

Exemplar

Excellence

Comparison investigation

(Box & Whisker plot)

1.1

Explore data using
a statistical inquiry
process (Internal)

NCEA Level 1

AS 91944

5 credits

TRAJECTORY
EDUCATION

Problem

I wonder whether the median height (m) is higher for rugby players who play as a 'Forward' compared to rugby players who play as a 'Back' out of all All Blacks players and Springbok players in the 2012/2013 season (from the NZGrapher dataset).

In rugby, a team usually has 7 backs and 8 forwards. 'Forwards' usually take part in set pieces to contest for the ball such as a scrum and line out (<https://www.activesgcircle.gov.sg/learn/rugby/rugby-positions-forward>). 'Backs' tend to fill specialist roles in the outfield (https://www.activesgcircle.gov.sg/learn/rugby/rugby-positions-backs?tab=how_to_play).

I chose to do this investigation because I play rugby and wonder whether forwards or backs tend to be taller. In my team, it is mixed, but when I watch international rugby tests I notice that the backs tend to be shorter.

The results could be useful for coaching staff for international rugby teams when deciding whether a player might be more suitable as a forward or a back, depending on their height. It could also help players themselves (who want to play rugby professionally) determine whether they are under/over the expected height for their particular position, and potentially make a role switch.

Since the data only relates to NZ and South African players, it might be difficult to apply the results to all international rugby teams. For example, according to the Japanese national team squad lineup in 2025/2026 (<https://www.ultimaterugby.com/japan/squad>) the Japanese rugby side has an average height of 1.83m (71.42/39). This is lower compared to the average height of the Springbok side of 1.88m in 2025/2026 (93.88/50) (<https://www.sarugby.co.za/sa-teams-players/springboks/>). This might mean that my results can only be applied for All Blacks and Springboks.

I'm expecting that the median height of players will tend to be higher for forwards than backs. This is just based off what I've seen in professional test matches, where forwards like Scott Barrett (1.97m) and Ardie Savea (1.9m) tend to be taller than backs like Sevu Reece (1.79m) and Finlay Christie (1.77m). Also, according to sources, "Forwards tend to be taller and heavier to generate power in scrums and mauls, while backs are generally leaner and faster to exploit space and handle quick passes." (<https://www.redbull.com/nz-en/rugby-union-player-positions-guide>). This suggests that being tall is an important advantage of forwards, because it means they can generate more power. So, this research also suggests that the forwards will be taller.

Plan

The dataset is from the NZGrapher 'Rugby' dataset. It is real data collected by rugby website 'RugbyHow' for the 2012/2013 season.

It is difficult to know whether the data is reliable because RugbyHow isn't an official/government website. We don't have any information on how it was collected (for example whether reserve players were included). However, because the data can easily be recorded/checked using other internet sources, I believe it will be reliable.

No cleaning of the data was required because there wasn't any incomplete data, and none of the data appeared to be incorrectly recorded.

Out of the total population of 154 players I took a random sample of 50 forwards and 50 backs. I used the 'random' sample tool on NZGrapher to do this. Taking a random sample helped ensure there's no bias in how the data is sampled.

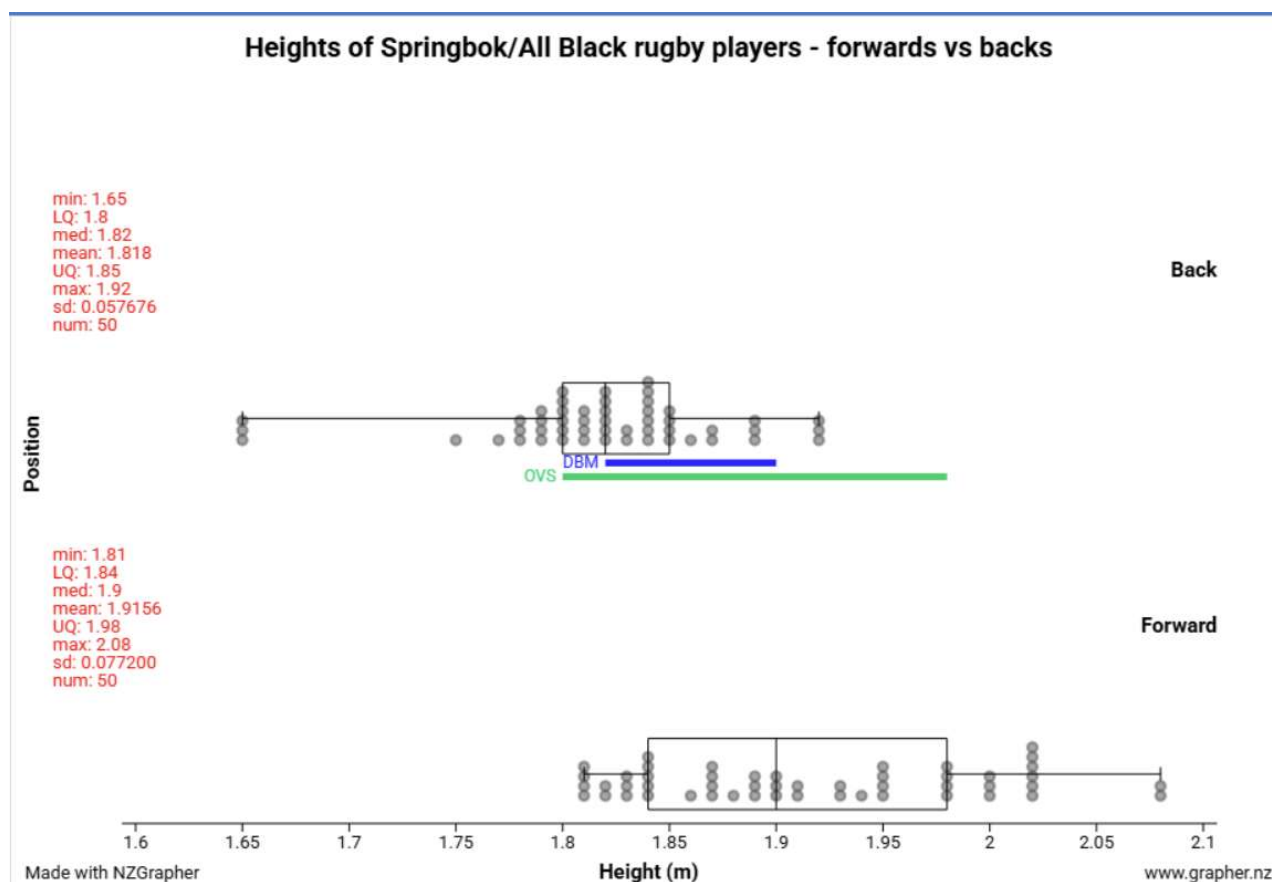
There might be occasion-to-occasion variation, which means that the same player might have a different height each time their measurement is taken. This is particularly for the younger players like Wallace Sititi, who could still have some growing to do. Also, players might switch between being forwards and backs, so they might be a forward at one point in time but switch to



being a back. To manage this variation, the data only looks at players' height at one particular point in time during the 2012/2013 season. We don't know exactly when the data was taken but we can assume it was all done at the start of the season, so this variation should be managed.

Another type of variation is measurement variation. This is the variation that occurs because there might be differences in how a player's height is measured, like different measuring equipment and methods. For example, whether the player was measured with or without shoes/socks. This variation is somewhat managed because International Rugby should have clear rules around how players' heights are measured, so there should not be too much measurement variation.

Data



Analysis – Box & Whisker plot

Centre:

For centre, I notice that the median height for backs is 1.82m and the median for forwards is 1.9m. This is a difference of 0.08m.



This means that forwards tend to be taller than backs by 8cm. I actually expected this difference to be slightly higher (about 15cm) based on watching the All Blacks lineup on TV, but this result does make sense as I didn't do a full analysis of the current All Blacks lineup and it's possible the forwards just appear bigger on TV than they actually are in real life.

Spread:

I notice that the IQR for backs is 0.05m and the IQR for forwards is 0.14m.

This means that the data for the height of backs has a lot less spread than the data for forwards. I find this interesting as it shows that there's a lot more variation in the heights of forwards compared to backs, which are much more concentrated around the 1.8m – 1.9m range.

This makes sense as forwards can still bulk up as much as they need to, regardless of their height. Backs, on the other hand, would struggle to be nimble enough the taller they get, so an ideal height for them might be around that 1.8m – 1.9m range.

Shift/Overlap:

I notice that the middle 50% of the data for backs is shifted to the left of the data for forwards. There is only 1cm overlap between the two groups (UQ of backs = 1.85m and LQ of forwards = 1.84m, so $1.85 - 1.84 = 1\text{cm}$).

Because there is very little overlap, it suggests that the middle 50% of backs tend to be quite different to forwards.

Unusual Features:

There is an interesting cluster of 3 backs at the 1.65m mark. They are quite far away from the next tallest player, which is 1.75m. It is possible that these players play a particular position which has really low weight requirements, for example scrum half. Scrum halves don't have much involvement in heavy collisions so they tend to be a lot smaller (see: <https://www.rugbypass.com/articles/scrum-half-halfback-position-guide/>). However, we can't verify whether these 3 players are scrum halves as we don't have specific data on this.

Making the call (DBM & OVS):

The Distance Between Medians (DBM) is 0.08m (shown in **blue** on the graph) and the OVS is 0.18m (shown in **green** on the graph).

Because the DBM is greater than 1/3 of the OVS, we can make the call that the median height (m) for forwards tends to be greater than the height for backs out of all All Blacks players and Springbok players in the 2012/2013 season (from the NZGrapher dataset).

Conclusion

Overall, based on the OVS/DBM as discussed in the analysis, there is sufficient evidence to make the call that the median height (m) for forwards tends to be greater than the height for backs out of all All Blacks players and Springbok players in the 2012/2013 season (from the NZGrapher dataset).

My analysis was based on a sample of 50 per group out of the dataset population of 135. Because of sampling variability, if I were to take another sample of the same population, it is possible that I would get different results. However, because I took a large sample, the results will probably be roughly the same.

Overall, my hypothesis was correct about forwards tending to be taller than backs out of all All Blacks players and Springbok players in the 2012/2013 season (from the NZGrapher dataset). This result can be expected from my observations of watching the All Blacks/Springbok test matches on TV. It also matches up with sources, for example in



<https://blog.networldsports.co.uk/rugby-union-positions-numbers-explained/> they explained that “The forwards are usually significantly larger and heavier, taller and have higher levels of body-fat relative to the backs, and use their size to gain ground, win possession of the ball in scrums and line-outs.”

In the future, it would be interesting to investigate how the heights of different particular rugby positions compare (e.g. scrum half compared to prop). This is because I noticed that, even within the forward packs/back packs, there seems to be a lot of variation in height depending on position. For example, I suspect the cluster of 3 backs all at 1.65m tall are scrum halves, but it's not possible to confirm this without doing a full investigation. This investigation would be useful for coaches to have more specific information about the expected heights of particular positions, and also look at what height the highest performing players have.

One reflection I have on the process is that it might have been better to look at all international rugby teams, not just All Blacks and Springboks. This is because different nationalities have biological differences which mean that their players have different builds. This can be seen on this statistics website which shows that the average height of boys ranges from 160cm (Timor-Leste) to 184cm (Netherlands) - <https://worldpopulationreview.com/country-rankings/average-height-by-country>.

Some limitations for this analysis is it might not be useful for amateur rugby coaches because the build of professional athletes is likely to be different to amateur rugby players. It might still be useful for provincial rugby competitions and Super Rugby because those players are professional. Another limitation is that the results are limited to being relevant to Springboks and All Blacks, not all countries.

