For the students who completed the 2017 New Zealand Census at School I wonder if the median armspan of year 11, 12 and 13 boys (senior boys) is greater than the median armspan of year 11, 12 and 13 girls (senior girls).

I think that the median armspan of the senior boys will be greater than the median armspan of the senior girls because arm span is approximately equal to your height. By this age people have generally stopped growing and senior boys are generally taller than senior girls so it seems reasonable it would be true for their armspans as well.

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Someone who would benefit from the result of this investigation would be a school blazer manufacturer. Generally senior students wear blazers more than junior students. The school blazer manufacturer could use the results to decide what length to make the arms on their blazers for males and females and whether the lengths of the arms on the blazers would be different for males and females.

I used a random sample of 50 for each group. Each sample is made up of year 11, 12 and 13 students.

Armspan of year 11, 12, 13 students 2017
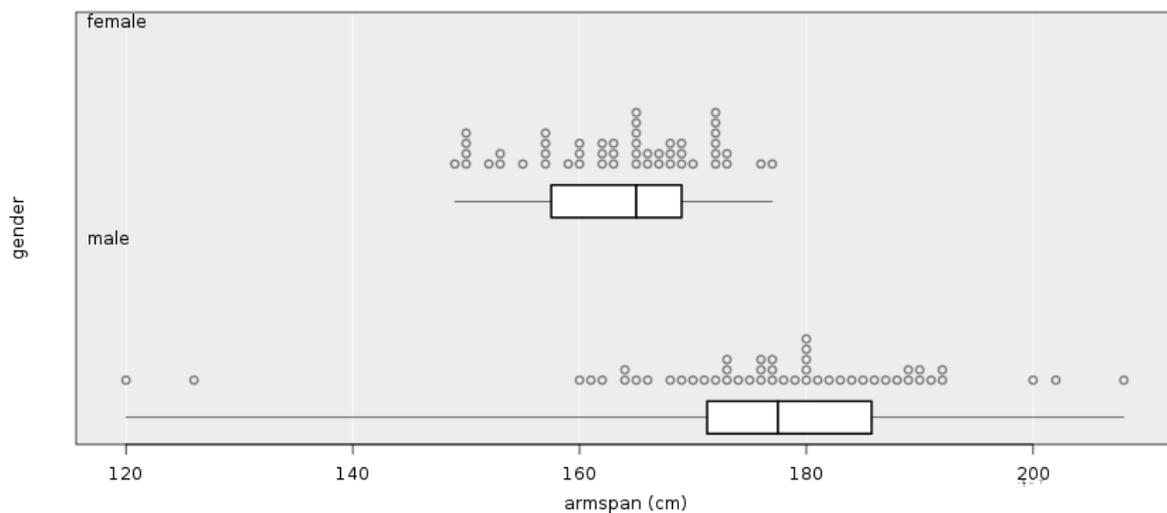
	Min	LQ	Median	UQ	Max	Mean	SD	Num
female	149	157.5	165	169	177	163.4	7.552	50
male	120	171.2	177.5	185.8	208	176.8	15.299	50

From the graph of my samples I notice that the males armspans are shifted further up the scale to the right of the female armspans. The median armspan for the female year 11, 12 and 13 students is 165 cm and for the year 11, 12 and 13 male students the median arm span is 12.5 cm more at 177.5 cm. The box of the middle 50% of the armspans for the males is the right of the box for the females and there is no overlap in the middle 50% of the armspan lengths. This can be seen by the LQ for the year 11, 12 and 13 males being 171.2 cm which is greater than the UQ for the year 11, 12 and 13 female students at 169 cm so more than 75% of the year 11, 12 and 13 males had armspans greater than 25% of the year 11, 12 and 13 females.

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The IQR for each group is quite similar (11.5 cm for females and 14.6 cm for males) so each of the samples has a similar spread in the middle 50%, but slightly greater for the male group. The overall spread of the male group is larger than the female group. The range for the female armspans is 28 cm compared to the larger range for the males of 88 cm. The

larger overall spread of the males in the sample I took gives the graph a slightly different appearance. On the right hand side there are three points above 200 cm that are removed a bit from the rest of the data but these points seem sensible because the armspan will be approximately equal to height and a senior male student taller than 2 m is reasonable. On the other side of the males graph there are two points below 130 cm. These are smaller than I would expect but could still be reasonable and it is likely these students are quite short. Back in the population I think the data would be more symmetrical than in my samples. There would be more data so I wouldn't expect to see the peaks like there are (172 cm and 150 cm for females) or the gaps in the data and with a body measurement like this I would expect it to more like a normal distribution. I would expect the population data to have a higher median armspan for the year 11, 12 and 13 males but I think the spread for males and females would be similar. I think the males range is only larger for my sample due to the extreme figures (above 200 cm and below 130 cm) and I have no reason to believe there will be more spread for one group than the other.

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armspan by gender
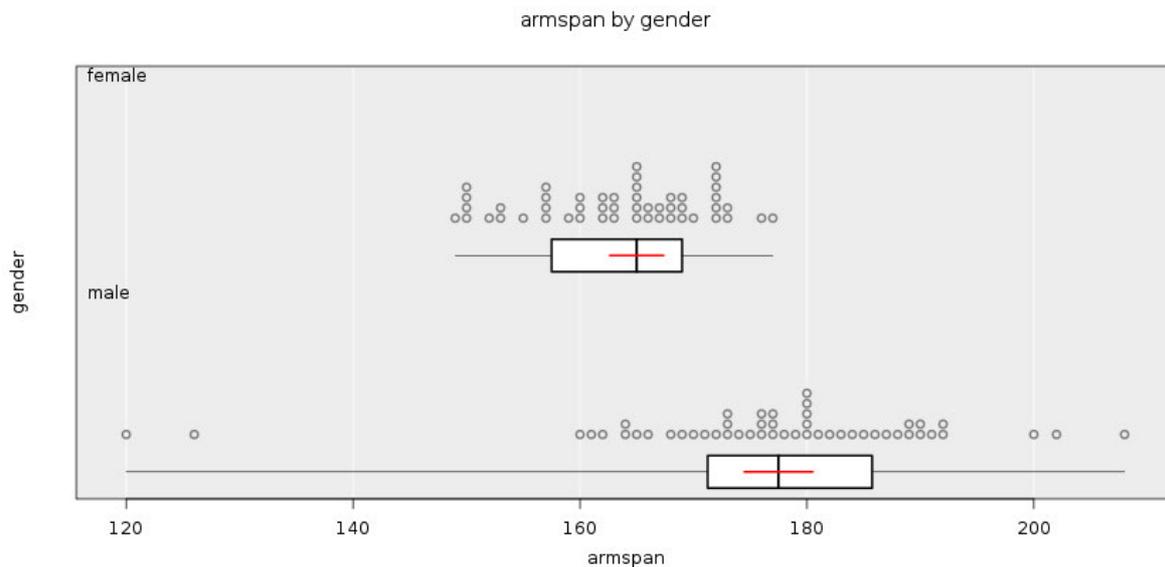
	lower	upper
female	162.5605	167.4395
male	174.4241	180.5759

I have found informal confidence intervals for the median. I can be pretty confident that the population medians will be inside these confidence intervals. I am therefore pretty sure for the students who did the Census at School in 2017 the median armspan for the year 11, 12 and 13 females is between 162.6 cm and 167.4 cm and the median armspan for the year 11, 12 and 13 males is between 174.4 cm and 180.6 cm. Because these intervals don't overlap I can claim that the median armspan of year 11, 12 and 13 males is greater than the median armspan of year 11, 12 and 13 females.

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These results are based on my samples. If I was to repeat this sampling process and take another random sample from Census at school 2017, I would get different data in my samples and so get a different median, different quartiles, different minimum and maximum values. The informal confidence intervals might be different but I will still expect to make the same claim.

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A school blazer manufacturer could use these results to determine the average length to make the arms on the blazers. They will also know that senior males generally have longer armspans than senior females and therefore they may decide that they may need to make different length arms on the blazers for senior male and females students.