



# Modelling shooting performance across major international tournaments in elite men's wheelchair basketball

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# Introduction

- Limited research has been conducted in wheelchair basketball (Gómez et al., 2014; 2015; Goosey-Tolfrey et al. 2002)
- Reliability and validity issues surrounding the use of box score data (Viz et al., 2010)
- Shooting is one of the six key technical skills (Zwakhoven et al., 2003)

# Wheelchair Basketball Field-Goal Shooting

Francis et al. (2016) found shooting success :

- ↑ if the shooting player is positioned with his shoulders directly facing the basket.
- ↑ if the shooting player is releasing the ball from a higher release point.
- ↑ if the shooting player is 'near' the basket or from the '45' locations
- ↓ if the space around a shooting player's cylinder decreases.

# Research Aim

To explore the key determinants of two-point and three-point shooting across two major tournaments and develop a valid prediction model.



# Method

- Analysis of 2,432 shots from 30 games at the 2016 Paralympic Games
- Combined with the data from 1,144 shots from nine games during the 2015 European Championships (Francis et al., 2016)



2 Point	3 Point	Lay-Up	Set-Shot	Post-Up	24 - 18 seconds	17 - 13 seconds	12 - 7 seconds	6 - 0 seconds
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Q1	Q2	Pick n Roll	Curl	Catch & Shoot	Dribble & Shoot
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Q3	Q4	Square to Basket	0-90 Left	0-90 Right	Reverse
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Over Time	Stationary	Towards Basket	Away From Basket	Rotating Left	Rotating Right
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Winning

Drawing

Losing

High-Pointer

Mid-Pointer

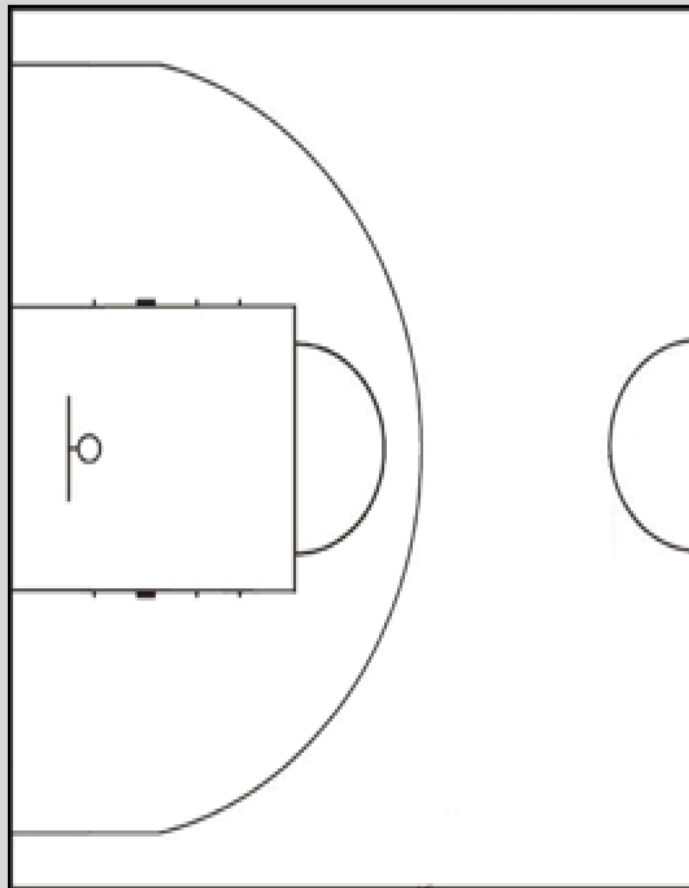
Low-Pointer

Left Hand

Right Hand

One Handed

Two Handed



Pressure				
P0	P1	P2	P3	P4

Number of Defenders					
0	1	2	3	4	5

Defender-In-Front - Yes	Defender-In-Front - No
Defender Behind - Yes	Defender Behind - No
Defender On Side - Yes	Defender On Side - No
Shooting Hand - Yes	Shooting Hand - No
Non-Shooting Hand - Yes	Non-Shooting Hand - No
Space - Yes	Space - No

Successful

Unsuccessful



# Results

	x-squared	DF	p-value
<b>Defenders Positioning – Defender in Front</b>	78.077	1	< 0.001
<b>Number of Defenders</b>	96.037	4	< 0.001
<b>Shot Clock Time Remaining</b>	101.07	3	< 0.001
<b>Point</b>	124.64	1	< 0.001
<b>Shot Positioning</b>	126.02	3	< 0.001
<b>Shot Type</b>	154.47	2	< 0.001
<b>Shot Location</b>	266.76	9	< 0.001
<b>Defenders Marking – Shooting Hand</b>	57.29	1	< 0.001
<b>Shot Movement</b>	66.839	4	< 0.001
<b>Pressure</b>	50.284	4	< 0.001
<b>Pre-Shot Action</b>	46.926	3	< 0.001
<b>Game Status</b>	37.037	2	< 0.001
<b>Shot Handed</b>	13.357	1	< 0.001
<b>Defenders Positioning – Defender Behind</b>	8.624	1	0.003
<b>Shot Hand</b>	6.8857	1	0.009
<b>Classification</b>	6.7191	2	0.035
<b>Defenders Marking – Non-Shooting Hand</b>	2.3766	1	0.123
<b>Defenders Positioning – Defender on Side</b>	0.33293	1	0.564
<b>Quarter</b>	2.4371	4	0.656
<b>Defenders Marking – Space</b>	0.16204	1	0.687
<b>Tournament</b>	0.00244	1	0.961

# The Shooting Model

Shot Location +  
Defenders Marking – Shooting Hand +  
Shot Positioning +  
Game Status +  
Shot Type +  
Shot Clock Time Remaining +  
Shot Movement +  
Number of Defenders +  
Pre-Shot Action +  
Classification +  
Pressure +

Defenders Positioning – Defender Behind +  
Defenders Marking – Non-Shooting Hand

Shot Success ~



# Intercept Model

When an athlete has a shot with the following:

Shot Location – 2 Point – Centre-Long

Shot Positioning – Square to Basket

Shot Type – Set Shot

Shot Clock Time Remaining – 6-0.1  
seconds

Shot Movement – Stationary

Pre-Shot – Catch and Shoot

Classification – Mid-Pointer

Number of Defenders – 0

Pressure - 0

Defender is Positioned - Behind

Defender is Marking - Shooting Hand

Defender is Marking – Non-Shooting  
Hand

Game Status - Drawing

He is going to be successful

**45.25%** of the time

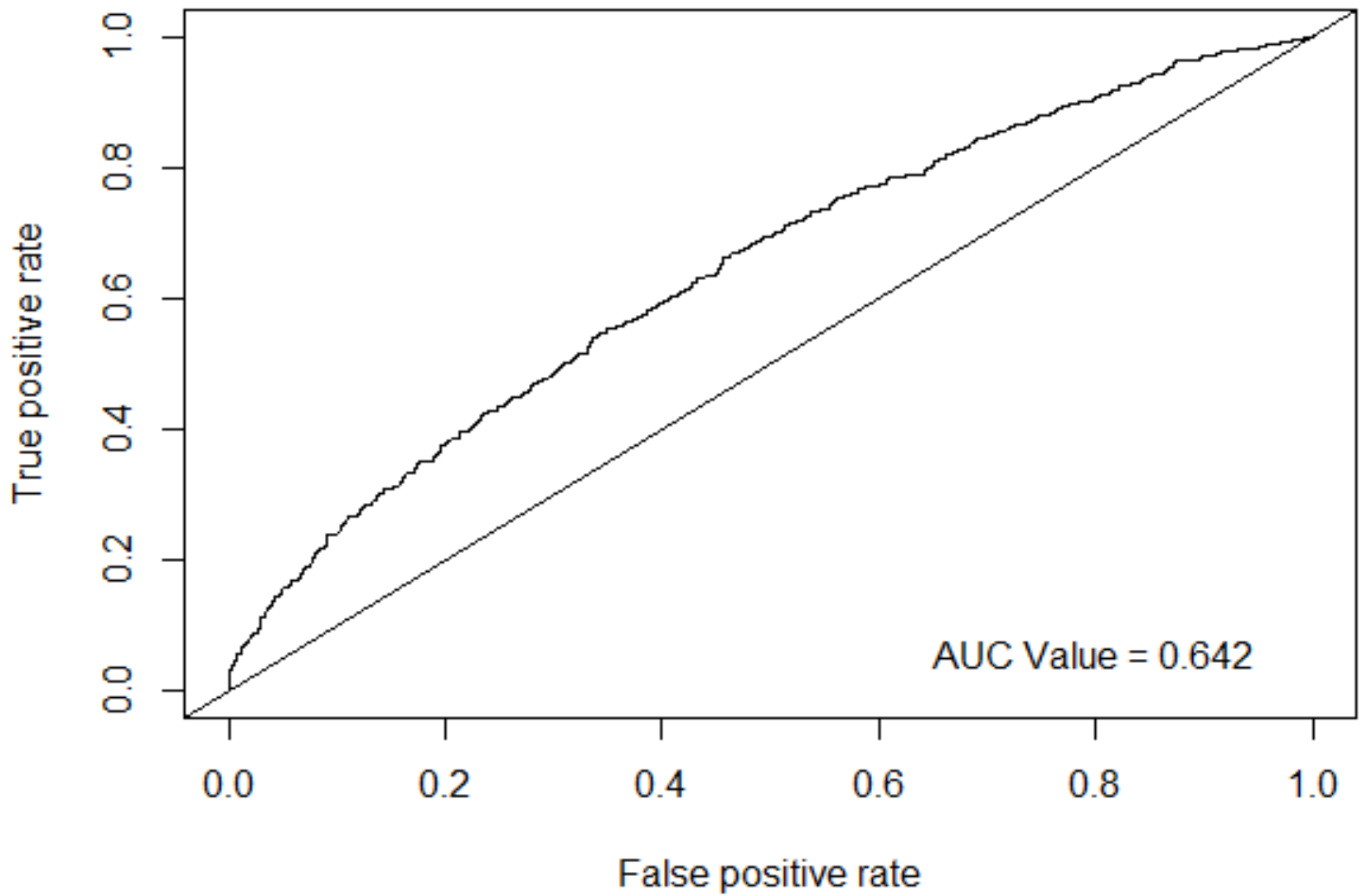
		Estimate	Odds	Propability	Affect
	(Intercept)	-0.19	0.83	45.25%	
Game Status	Losing	-0.34*	0.59	36.93%	-8.32%
	Winning	-0.11	0.74	42.53%	-2.72%
Shot Location	2 Point - Centre - Mid	0.18	0.99	49.84%	<b>4.59%</b>
	2 Point - Centre - Near	0.66*	1.60	61.59%	<b>16.33%</b>
	2 Point - Left - 45	0.32*	1.13	53.12%	<b>7.87%</b>
	2 Point - Left - Base	0.54*	1.42	58.72%	<b>13.47%</b>
	2 Point - Left - Elbow	0.08	0.90	47.25%	<b>2.00%</b>
	2 Point - Right - 45	0.60*	1.50	59.99%	<b>14.74%</b>
	2 Point - Right - Base	0.90*	2.03	66.96%	<b>21.70%</b>
	2 Point - Right - Elbow	0.26	1.07	51.79%	<b>6.53%</b>
	3 Point	-0.42*	0.54	35.09%	-10.17%
Shot Positioning	10-90 Left	-0.42*	0.54	35.13%	-10.12%
	10-90 Right	-0.39*	0.56	35.77%	-9.48%
	Reverse	-0.80*	0.37	27.04%	-18.22%

		Estimate	Odds	Propability	Affect
	(Intercept)	-0.19	0.83	45.25%	
Shot Type	Lay-Up	0.06	0.88	46.87%	<b>1.61%</b>
	Post-Up	0.33*	1.14	53.36%	<b>8.11%</b>
Shot Clock Time Remaining	12 - 7 seconds	0.23*	1.04	50.87%	<b>5.62%</b>
	17 - 13 seconds	0.32*	1.14	53.32%	<b>8.07%</b>
	24 - 18 seconds	0.50*	1.36	57.65%	<b>12.40%</b>
Shot Movement	Away From Basket	-0.48*	0.51	33.74%	-11.51%
	Rotating Left	0.01	0.83	45.43%	<b>0.18%</b>
	Rotating Right	-0.10	0.75	42.74%	-2.52%
	Towards Basket	-0.01	0.81	44.89%	-0.37%
Pre-Shot Action	Curl	-0.44	0.53	34.74%	-10.51%
	Dribble & Shoot	-0.28*	0.63	38.48%	-6.78%
	Pick n Roll	-0.06	0.78	43.72%	-1.53%
Classification	High-Pointer	0.15*	0.96	49.04%	<b>3.79%</b>
	Low-Pointer	-0.21*	0.67	40.18%	-5.08%

		Estimate	Odds	Propability	Affect
	(Intercept)	-0.19	0.83	45.25%	
Defender Marking - Shooting Hand	No	0.38*	1.21	54.81%	<b>9.55%</b>
Defenders Positioning – Defender Behind	No	-0.18	0.69	40.81%	-4.45%
Number of Defenders	One	-0.40*	0.55	35.54%	-9.71%
	Two	-0.34*	0.59	37.11%	-8.14%
	Three or More	-0.28	0.62	38.34%	-6.92%
Pressure	One	0.06	0.88	46.84%	<b>1.59%</b>
	Two	-0.20	0.67	40.29%	-4.97%
	Three	-0.40*	0.55	35.57%	-9.68%
	Four	-0.47	0.51	33.96%	-11.29%

\* p<0.05

# ROC curve



# Practical Application

- What are the key points for a shooting player to consider?
  - Shot Location (Odds Ratio: 0.90-2.03)
  - Shot Positioning (Odds Ratio: 0.37-0.56)
  - As time decrease success decreases
  - 3.5, 4.0 and 4.5 players have a higher odds of success (0.96)



# Practical Applications

- How is it best to defend a shooting player?
  - If defensive pressure increases shooting success decreases
  - Defending the players shooting hand decreases shooting success

# Conclusion

- Tournament had no significant effect
- More variables in comparison to Francis et al.'s (2016) model
  - Rotating Left produced a lower odds ratio (Euro 36.07; Both 0.83)
  - Defender Marking Space or Non-Shooting Hand were not included in the new model
- Shooting from the 2 Point - Right - Base Shot Location had the highest odds of success

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