>The box on the 2026 plot looks slightly larger and more symmetrical than the 2006 box. This suggests that in 2026 the middle 50% of the population's ages will have a greater spread and be more evenly distributed around the median.</p> |