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Technical performance differences amongst international netball teams at the Commonwealth Games 2022

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ABSTRACT

Team and opposition quality are factors that can influence netball performance. Although these effects are present within domestic netball, there is currently no assessment of these at the international level. The aim of this study was to assess performance differences between teams during all competition stages and matches at the 2022 Commonwealth Games. Thirty-six fixtures from all 12 teams were analysed, with performance indicators (PIs) relating to centre passes, turnovers and goal scoring assessed. Teams were split into three groups based on their finishing position in the competition (top 4, middle 4, bottom 4). When assessing team quality differences, significant differences were revealed for all but three PIs between groups (total number of restart and live turnovers and the total number of these combined). The quality of the opponent was also found to affect teams differently, with top-quality teams performing more consistently than lower-quality teams and being able to beat these teams by large winning margins (average of 55 goals and 26 goals versus bottom-quality and middle-quality teams respectively). Therefore, lower-quality teams should focus on implementing clear and effective tactical plans prior to matches, and performance analysis tools should be created for these teams to raise the quality of international netball.

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Netball; commonwealth; international; performance indicators; team quality

1. Introduction

Within netball, team success is heavily dependent on keeping possession (O'Donoghue, 2006). Performance Indicators (PIs) relating to possession and shooting are therefore fundamental to success (O'Donoghue & Longville, 2004), as a team can only score a goal when they have possession of the ball (Navin, 2008) which is gained through a centre pass or a turnover (O'Donoghue, 2006; O'Donoghue & Longville, 2004). It is also important to consider team quality, and the quality of the opposition when assessing team performance, as research has found that team and opposition quality influence the technical PI values in multiple invasion games (Carroll, 2013; Lord et al., 2022; Parmar et al., 2017; Taylor et al., 2008), including netball (O'Donoghue & Longville, 2004; O'Donoghue et al., 2008; Rose, 2013).

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When assessing team and opposition quality influences in netball, O'Donoghue and Longville (2004), O'Donoghue (2006) and O'Donoghue et al. (2008) all found that more successful teams were able to score from a higher percentage of centre passes than less successful teams and that as the standard of opposition quality decreased, the possessions converted to goal increased. O'Donoghue (2006) suggested that the oppositional effects were different for teams of differing standards, which is consistent with O'Donoghue et al. (2008). Findings from O'Donoghue et al. (2008) suggested that top-half teams scored from a similar percentage of centre passes regardless of the quality of the opposition, whereas bottom-half teams scored from a significantly greater percentage of centre passes ($p < .05$) against bottom-half opponents than when against top-half opponents. A similar pattern can also be seen in turnover possession statistics, with O'Donoghue et al. (2008) finding successful teams achieved more turnovers in a match than less successful teams, and that successful teams were able to score from a higher percentage of turnovers. Similarly, Bruce et al. (2018) suggested that more successful teams were able to execute basic skills better under pressure than less successful sides, such as high shooting percentages and successful centre pass receives, and performed a more "universal" style of play relative to their opponents.

Opposition and team quality effects can also be noticed at the international level too within invasion games, with Kubayi and Larkin (2022) finding that in international football (African Cup of Nations Competition (AFCON)), more successful, winning teams performed significantly better than losing teams on shots, shots on target and shots from counter-attacks. Similarly, Drikos et al. (2022) found that in international volleyball (at the men's European Championship 2019) opposition quality effects were present and for balanced matches (i.e. a higher quality team versus a higher quality team), the efficacy of the attack was most important due to a lack of large performance differences between the two teams. Although research reveals opposition and team quality effects at the domestic league level in netball, there are currently no studies to assess this at the international level.

Due to an elaborate ranking process (World Netball, 2023) and other external factors such as funding and government support, large performance differences are often noticed between international netball teams of different rankings. For example, the 2022 Commonwealth Games saw Jamaica become the first team to score more than 100 goals in a game, beating Barbados (who were only ranked eight positions lower than them) 103–24. Couple this with a lack of research investigating performance differences within international netball, this calls for an assessment of team and opposition quality within netball at the international level. This will allow teams of a lower ranking to assess their performance in comparison to higher-ranking teams, potentially allowing for an improvement in the overall standard of International and World Netball. This will also allow for teams of a similar standard to notice where minor differences in technical gameplay are essential for success. Therefore, the aim of this study was to assess the performance differences between teams during all matches at the 2022 Commonwealth Games

2. Methods

2.1. Sample

A total of 38 fixtures were played in the 2022 Commonwealth Games competition, with 30 fixtures being played within the pool rounds and 8 in the positioning rounds. All eight

Table 1. CWG ranking and finishing position at the CWG 2022 competition.

Team	Finishing Position at the CWG Competition 2022	Commonwealth Games Ranking (July 2022)
Australia (Top 4)	1	1
Jamaica (Top 4)	2	4
New Zealand (Top 4)	3	2
England (Top 4)	4	3
Uganda (Middle 4)	5	7
South Africa (Middle 4)	6	5
Malawi (Middle 4)	7	6
Wales (Middle 4)	8	9
Scotland (Bottom 4)	9	8
Northern Ireland (Bottom 4)	10	11
Trinidad & Tobago (Bottom 4)	11	10
Barbados (Bottom 4)	12	12

fixtures from the positioning rounds were included and analysed as part of the sample; however, due to recording and streaming issues, only 28 fixtures from the pool rounds were included and analysed. As a result, a total of 36 fixtures were included as part of the sample.

A total of 12 teams competed in the competition, with varying ranking positions (Table 1). At the beginning of the competition, teams were split into two pools; Pool A and Pool B. The top two teams from each Pool progressed straight into the Semi-finals, whilst the remaining four teams in each pool played for the relevant positions (i.e. two teams at the bottom of each pool performed in the play-off for 11th and 12th places). The two teams that lost the semi-finals then played in the 3rd and 4th place play-off, with the winners going into the final. For this study, teams were split into three groups based on the team's finishing position in the competition; top 4, middle 4 and bottom 4. Fixtures were then split into nine different categories based on team quality and opposition quality; TvT, TvM, TvB, MvT, MvM, MvB, BvT, BvM and BvT. For top team performances, there were 12 Top team v. Top team (TvT) fixtures, 6 Top team v. Middle team (TvM) fixtures, and 8 Top team v. Bottom team (TvB) fixtures. For middle team performances, there were 7 Middle team v. Top team (MvT) fixtures, 7 Middle team v. Middle team (MvM) fixtures, and 9 Middle team v. Bottom team (MvB) fixtures. For bottom team performances, there were 7 Bottom team v. Top team (BvT) fixtures, 9 Bottom team v. Middle team (BvM) fixtures, and 7 Bottom team v. Bottom team (BvB) fixtures.

2.2. Procedure

Matches were accessed from publicly available streaming services, including the BBC iPlayer (https://www.bbc.co.uk/iplayer) and YouTube (https://www.youtube.com). Match footage was downloaded and imported into Hudl Sportscode™ Pro (Version 12.5.0, Hudl, U.S.A.). Using this software, ball possessions, from centre passes and turnovers and the percentage of these possessions that led to a goal were calculated and coded, and how teams gained possession of the ball either through a Live or Restart turnover (see operational definitions) were also coded. Circle feeds and feed success rate and individual shooting statistics were also coded and calculated. A bespoke code window and output window were used to analyse fixtures and determine the statistics (Appendix 1). All matches were coded post-match by two

experienced and independent analysts (who both had 7+ years working as a performance analyst in netball). Once all fixtures were coded and analysed, data was exported to Microsoft Excel (Microsoft, U.S.A.). Data were organised by team quality (top 4, middle 4 or bottom 4), match type (TvT, TvM, TvB, MvT, MvM, MvB, BvT, BvM and BvB) and outcome (win or loss).

2.3. Operational definitions

Definitions of performance indicators were taken from Mackay et al. (2023) and England Netball guidelines (Appendix 2). Definitions are listed in Table 2.

2.4. Reliability

Reliability between researchers was tested through inter-observer techniques. This was performed by re-analysing four randomly selected matches to represent over 10% of the matches analysed. For inter-observer testing, the matches that were selected were coded by the other independent analyst who did not conduct the original analysis. Inter-rater reliability testing was conducted using intraclass correlation coefficient (ICC) analysis using a 2-way mixed effects approach. It was determined to be excellent inter-rater reliability between the researchers, with ICC reported as 0.980–1.000 for all variables measured (Appendix 3).

2.5. Data analysis

Data were imported into IBM SPSS Statistics (IBM SPSS Statistics 27, U.S.A.) and were tested for normality using the Shapiro–Wilk normality test. All data were

Table 2. Operational definitions of selected KPIs.

Performance Indicator	Definition
Centre Pass (CP) (to goal)	A restart in play from the centre circle, at the start of each quarter and after each goal, taken alternatively by the Centre of each team. *For the event to show as to goal, a goal had to be scored. If a goal was not scored, and/or there was a change in possession, this was not deemed a CP to goal
Restart Turnover (to goal)	When possession changes because a player on the team in possession makes an error or infringement that results in a restart in play. This included umpire calls (penalties against the team in possession) and the ball going out of court (sideline and goal-line) *For the event to show as to goal, a goal had to be scored. If a goal was not scored, and/or there was a change in possession, this was not deemed as a turnover to goal
General play/Live Turnover (to goal)	When possession changes team in general play without umpire call/intervention and play then continues (e.g. an interception or defensive rebound). If this event occurs, and there is an umpire call/intervention after the ball has changed possession, the event will still be deemed as a live turnover as this was the first instance to occur. *For the event to show as to goal, a goal had to be scored. If a goal was not scored, and/or there was a change in possession, this was not deemed as a turnover to goal
Successful feed	When a pass from outside the shooting circle is successfully thrown and received in the shooting circle by a shooter (GA or GS) who has both feet in the shooting circle. If two passes are made in quick succession this counts as two feeds.
Unsuccessful feed	When a player attempts to throw the ball into the shooting circle from outside of the shooting circle, but it does not land, e.g. it goes out of court/goes straight over to the other side of the circle/intercepted or tipped by a defender.
Goal	A shot at goal during match play that is successful taken by the GA or GS
Miss	Missed shot by GA or GS. If a player missed a shot, but a penalty is called and the shot is re-taken, then the first miss is not coded

deemed to be non-parametric as significance values were $p < .05$ for variables and failed to satisfy assumptions of normality ($p > .01$). Data is presented as Median, with upper and lower quartiles (Q1, Q3). Descriptive statistics were also calculated for each standard of team (top, middle and bottom) and for each match type. A Kruskal-Wallis ANOVA test, with significance set at $p \leq .05$, was performed on the data to determine differences between teams of different standard (top, middle and bottom) across all fixtures, and within each standard (Top team performances (TvT, TvM and TvB), Middle team performances (MvT, MvM and MvB) and Bottom team performances (BvT, BvM and BvB)). This test was performed as data came from different sets of matches and teams. The Dunn test was used for post-hoc testing after the Kruskal–Wallis test to determine significant differences at the quality level (Top v. Middle, Top v. Bottom and Middle v. Bottom) and opposition quality level for each standard (i.e. TvT v. TvM, TvT v. TvB and TvM v. TvB) (Elliott & Hynan, 2011). A Bonferroni correction was applied to adjust significance values and to control for Type 1 error rate when conducting multiple comparisons. Eta-Squared (η^2) effect sizes were also calculated to assess the magnitude of the differences between groups. Effect sizes were considered to be small ($\eta^2 = 0.01–0.05$), medium ($\eta^2 = 0.06–0.13$) and large ($\eta^2 = 0.14$ or higher) (Cohen, 1988).

3. Results

3.1. Team quality differences

Significant differences were revealed for all indicators between, top, middle and bottom teams, except for the number of RTO, LTO and Total TO (Table 3). Post-hoc analysis revealed that top teams had and converted significantly more centre passes than bottom teams, whilst middle teams converted significantly more centre passes than bottom teams. Similarly, top and bottom teams converted significantly more RTO to goal than bottom teams. Additionally, top teams were able to have a higher number of LTO to goal than middle and bottom teams, but conversely, top and middle teams were able to convert a higher percentage of LTO than bottom teams. Moreover, top teams converted significantly more total TOs (total number and percentage) than bottom teams, whilst middle teams converted a significantly higher percentage of total TOs to goal than bottom teams. Top and middle teams also had a significantly higher number of shots and goals, and a significantly higher shooting percentage than bottom teams. Finally, top teams had a higher number of circle feeds and successful feeds than middle and bottom teams, but when looking at the successful feed percentage, top teams had a significantly higher percentage than bottom teams but not middle teams (Table 3).

3.2. Opposition quality

3.2.1. Top team performances

For CP performance, only one significant difference was identified for top team performances (CP to goal percentage). Post-hoc analysis revealed that when playing a bottom-quality opposition, top-quality teams were able to convert a significantly higher percentage of CP to goal than when playing a top-quality opposition. For turnover performance, significant

Table 3. Median *(Q1, Q3)* for possession, shooting and feeding statistics for top, middle and bottom teams during all stages of the competition.

	Top Teams	Middle Teams	Bottom Teams	p-Value	Effect Size
No. of CP	56 *(51, 59)*†	53 *(50, 60)*	49 *(47, 53)*	$p < .05$	0.10
No. of CP to Goal	43 *(37, 48)*†	38 *(33, 42)*†	22 *(18, 29)*	$p < .001$	0.53
CP to Goal %	77 *(72, 84)*†	72 *(61, 77)*†	49 *(40, 58)*	$p < .001$	0.47
No. of RTO	13 *(8, 18)*	10 *(8, 16)*	10 *(7, 14)*	$p = 0.553$	−0.01
No. of RTO to Goal	9 *(6, 15)*†	7 *(6, 13)*†	5 *(3, 7)*	$p < .001$	0.17
RTO to Goal %	77 *(69, 88)*†	72 *(67, 86)*†	44 *(40, 60)*	$p < .001$	0.43
No. of LTO	15 *(10, 20)*	9 *(6, 18)*	11 *(8, 15)*	$p = .101$	0.04
No. of LTO to Goal	11 *(7, 16)*†, ^	7 *(4, 11)*	4 *(2, 7)*	$p < .001$	0.21
LTO to Goal %	76 *(69, 85)*†	67 *(56, 78)*†	44 *(25, 55)*	$p < .001$	0.43
No. of Total TO	25 *(19, 38)*	20 *(16, 14)*	23 *(15, 28)*	$p = .174$	0.02
No. of Total TO to Goal	18 *14, 31)*†	13 *(11, 24)*	10 *(6, 15)*	$p < .001$	0.21
Total TO to Goal %	76 *(71, 81)*†	69 *(63, 77)*†	45 *(29, 57)*	$p < .001$	0.53
Total Losses in Possession	19 *(14, 21)*†	21 *(16, 29)*†	36 *(30, 41)*	$p < .001$	0.52
No. of Shots	69 *(61, 84)*†	61 *(53, 69)*†	44 *(36, 54)*	$p < .001$	0.36
No. of Goals	67 *(55, 75)*†	54 *(48, 62)*†	33 *(26, 42)*	$p < .001$	0.50
Shooting %	92 *(89, 95)*†	89 *(85, 91)*†	76 *(68, 83)*	$p < .001$	0.55
Total No. of Circle Feeds	91 *(84, 102)*†, ^	78 *(61, 88)*	69 *(50, 76)*	$p < .001$	0.26
Total No. of Successful Feeds	85 *(76, 96)*†, ^	70 *(56, 83)*	55 *(44, 65)*	$p < .001$	0.31
Successful Feed %	93 *(90, 94)*†	88 *(86, 94*	87 *(79, 92)*	$p < .05$	0.19

^Denotes significant difference to Middle Teams ($p < .05$).
†Denotes significant difference to Bottom Teams ($p < .05$).

differences were found for the number of RTO and LTO (total and to goal), but not for percentage to goal. When playing bottom-quality opposition, top-quality teams were able to gain a significantly higher number of RTO and LTO and converted a significantly higher number of these to goal than when playing a top-quality opposition. For total TO performance top-quality teams had significantly more total TO, TO to goal and TO to goal percentage when playing a bottom-quality opposition than when against a top-quality opposition. Furthermore, top-quality teams had significantly more total TO when playing a middle-quality opposition than when against a top-quality opposition. When playing a bottom-quality opposition, top-quality teams were able to have a significantly higher number of shots, goals, circle feeds, and successful circle feeds than when playing a top-quality opposition. There were no other significant differences determined for PIs for top teams. For all significant results, Eta-squared calculations revealed large effect sizes (Table 4).

3.2.2. Middle team performances

For CP performance only one significant difference was identified for middle team performances (CP to goal percentage). Post-hoc analysis revealed that when playing bottom-quality and middle-quality opposition, middle-quality teams were able to convert a significantly higher percentage of CP to goal than when playing a top-quality opposition. For turnover performance, significant differences were found for the number of RTO and LTO (total and to goal), and for LTO to goal percentage but not RTO to goal percentage. When playing a bottom-quality opposition, middle-quality teams were able to gain a significantly higher number of LTO and LTO to goal, than when playing a top-quality opposition. Further, middle-quality teams had a significantly higher LTO to goal percentage against middle-quality teams than when against top-quality teams. Middle-quality teams had significantly more total RTO and RTO to goal against middle-quality teams than when against bottom-quality opposition. For total TO performance, middle-quality teams had significantly more

Table 4. Median *(Q1, Q3)* for possession, shooting and feeding statistics for top team performances (TvT, TvM, TvB) during all stages of the competition.

	TvT	TvM	TvB	*p*- Value	Effect Size
No. of CP	55 *(52, 56)*	58 *(50, 61)*	55 *(50, 59)*	$p = .752$	−0.06
No. of CP to Goal	40 *(37, 44)*	46 *(36, 54)*	48 *(39, 49)*	$p = .294$	0.02
CP to Goal %	72 *(71, 80)*†	80 *(74, 88)*	84 *(75, 87)*	$p < .05$	0.25
No. of RTO	8 *(7, 11)*†	14 *(11, 16)*	22 *(16, 26)*	$p < .001$	0.71
No. of RTO to Goal	6 *(5, 7)*†	10 *(9, 12)*	18 *(15, 22)*	$p < .001$	0.72
RTO to Goal %	71 *(64, 85)*	76 *(69, 90)*	84 *(75, 88)*	$p = 0.317$	0.01
No. of LTO	10 *(8, 13)*†	17 *(13, 20)*	21 *(16, 31)*	$p < .001$	0.64
No. of LTO to Goal	7 *(5, 9)*†	12 *(9, 14)*	18 *(14, 25)*	$p < .001$	0.64
LTO to Goal %	76 *(64, 84)*	72 *(67, 78)*	81 *(74, 86)*	$p = 0.230$	0.04
No. of Total TO	19 *(17, 21)*†, ^	32 *(24, 36)*	41 *(37, 54)*	$p < .001$	0.79
No. of Total TO to Goal	14 *(10, 17)*†	22 *(18, 27)*	35 *(31, 44)*	$p < .001$	0.80
Total TO to Goal %	73 *(64, 80)*†	73 *(68, 79)*	79 *(77, 87)*	$p < .05$	0.19
Total Losses in Possession	19 *(17, 21)*	17 *(13, 24)*	17 *(13, 21)*	$p = .576$	−0.04
No. of Shots	61 *(55, 64)*†	75 *(69, 78)*	89 *(80, 103)*	$p < .001$	0.78
No. of Goals	55 *(51, 59)*†	69 *(64, 75)*	79 *(73, 91)*	$p < .001$	0.73
Shooting %	92 *(89, 96)*	93 *(89, 97)*	91 *(86, 94)*	$p = .418$	−0.01
Total No. of Circle Feeds	85 *(69, 90)*†	92 *(87, 95)*	110 *(96, 121)*	$p < .05$	0.40
Total No. of Successful Feeds	77 *(63, 84)*†	85 *(77, 88)*	100 *(90, 103)*	$p < .05$	0.36
Successful Feed %	93 *(91, 95)*	92 *(90, 93)*	92 *(89, 94)*	$p = .451$	−0.02

^Denotes significant difference to Middle-QualityOpposition (TvM) ($p < .05$).
† Denotes significant difference to Bottom-Quality Opposition (TvB) ($p < .05$).

total TO, TO to goal and TO to goal percentage when playing a bottom-quality opposition than against a top-quality opposition. Furthermore, middle-quality teams had significantly more TO to goal percentage when playing a middle-quality opposition than against a top-quality opposition. Moreover, middle-quality teams had significantly more total TO and total TO to goal against bottom-quality teams than when against middle-quality teams. Middle-quality teams had significantly more shots and goals against bottom-quality opposition than when against top-quality opposition. Also, middle-quality teams had a significantly lower shooting percentage against top-quality teams than when against middle-quality and bottom-quality teams. Finally, middle-quality teams were able to have a significantly higher number of circle feeds against a bottom-quality opposition than when against a top-quality opposition and a significantly higher number of successful circle feeds against bottom-quality opposition than when against a top-quality and middle-quality opposition. There were no other significant differences determined for PIs for middle teams. For all significant results, Eta-squared calculations revealed large effect sizes (Table 5).

3.2.3. Bottom team performances

For CP performance, only one significant difference was identified for bottom team performances (CP to goal percentage). Post-hoc analysis revealed when playing top-quality opposition, bottom-quality teams converted a significantly lower percentage of CP to goal than when playing a middle-quality and bottom-quality opposition. For turnover performance, significant differences were found for RTO (total and to goal) and LTO (total, to goal and LTO to goal percentage). When playing top-quality opposition, bottom-quality teams had significantly less RTO (total and to goal) than when playing a bottom-quality opposition. Moreover, bottom-quality teams had significantly less LTO (total, to goal, and LTO to goal percentage) when playing top-quality opposition and less LTO and LTO to goal when playing middle-quality opposition than when playing a bottom-quality opposition. For total TO

Table 5. Median *(Q1, Q3)* for possession, shooting and feeding statistics for middle team performances (MvT, MvM, MvB) during all stages of the competition.

	MvT	MvM	MvB	p-Value	Effect Size
No. of CP	59 *(51, 60)*	52 *(51, 61)*	50 *(46, 61)*	$p = .504$	−0.03
No. of CP to Goal	31 *(24, 41)*	40 *(38, 43)*	36 *(34, 51)*	$p = .116$	0.12
CP to Goal %	53 *(42, 67)* †, ^	73 *(72, 77)*	76 *(70, 84)*	$p < .05$	0.46
No. of RTO	9 *(9, 15)*	8 *(6, 10)*†	16 *(11, 19)*	$p < .05$	0.42
No. of RTO to Goal	7 *(4, 10)*	6 *(4, 6)*†	13 *(9, 14)*	$p < .05$	0.50
RTO to Goal %	67 *(57, 75)*	70 *(60, 86)*	76 *(70, 94)*	$p = .162$	0.08
No. of LTO	8 *(4, 9)*†	7 *(6, 10)*	18 *(13, 21)*	$p < .05$	0.35
No. of LTO to Goal	3 *(2, 4)*†	5 *(4, 7)*	11 *(9, 15)*	$p < .05$	0.41
LTO to Goal %	50 *(44, 60)* ^	78 *(70, 83)*	67 *(59, 78)*	$p < .05$	0.42
No. of Total TO	19 *(13, 24)*†	16 *(12, 20)*†	34 *(26, 39)*	$p < .05$	0.45
No. of Total TO to Goal	11 *(8, 13)*†	11 *(10, 14)*†	24 *(18, 30)*	$p < .05$	0.50
Total TO to Goal %	58 *(54, 67)*†, ^	73 *(65, 81)*	73 *(67, 78)*	$p < .05$	0.34
Total Losses in Possession	32 *(34, 37)*†, ^	17 *(16, 21)*	18 *(14, 28)*	$p < .05$	0.42
No. of Shots	51 *(41, 58)*†	61 *(53, 67)*	70 *(64, 78)*	$p < .05$	0.47
No. of Goals	43 *(35, 49)*†	54 *(48, 56)*	62 *(57, 70)*	$p < .05$	0.50
Shooting %	84 *(83, 86)*†, ^	91 *(89, 94)*	90 *(88, 92)*	$p < .05$	0.38
Total No. of Circle Feeds	67 *(58, 83)*†	62 *(60, 78)*	88 *(80, 105)*	$p < .05$	0.32
Total No. of Successful Feeds	61 *(43, 70)*†	59 *(52, 70)*†	83 *(73, 91)*	$p < .05$	0.41
Successful Feed %	85 *(78, 88)*	89 *(87, 90)*	94 *(86, 96)*	$p = .073$	0.16

^ Denotes significant difference to Middle-Quality Opposition (MvM) ($p < .05$).
† Denotes significant difference to Bottom-Quality Opposition (MvB) ($p < .05$).

performance, bottom-quality teams had significantly less total TO, TO to goal and TO to goal percentage when playing a top-quality opposition and less TO to goal middle-quality opposition than when against a bottom-quality opposition. Bottom-quality teams had significantly less shots and goals when playing top-quality and significantly less shots playing middle-quality opposition than when playing bottom-quality opposition. Finally, bottom-quality teams had significantly less circle feeds and successful circle feeds against top-quality opposition than when against bottom-quality opposition and a significantly lower successful feed percentage against top-quality opposition than when against middle-quality opposition. There were no other significant differences determined for PIs for bottom teams. For all significant results, Eta-squared calculations revealed large effect sizes (Table 6).

4. Discussion

The aim of this study was to explore the performance differences between international netball teams during the Commonwealth Games. The key findings revealed during the Commonwealth Games both top-quality and middle-quality teams had significantly higher CP, turnover, shooting and feeding statistics compared to bottom-quality teams. However, top-quality and middle-quality teams overall were comparable in the number of these PIs. When factoring in opposition team quality, for significant results, all teams had significantly lower PIs (apart from total losses in possession which were significantly higher) when playing against top-quality teams than against middle-quality and bottom-quality teams. Furthermore, some significant differences were also noticed for all teams when playing against middle-quality opposition, yet these were not as frequent as when playing against bottom-quality opposition.

There were significant differences revealed for all possession statistics between teams of different quality. Top-quality and middle-quality teams were able to convert significantly

Table 6. Median *(Q1, Q3)* for possession, shooting and feeding statistics for bottom team performances (BvT, BvM, BvB) during all stages of the competition.

	BvT	BvM	BvB	p-Value	Effect Size
No. of CP	52 *(49, 57)*	48 *(46, 54)*	47 *(38, 52)*	$p = .060$	0.18
No. of CP to Goal	18 *(13, 21)*	24 *(22, 32)*	25 *(20, 36)*	$p < .05$	0.21
CP to Goal %	31 *(25, 41)*†, ^	52 *(47, 60)*	53 *(46, 77)*	$p < .05$	0.43
No. of RTO	7 *(6, 12)*†	10 *(8, 13)*	14 *(10, 20)*	$p < .05$	0.28
No. of RTO to Goal	3 *(3, 5)*†	5 *(3, 7)*	7 *(5, 13)*	$p < .05$	0.32
RTO to Goal %	42 *(38, 60)*	42 *(29, 57)*	60 *(44, 65)*	$p = .160$	0.08
No. of LTO	6 *(6, 12)*†	10 *(9, 14)*	20 *(13, 22)*	$p < .05$	0.36
No. of LTO to Goal	2 *(2, 3)*†	4 *(2, 6)*†	11 *(6, 16)*	$p < .05$	0.55
LTO to Goal %	33 *(17, 44)*†	40 *(23, 51)*	62 *(46, 64)*	$p < .05$	0.33
No. of Total TO	14 *(13, 21)*†	21 *(17, 26)*	33 *(28, 40)*	$p < .05$	0.52
No. of Total TO to Goal	6 *(5, 7)*†	11 *(5, 13)*†	18 *(15, 26)*	$p < .05$	0.54
Total TO to Goal %	36 *(24, 50)*†	44 *(27, 53)*	57 *(45, 65)*	$p < .05$	0.25
Total Losses in Possession	41 *(36, 56)*†	34 *(29, 42)*	33 *(24, 38)*	$p < .05$	0.28
No. of Shots	34 *(29, 36)*†, ^	45 *(39, 53)*	60 *(51, 73)*	$p < .001$	0.60
No. of Goals	24 *(20, 27)*†	33 *(28, 42)*	43 *(41, 63)*	$p < .05$	0.57
Shooting %	75 *(56, 77)*	76 *(68, 80)*	83 *(68, 86)*	$p = .463$	−0.02
Total No. of Circle Feeds	50 *(47, 59)*†	70 *(51, 77)*	71 *(62, 106)*	$p < .05$	0.23
Total No. of Successful Feeds	41 *(34, 50)*†	64 *(45, 68)*	62 *(53, 93)*	$p < .05$	0.37
Successful Feed %	76 *(72, 85)*^	90 *(84, 92)*	88 *(84, 92)*	$p < .05$	0.34

^Denotes significant difference to Middle-Quality Opposition (BvM) ($p < .05$).
†Denotes significant difference to Bottom-Quality Opposition (BvB) ($p < .05$).

more CP to goal than bottom teams, and when looking at the effects of opposition quality, top-quality teams were more consistent in their CP performance. Middle-quality and bottom-quality teams were both able to convert more of their centre passes against middle-quality and bottom-quality opposition than when against top-quality opposition. Whereas top-quality teams only converted significantly more of their CPs against bottom-quality opponents than when against middle-quality and top-quality teams. A similar pattern can be seen for both RTO and LTO to goal both in percentages and total numbers, where top-quality teams had more consistent performances regardless of opposition (also noticed by lack of significant differences for the percentage conversions of these events to goal). Moreover, there was a decrease in CP and TO totals and conversion rates when teams played opposition of better quality, particularly against top-quality opposition. This coincides with previous research by O'Donoghue et al. (2008), who found that top-half teams did not score from a significantly greater percentage of CP and TO against bottom-half opponents than when against top-half opponents but did gain significantly more turnovers. It was also found that bottom-half teams were able to score from a significantly higher percentage of possessions against similar bottom-half opposition than when against top-half opposition, thus suggesting that opposition quality affects top-half and bottom-half teams differently, which is apparent in the results of this current study.

Additionally, there were no significant differences between top-quality and middle-quality, teams and opposition, for total circle feeds and total successful circle feeds. Furthermore, a decrease in the total number of circle feeds can be observed against top-quality opposition without a decrease in shooting percentage for top-quality and bottom-quality teams. Possession is key in netball and can only come from two key events, possession of the team's own CP, or turning over the opposition's CP. Within this study, it was determined that having more possessions equates to more scoring opportunities, thus a higher likelihood of winning. Therefore, higher quality teams were more successful

than lower quality teams as they were scoring from more of their own possessions, and creating more turnovers and converting them to goal. This is further demonstrated by the average winning margins, with higher quality teams having greater winning margins against lower quality teams (e.g. TvB: 55 goals, TvM: 26 goals, TvT: 8 goals). Teams that can consistently move the ball forward from a CP can give the shooters the best chance to set up and score (Woodlands, 2006), and research by Ofoghi et al. (2021) determined that when international teams lost games, more turnovers were given away than when they won.

The findings that top-quality teams were more successful at converting their possessions into goals could be due to better technical and tactical knowledge from players and coaches. It could be suggested that top-quality teams were overall more successful due to better offensive CP strategies and set-ups to maintain possession and better defensive structures than bottom-quality teams, which allows them to create defensive pressure to cause turnovers. Shooting percentage can also be examined, as although top-quality and middle-quality teams (92% and 89% respectively) were able to score from a greater percentage of shots than bottom-quality teams (76%), there was overall a relatively high conversion rate for shooting, potentially highlighting that the issue for bottom-quality teams is possession and offensive strategies to get the ball to the shooters, and not the actual shooting performance. This is further highlighted by decreased total and successful circle feeds without a significant decrease in shooting percentage for bottom-quality teams when playing against top-quality teams compared to middle-quality and bottom-quality teams. Research by Croft et al. (2017) investigated playing styles in the ANZ Championship whereby it was determined that teams were able to set up successful CP strategies that influenced winning or losing. Within the top teams in this current study (Australia, New Zealand, England, and Jamaica) the majority of players play in the top three domestic leagues in the world (Suncorp Super Netball, ANZ, and Netball Superleague). Therefore, these players are playing and training in high-performance leagues with and against the best players, thus allowing them to develop, and exercise their technical and tactical knowledge, and bring that to the international stage. Bottom-quality teams should, therefore, develop defensive structures similar to top teams to gain more turnovers, as well as, improve attacking structures to convert more centre passes to goal which will lead to fewer turnovers being given to opposition teams.

However, it is important to also consider the development of netball as a sport, particularly since the O'Donoghue et al. (2008) assessment. According to O'Donoghue et al. (2008), 54.3% of CP, and 50.8% of TO were converted to goal, and 75.9% of shots were scored when top-half teams played bottom-half teams. Compared with this study's findings, where top teams converted an average of 84% of CP, 84% of RTO and 81% of LTO to goal, and scored from 91% of shots, respectively, against bottom-quality opponents. Bruce et al. (2018) found that in the ANZ Championship, since 2011, there has been an upward trend in the number of CP receives, indicating that teams are scoring more goals. However, bottom-quality teams in this study converted an average of 49% of CP, 44% of RTO and 44% of LTO. This suggests a development in the sport in terms of team and player development, but perhaps more so amongst top-flight international teams, who are able to include top players in their squads due to better domestic leagues and improved player progress and development. Therefore, there appears to be a gap in quality between top and bottom teams. Bottom-quality teams could, therefore, use performance analysis tools to assess top-quality team attacking and defensive structures

and implement these into their own performance to improve CP and TO conversion rates to close the performance gap.

4.1. Limitations and future research

The CWG includes all the top-performing nations within netball, therefore this tournament is not representative of international netball, as many more nations play netball, but just did not qualify for the 12 teams that can play as part of the CWG. This study, also, assessed only one international competition which only provides a cross-sectional view of international netball, and further inclusion of other competitions (e.g. Netball World Cup) should be considered in future research. However, this study has highlighted the gap in performance standards between the teams within the top 12 which is likely to be greater for teams that did not qualify for the CWG. This study has also allowed for a more recent investigation of netball performances, furthering and expanding on the work of O'Donoghue et al. (2008).

When looking forward, as noted by Bruce et al. (2018) future research should assess the factors that contribute to team success within elite netball. This study has revealed where significant differences lie amongst teams of different qualities at the international level, but more research needs to be conducted on the tactical elements of play. For example, assessing successful offensive and defensive centre pass strategies, how and where teams are turning over the ball and how to exploit this, or circle feeding strategies to create optimal shooting positions within the circle. Publication and promotion of this information will help improve the standard of the lower-performing teams, allowing for a potential overall increase in the standard of the sport internationally. Furthermore, performance analysis tools could be created to assist lower-performing teams to aid with tactical and technical performance.

5. Conclusion

To conclude, this study has noted key performance differences amongst teams of different quality at the international level, providing a greater insight into team performances which can be used by coaches to help prepare and improve performances against different standards of opposition. For performance differences and winning margins to be closer amongst teams of differing qualities, teams at lower levels should focus on clear tactical plans prior to games, and implementing these effectively, knowing when to amend and adapt. To support this, performance analysis tools could be created to assist lower-performing teams. This may then have an overall positive impact on the sport of netball, creating more competitive matches, and more opportunities for international netball competitions.

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Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

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Appendices

Appendix 1-Bespoke Code Windows and Output Windows used for analysis

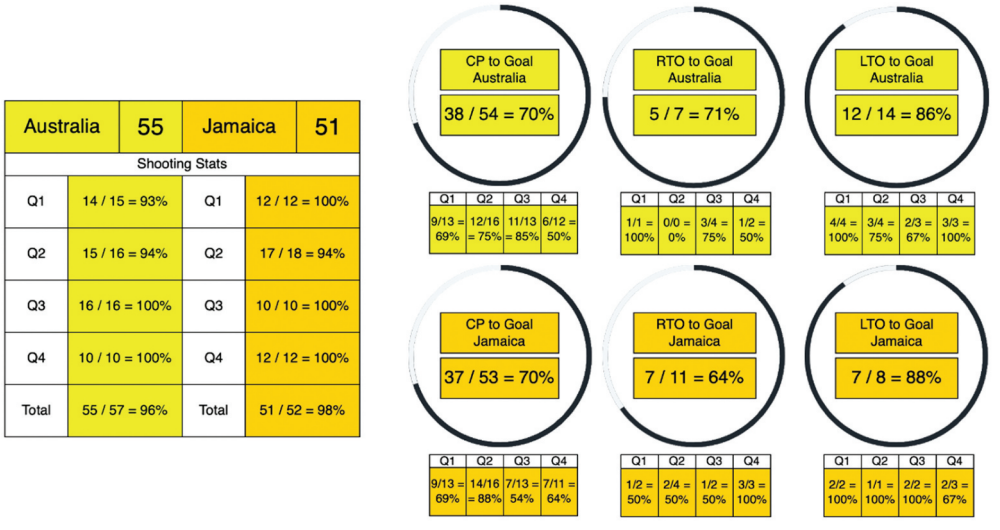

Figure A1. Output window used as part of analysis showing key possession statistics.

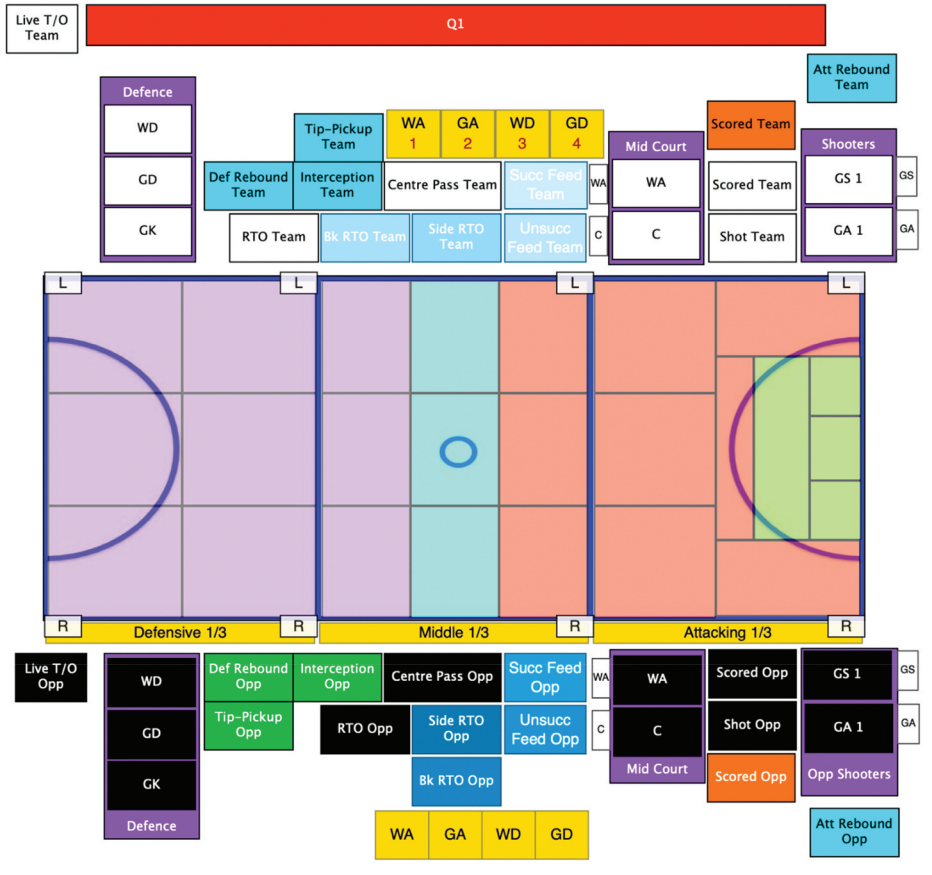

Figure A2. Code window used for analysis.

Appendix 2-England Netball guidelines and definitions for key performance indicators

These are the current definitions used by working analysts in the British Superleague and National Performance League (NPL)

Centre Pass Team (/Opp):Taken at the beginning of each quarter and to re-start the game after each goal

NOTE: It will stay as a centre pass until either a goal is scored, the other team gain possession (with control) or the end of the quarter

Live TO Team (/Opp): A change of possession when there is not a break or pause in play

Interception Team (/Opp): When possession is gained by a player catching a pass made by the opposing team

Def Reb Team (/Opp): When possession is gained by a player catching the ball after a missed shot from the opposing team

Restart TO Team (/Opp): A change of possession when there is a break in play from the ball going out of court or the umpires calling a penalty

Back RTO (/Opp): A change of possession and the ball goes out of court and the throw in is taken from theDEFENSIVE back line

Side RTO (/Opp): A change of possession and the ball goes out of court and the throw in is taken from asideline

Successful Feed Team (/Opp): When a pass is successfully thrown and received in the shooting circle by an attacker who has both feet in the shooting circle. If two passes are made in quick succession, this counts as two feeds

Unsuccessful Feed Team (/Opp): When a player attempts to throw the ball into the shooting circle, but it does not land, e.g. it goes out of court/goes straight over to the other side of the circle/ intercepted by a defender

Scored: Goal

Miss: Missed shot

NOTE: If a player misses a shot, a penalty is called, and the shot is re-taken then the first miss is not coded

Appendix 3- Reliability testing results

Table A1. Inter-rater reliability testing results from coder one and coder two.

Variable	ICC
Total CP	1.000
Total CP to Goal	0.999
Total RTO	0.997
Total RTO to Goal	1.000
Total LTO	0.983
Total LTO to Goal	0.997
Total TO	0.992
Total TO to Goal	0.999
Total losses in possession	0.980
Total shots	1.000
Total goals	1.000
Total circle feeds	1.000
Total successful feeds	1.000