Validity and reliability of an Australian football small-sided game to assess kicking proficiency

Validity and reliability of an Australian Football small-sided game to assess kicking proficiency

Nathan Bonney [1], Jason Berry [2], Kevin Ball [1] and Paul Larkin [1, 3]

[1] Institute for Health and Sport, Victoria University, Melbourne, Australia

[2]IMG Academy, Bradenton, Florida, USA

[3]Maribrynong Sports Academy, Melbourne, Australia

Keywords

Small-sided Game; Kicking; Australian Football; Talent Identification

Submitted to *Journal of Sports Sciences*: May 2019

Please direct all correspondence to Nathan Bonney

Institute for Health and Sport,
Victoria University
Melbourne, Victoria, 3011
AUSTRALIA
Phone: 0412 529 792
Email: nathan.bonney@live.vu.edu.au

Validity and reliability of an Australian Football small-sided game to assess kicking proficiency

Abstract

In Australian Football (AF), small sided games have been used extensively as an alternative training method for technical and physical adaptations. Considering their application to AF, it is surprising a valid and reliable small-sided game kicking assessment remains absent. Therefore, the aim of this study was to develop a valid and reliable 5v6 Australian football small-sided game kicking proficiency assessment. Youth male AF players (n = 145) from different stages within the AF talent pathway were recruited. Validity (i.e., logical and construct) and reliability (i.e., test re-test) were assessed. The largest kicking proficiency difference was between U13 and U16 players and between novice and sub-elite players. Between the ages of U16 and U18 kicking proficiency appears to stabilize. The Australian football small-sided kicking assessment was 97% successful in identifying players as either novice or sub-elite. Larger physical performance (i.e., odometer, m/min^{-1} and %HIR) outputs were noted between U14 and U18 players and novice and sub-elite players. Collectively, these findings suggest the Australian football small-sided kicking assessment is a valid and reliable AF kicking proficiency assessment tool and may provide worthwhile information to coaches regarding kicking performance along the AFL pathway, to profile player strengths whilst identifying specific areas of improvement.

Validity and reliability of an Australian Football small-sided game to assess kicking proficiency

Talent identification (TI) programs aim to identify and select youth athletes with the potential to become an elite senior athlete (Williams & Reilly, 2000). In an attempt to more accurately identify and discriminate between players (i.e., novice and sub elite), researchers in Australian Football (AF) have investigated key performance characteristics including anthropometrics (e.g., height) (Keogh, 1999), physiological capacity (e.g., aerobic endurance) (Veale, Pearce, & Carlson, 2010), technical competency (e.g., kicking accuracy) (Woods, Raynor, Bruce, & McDonald, 2015) and perceptual-cognitive skill (e.g., decision making) (Woods, Raynor, Bruce, & McDonald, 2016). Whilst these assessments do provide specific feedback (e.g., dominant and non-dominant leg kicking accuracy, aerobic capacity), they are performed in isolation (e.g., no opposition) and therefore remain distant from what occurs during match play (Bonney, Berry, Ball, & Larkin, 2019a).

In an attempt to more accurately predict talented AF players, researchers have implemented multidimensional assessment designs, which incorporate a range of assessments including anthropometrics, motor competence, physical and skill abilities (Tribolet, Bennett, Watsford, & Fransen, 2018). Tribolet, et al. (2018) found significant age-related differences for anthropometry, fitness and coach skill ratings. Furthermore, they noted their multi-dimensional approach was 90.9% accurate at identifying selected U15 players and 90% accurate at identifying the deselected U15 players. Woods and colleagues (2016) also investigated whether a multi-dimensional assessment could discriminate between talent identified and non-talent identified U18 players. They assessed physical, technical and perceptual-cognitive performances and found their assessment could correctly classify 95% of the talent identified players and 86% of the non-talent identified players. Although these designs were more successful at identifying talented AF athletes than single assessment

approaches, they do not consider how these characteristics are interconnected or replicate the performance demands of the game (e.g., performing a kick under pressure).

One method that may be used to assess athlete performance in an environment that resembles the demands of the game is small sided games. Small sided games have been used extensively in sport training due to their ability to replicate modified versions of match play (Davids, Araujo, Correia, & Vilar, 2013). As a method of assessment, small-sided games can potentially create opportunities for athletes to gain possession of the ball and display their skill proficiency, as well as apply game strategy and tactical manoeuvres in an easily manipulated and convenient setting (Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011).

In AF, small-sided games have predominantly been used to understand the implications of the small-sided game on physical performance. For example, published small-sided game research has been limited to comparing the effects of traditional and small-sided game training on athletes physical performance (Young & Rogers, 2014). More recently, Fleay, Joyce, Banyard, and Woods (2018) investigated how manipulating field dimensions during small-sided games impacts the technical and physical profiles of Australian footballers. The authors found a reduction in playing space led to a greater amount of turnovers, ineffective handballs and tackles whilst a ‘large’ small-sided game resulted in greater total, relative and high-speed running distances and maximum velocities.

Recent AF performance analysis investigations have suggested greater ball possession and kicking skill proficiency relative to the opposition have been shown to have greater influences on match outcomes (Robertson, Back, & Bartlett, 2015). Considering the importance of kicking in AF, research has largely focused on biomechanical analysis (Blair, Duthie, Robertson, Hopkins, & Ball, 2018; Peacock, Ball, & Taylor, 2017) with limited research conducted on the assessment of match play kicking proficiency (Anderson, Breed, Spittle, & Larkin, 2018; Gastin, Tangalos, Torres, & Robertson, 2017; Robertson, et al., 2015).

Woods and colleagues (2015) assessed 50 U18 male athletes (25 state representatives and 25 non state representatives) using the Australian Football Kicking Test. The test involves players running towards a feeder and receiving a ball, turning and executing a kick to one of six randomly assigned stationary targets (Cripps, Hopper, & Joyce, 2015). Kicking performance is subjectively assessed on a scale from 0-5 (5 being the highest) for each kick. It was found when kicking accuracy and ball speed were combined playing status was able to be predicted (Woods, et al., 2015). In another study, Cripps, et al. (2015) investigated 121 sub-elite U16 male AF players and although they found the inter-rater reliability to be high, the test could only differentiate between dominant and non-dominant kicking leg accuracy. A limitation of the current AF kicking test, is the assessment is conducted in isolation and does not assess the range of kicks typically performed within the performance environment (e.g., performing a kick under physical pressure). As a result, kicking ability is not assessed under match referenced conditions and consequently players may perform alternative actions and performances (Araujo, Davids, & Hristovski, 2006).

Australian Football is played within an unpredictable environment where athletes adapt to situations in an attempt to best deliver the ball. This suggests a variety of interconnected factors are involved when attempting to successfully perform a domain-specific skill during match play. Although the design and implementation of small-sided games in AF training is varied, largely depending upon the goal of the training session (Hill-Haas, et al., 2011), they are a progression along the Performance Assessment Model suggested by Bonney, et al. (2019a). Accordingly, an AF small-sided game may be an appropriate method for assessing AF skill proficiency, in particular, kicking. Therefore, the aim of this study was to 1) develop an Australian football small-sided game kicking assessment in consultation with players and coaches; 2) assess the logical, content and construct validity of the assessment to see if it can differentiate between age groups (i.e., U13; U14; U16; U18) and skill groups (i.e., novice and

sub-elite); 3) assess the test re-test reliability of the assessment; and 4) assess the inter-rater reliability of the assessment.

Method

Participants

Youth male Australian Football players (n = 145) from different stages within the AF talent pathway were recruited. The players were recruited from a local club (novice; U13: n = 22; U14: n = 26; U16: n = 22; U18: n = 11); state junior representatives (sub-elite; U16: n = 22; U18: n = 42).

Test Development

When developing new assessments, validity is an important consideration as it ensures the test measures what it claims to measure (Thomas, Nelson, & Silverman, 2011). The 50m arc area was selected as notational analysis from six U18 sub-elite level matches (Mantle, 2017) and 19 AFL matches (Back, 2015) identified this was a common area where attackers, defenders and midfield players participated within. Furthermore, during match play, critical actions occur within this zone such as kicking for goal, delivering the ball inside 50m and rebounding the ball outside the 50m zone.

To assess the content validity of the test, a pilot study was conducted to obtain feedback (i.e., verbal and notational analysis) from an expert panel on the design, functionality and assessment process of the 5v6 small-sided game. Two of these experts are co-authors of this study with initials reported in parenthesis. This panel included a current elite U18 representative squad coach (n = 1); recently retired elite AFL players (n = 2); current sub-elite U15 AF players (n = 11); current sub-elite U18 AF players (n = 26); skill acquisition experts (n = 2, PL); a biomechanist (n = 1, KB); and a senior sport scientist working within an AFL club (n = 1). Feedback was obtained from the panel and slight modifications to the procedure

of the test were applied. For example, it was suggested to include a 5m zone outside the 50m area to further challenge kicking proficiency.

The Australian football small-sided kicking assessment involved 4 x 3min quarters with 60 seconds recovery between the 1st and 2nd and 3rd and 4th quarters and 90 seconds between the 2nd and 3rd quarters in an attempt to replicate match play break durations (i.e., in AFL match play there is a longer break at half time in comparison to quarter time and three quarter time).

Data Analysis

Video footage from the three cameras were stacked (i.e., having the three camera angles showing on the one screen side-by-side) and coded using SportsCode 10.3.25. Each kick was scored according to how accurate the kick was executed. The same scoring criteria was used as previously published by Bonney, Berry, Ball, and Larkin (2019b). Kicking proficiency percentage was calculated as total scored achieved / maximum possible score for kicks taken * 100.

Logical validity gathered from the Likert scale questionnaire is presented in the form of descriptive statistics and was assessed by a cross-section of sub-elite U18 players (n = 30), elite U18 representative squad coaches (n = 3), and skill acquisition experts (n = 2). One skill acquisition expert (PL) was also involved in the development of the test. The mean and standard deviation for each topic section were calculated from the 5-point Likert scale (i.e., 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree) (Boone & Boone, 2012). Mean results were classified using previously published descriptors by Bonney, et al. (2019b) strongly disagree (1-1.9), disagree (2-2.9), agree (3-3.9), strongly agree (4-4.9). Likert scale questions were provided to two senior sport scientists and one elite U18 representative coach for feedback prior to use. The questionnaire had 11 questions pertaining to player assessment, game simulation and test suitability in comparison to match play (e.g., the time the player had to dispose of the ball was similar to that performed during match play at your level). To ensure

reliability of the questionnaire, sub-elite U18 players (n = 10) and an elite U18 representative coach (n = 1) were given the same questionnaire on two separate occasions, one week apart. Their results were assessed using Cronbach's alpha with a score of 0.96, indicating excellent reliability (Altman, 1991).

To determine construct validity, a One-Way ANOVA was used to compare between groups (e.g., U13; U14; U16; U18) (independent variable) and kicking proficiency score (dependent variable), and within group comparisons assessing skill (e.g., U18 novice and U18 sub-elite) (independent variable) and the kicking proficiency score (dependent variable). Significance for data sets were set at $p < 0.05$. A multinomial logistic regression was used to determine if kicking proficiency percentage could accurately classify age (i.e., U13; U14; U16; U18) and skill groups (i.e., novice; sub-elite) of players.

The Catapult Sprint 5.1.7 software was used to download the GPS data. Individual player odometer, meters travelled per minute (m/min^{-1}) and percentage of high intensity running (%HIR) were recorded as measures of central tendency. Effect sizes (ES) for ANOVAs were reported as partial eta squared (η_p^2) (Olejnik & Algina, 2003) and post hoc effect sizes were calculated using Cohen's d with 95% confidence intervals (CI) (Cohen, 1988). All other calculations were made using the statistical package SPSS Statistics (SPSS Version 25.0).

The stability of the test performances were determined by test re-test reliability using the two-way mixed-effects intra-class correlation coefficient (ICC) model (with absolute agreement) with 95% confidence limits (Koo & Li, 2016), the coefficient of variation (CV) and the standard error of measurement (SEM) (Hopkins, Marshall, Batterham, & Hanin, 2009). The ICC classifications used were >0.90 excellent, 0.75 and 0.90 good, 0.50 and 0.75 moderate and <0.50 poor (Koo & Li, 2016). Inter-rater reliability was examined with two trained independent assessors analysing 80% (116 players, 1138 kicks) of the kicks using the scoring procedure outlined by Bonney, et al. (2019b). The kappa (k) correlation was interpreted as

follow: poor (<0.20), fair (≤0.20-0.40), moderate (≤0.40-0.60), good (≤0.60-0.80) and very good (≤0.80-1.00) (Altman, 1991).

On both test occasions, standardised procedures and instructions were followed. The stability of individual responses was determined by one sub-section of sub-elite U18 participants (n =15) completing the protocol on two occasions, seven days apart, as long retest intervals can result in large variations due to factors such as participant behaviour or circadian variations (Robertson, Burnett, & Cochrane, 2014).

Procedures

Each small-sided game was completed on an outdoor regulation AF oval as outlined in Figure 1. Cones were placed on the field 5m from the 50m line to mark the "5m zone". Six spare AF regulation footballs were placed behind the goal posts in an attempt to maximise

game time after a score. The Australian football small-sided kicking assessment consisted of a 5v6 variation (with one player designated as a floater who is always on the attacking team). The first kick of each quarter was performed from the attacking team inside the goal square (this was rotated each quarter). The attacking team then needed to complete a minimum of two kicks before attempting to kicking the ball into the 5m zone. When kicking the ball outside the 50m arc within 5m (5m zone) only attacking players, leading for the ball, are allowed. If the lead is not successful players must return to within the 50m zone. If the pass is unsuccessful within this zone (i.e., the ball is dropped) the opposition obtain possession. If successful, the attacking team must complete another two kicks before a goal is attempted. If there is an intercept, the new attacking team must follow the same process of taking the ball out of the area before returning into the 50m zone to have an attempt at goal.

If the ball goes over the boundary line the opposition was awarded a free kick and to ensure the focus was on kicking, after every handball a kick needed to be executed. Goal posts were used however after a score (point or goal) the opposition had to play the ball immediately.

Regulation AF rules were imposed for each small-sided game (including tackling), with an umpire.

To increase the stabilization of performance data, the protocol for testing included a requirement for familiarization. Players participated in a practice session of approximately five minutes before the testing session began to allow players time to familiarize themselves with the test, as recommended by (Currell & Jeukendrup, 2008). A five-minute break then occurred before the test commenced. All testing sessions were conducted at the player's training ground in conditions deemed acceptable by the lead researcher.

All players were allocated numbered bibs for the Australian football small-sided kicking assessment and a GPS unit (Catapult, Minimax S5) to wear. During the assessment, three cameras were positioned on the field to capture the test performance. One camera was positioned five meters behind the goal posts (i.e., to capture shots at goal) and the other two cameras were positioned on opposite sides of the playing area approximately 2 metres outside the boundary line (i.e., to capture test footage in that specific side of the field).

*****Figure 1 near here*****

Results

Logical Validity

Logical validity was supported through both players and coaches strongly agreeing the test can assess kicking efficiency and assesses player decision making abilities similar to match play (mean ± SD; players 4.2 ± 0.69; coaches 4.47 ± 0.62). Further, players and coaches agreed the test simulated kicking patterns and playing intensity similar to match play (mean ± SD; players 3.78 ± 0.74; coaches 3.41 ± 1.13). The players strongly agreed, and coaches agreed, the test was suitable for the age and ability level of the group whilst also having potential to be used as a selection tool (mean ± SD; players 4.02 ± 0.77; coaches 3.80 ± 0.98).

Construct Validity

A one-way between subject ANOVA was conducted to compare the effect of age on kicking efficiency at the U13, U14, U16 and U18 age groups. There was a significant effect of age on kicking proficiency at the p<.05 level [$F(3, 162) = 17.582$, $p < 0.001$, $\eta_p^2 = .308$]. Post hoc comparisons using the Turkey HSD and the Cohen's *d* test indicated the mean score for the U14 group was significantly different with a very large ES to the U16 group ($d = 1.4$, $p < 0.001$) and a significant large ES to the U18 group ($d = 1.5$, $p < 0.001$). There was not a significant difference between the U13 and U14 age groups ($d = 0.4$, $p = .540$) and the U16 and U18 age groups ($d = -0.06$, $p = .960$). While this study was not longitudinal in nature, analysis of the kicking performance across age groups shows an increasing trend from U13 to U16. On average, there was a 4.99% kicking proficiency difference between the U13's and U14's, 13.54% from U14's to U16's and -0.65% from U16's to U18's. A multinomial regression analysis was conducted, using kicking proficiency percentage as a predictor of age group. This analysis identified the Australian football small-sided kicking assessment could correctly identify 87.1% of players as either U13, U14, U16 or U18.

A one-way between subject ANOVA was conducted to compare the effect of skill on kicking efficiency between U18 novice and U18 sub-elite players. There was a significant effect of skill on kicking proficiency at the p<.05 level [$F(2, 30) = 11.457$, $p < 0.001$, $\eta_p^2 = .495$]. Post hoc comparisons using the Turkey HSD and the Cohen's *d* test indicated the mean score for the novice group was significantly different with a very large ES to the sub-elite group ($d = 1.9$, $p < 0.001$). A multinomial regression analysis was conducted, using kicking proficiency percentage as a predictor of skill group. This analysis identified the Australian football small-sided kicking assessment could correctly identify 97.0% of players as either novice or sub-elite.

A one-way between subject ANOVA was conducted to compare the effect of age on odometer, m/min^{-1} and %HIR between U13, U14, U16 and U18 players. There was a

significant effect of age on distance covered [$F(3, 130) = 47.229$, $p < 0.001$, $\eta_p^2 = .522$], m/min^{-1} [$F(3, 130) = 48.155$, $p < 0.001$, $\eta_p^2 = .526$] and %HIR [$F(3, 130) = 45.482$, $p < 0.001$, $\eta_p^2 = .512$] at the $p < 0.05$ level. Post hoc comparisons using the Turkey HSD indicated as age increased so too did the distance covered by the players, the amount of ground covered per minute and the intensity at which the players participated.

A one-way between subject ANOVA was conducted to compare the effect of skill on odometer, m/min^{-1} and %HIR between novice and sub-elite players. There was a significant effect of age on distance covered [$F(1, 37) = 9.364$, $p = .004$, $\eta_p^2 = .202$], m/min^{-1} [$F(3, 37) = 14.883$, $p < 0.001$, $\eta_p^2 = .287$] and %HIR [$F(1, 37) = 16.607$, $p < 0.001$, $\eta_p^2 = .310$] at the $p < 0.05$ level. Post hoc comparisons using the Turkey HSD indicated as skill level increased so too did the distance covered by the players, the amount of ground covered per minute and the intensity at which the players participated (Table 1).

Reliability

For the reliability of the test, the ICC ± 95% CL, CV ± 95% CL and the SEM indicated good reliability between the test re-test assessment (ICC = 0.82 ± 0.45 - 0.94, CV = 14.80, SEM = 3.43). The kappa (k) correlation was classified as very good (k = 0.88).

*****Table 1 near here*****

Discussion

The aim of the study was to develop a valid and reliable Australian football small-sided game kicking proficiency assessment which can differentiate between age (i.e., U13; U14; U16; U18) and skill groups (i.e., novice and sub-elite). Validity (logical and construct) and reliability (test re-test) suggested the Australian football small-sided kicking assessment can successfully distinguish between age groups and skill groups. Kicking proficiency increased from U13 to U16 and as skill level increased from novice to sub-elite. The physical attributes (i.e., odometer, m/min^{-1} and percentage of %HIR) all increased from U14 to U18 and as skill

progressed from novice to sub-elite. The reliability of the Australian football small-sided kicking assessment, as assessed by test-re-test, was classified as good. Overall, this study is the first AF investigation attempting to validate the use of a 5v6 small-sided game to assess the kicking proficiency of players.

Logical validity was supported by players and coaches agreeing the Australian football small-sided kicking assessment can assess player performance and simulates playing actions and demands similar to match play. The players and coaches moderately supported the Australian football small-sided kicking assessment as a tool for selecting future teams. For the establishment of construct validity, the test should differentiate between known performance levels (Thomas, et al., 2011). To date, no AF small-sided game or kicking test has reported the construct validity of the assessment prior to its implementation. Therefore, without assessment of construct validity prior to the implementation of a new kicking test, it may be unclear whether performance differences are a result of skill differences or an unreliable test (Larkin, Mesagno, Berry, & Spittle, 2014). The results of this study demonstrate the Australian football small-sided kicking assessment was successful in distinguishing between players across age groups (i.e., U13; U14; U16 and U18) and across skill levels within the same age group (i.e., U18 novice and U18 sub-elite) along the AFL talent pathway.

The Australian football small-sided kicking assessment was successful in distinguishing a significant kicking proficiency difference between the age groups of U14 and U16 and U14 and U18 and whilst there was an increase from the U13 to U14 age group, it was not significant. There is limited empirical evidence to compare the results the Australian football small-sided kicking assessment to other similar AF small-sided games or match play performance within these age groups. When comparing the U13 and U14 kicking proficiency to those previously reported by Gastin, et al. (2017) the current study found similar results with disposal efficiency

increasing as age increased. It is important to note however, the Gastin, et al. (2017) study reported both kicking and handballing in their disposal efficiency percentage.

An interesting finding from the current study was the stabilisation in kicking proficiency between the U16 and U18 age group. This may suggest once selected into a team all players at that particular age and skill level may have the same technical capacity however, when comparing between higher and lower skill groups a difference in proficiency may be seen. The results of the current study found small-sided games were able to differentiate between novice and sub-elite athletes which is similar to those previously reported. Bennett et al. (2017) found higher skilled players had significantly greater number of attempted and completed passes, touches and total skill involvements compared to lower skilled players in youth soccer small-sided games. Furthermore, they found total skill proficiency was greater in higher skilled players than lesser skilled players which is a similar finding to this study.

The largest difference in kicking proficiency occurred between the U14 and U16 age group, which is consistent with previous findings on AF kicking proficiency (Bonney, et al., 2019b) however, further research is recommended to explore whether there is a key developmental period where kicking skill is more susceptible to development or simply due to maturation (i.e., early maturation). For example, Malina, Ribeiro, Aroso, and Cumming (2007) found when the stage of puberty, aerobic resistance and height are combined they can explain 29% of the variance for soccer skill, highlighting the inter-relationship of growth, maturity and functional characteristics of youth soccer players. In comparison, researchers have investigated the effect of physical parameters and maturity on skill performance of 12-13 year-old basketball players (Silva et al., 2010) and adolescent handball players (Matthys, Vaeyens, Coelho, Lenoir, & Philippaerts, 2012) and found maturity had no effect on sport-specific skills.

During the Australian football small-sided kicking assessment a higher physical performance (odometer, m/min^{-1} and percentage of %HIR) output was noted as age (i.e., U14

to U18) and skill (i.e., novice to sub-elite) increased. The m/min^{-1} was greater in this study when compared to those previously reported in youth (U10-U15) match play (Gastin, et al., 2017). A possible reason for this may be the amount of area the players had to participate within. For example, Gastin, et al. (2017) assessed player skill execution and physical performance through match play where players had larger areas to perform within and may have to wait for the ball to return from another area before moving again. In comparison, the Australian football small-sided kicking assessment restricted players to the 50m zone, affording players with more opportunities to be involved with the ball and subsequently covering more distance per minute.

When interpreting the findings of this study, some limitations should be considered. Firstly, this study is a cross-section design and to further clarify if the Australian football small-sided kicking assessment is a suitable assessment tool for all age groups more players, from more age groups, should be assessed through longitudinal research designs. Such designs could track athlete performance over the key developmental age periods in an attempt to identify the impact of age on athlete skill development. This may also assist with the development of more standardized scores to help coaches become more specific with their planning for development of players (i.e., kicking proficiency). Finally, the ICC 95% confidence interval results indicate the reliability to be between 0.45 (poor) and 0.94 (excellent). Accordingly, results from this study should be viewed with caution until more data has been has been collected and can confirm the findings of this study.

The demand for an ecological valid assessment of skill in AF, that closely represents game demands, has been requested in the literature (Tribolet, et al., 2018). Overall, these results suggest the Australian football small-sided kicking assessment could be included as part of a multidimensional assessment battery. This may provide worthwhile information to coaches regarding kicking performance along the AFL pathway, to profile player strengths whilst

identifying specific areas of improvement. This test does not require a large amount of equipment or time to complete and can assess 11 players at the one time, thereby making it appropriate for large scale testing days. Furthermore, the development of the Australian football small-sided kicking assessment supports Level-4 on the Performance Assessment Model suggested by Bonney, et al. (2019a) to help coaches provide more objective feedback to players regarding their kicking skill performance.

CONCLUSION

These data contribute significantly to the Australian football talent identification research as they provide an indicator of player kicking performance during an AF small-sided game. This study was the first to examine the applicability of an AF 5v6 small-sided game as a valid and reliable assessment tool. The results suggest as age and skill level (novice to sub-elite) increase so too does the kicking proficiency, odometer, m/min^{-1} and percentage of time spent running at high speeds. However, between the ages of U16 and U18 kicking proficiency appears to stabilize. Finally, the Australian football small-sided kicking assessment was 97% successful in identifying players as either novice or sub-elite. Collectively these findings support the use of the Australian football small-sided kicking assessment as a skill assessment tool for talent identification purposes.

References

Altman, D. G. (1991). *Practical Statistics for Medical Research*. London: Chapman & Hall.

Anderson, D., Breed, R., Spittle, M., & Larkin, P. (2018). Factors Affecting Set Shot Goal-kicking Performance in the Australian Football League. *Percept Mot Skills, 125*(4), 817-833. doi: 10.1177/0031512518781265

Araujo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. *Psychology of Sport and Exercise, 7*(6), 653-676.

Back, N. (2015). *The influence of constraints on athlete kicking performance in training and matches at an elite Australian Rules football club.* Bachelor of Applied Science Honours, Victoria University, Melbourne.

Bennett, K., Novak, A., Pluss, M., Stevens, C., Coutts, A., & Fransen, J. (2017). The use of small-sided games to assess skill proficiency in youth soccer players: a talent identification tool. *Science and Medicine in Football*. doi: https://doi.org/10.1080/24733938.2017.1413246

Blair, S., Duthie, G., Robertson, S., Hopkins, W., & Ball, K. (2018). Concurrent validation of an inertial measurement system to quantify kicking biomechanics in four football codes. *J Biomech, 73*, 24-32. doi: 10.1016/j.jbiomech.2018.03.031

Bonney, N., Berry, J., Ball, K., & Larkin, P. (2019a). Australian Football Skill-Based Assessments: A proposed model for future research. *Frontiers in Psychology*. doi: 10.3389/fpsyg.2019.00429

Bonney, N., Berry, J., Ball, K., & Larkin, P. (2019b). The Development of a Field-Based Kicking Assessment to Evaluate Australian Football Kicking Proficiency. *Research Quarterly for Exercise and Sport*, 1-10. doi: 10.1080/02701367.2019.1647331

Boone, H., & Boone, D. (2012). Analyzing Likert Data. *Journal of Extension, 50*(2).

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, N.J.: Erlbaum Associates.

Cripps, A. J., Hopper, L. S., & Joyce, C. (2015). Inter-Rater Reliability and Validity of the Australian Football League's Kicking and Handball Tests. *J Sports Sci Med, 14*(3), 675-680.

Currell, K., & Jeukendrup, A. E. (2008). Validity, reliability and sensitivity of measures of sporting performance. *Sports Med, 38*(4), 297-316.

Davids, K., Araujo, D., Correia, V., & Vilar, L. (2013). How small sided and conditioned games enhance acquistion of movement and decision-making skills. *Exercise and Sport Sciences Reviews, 41*(3).

Fleay, B., Joyce, C., Banyard, H., & Woods, C. T. (2018). Manipulating Field Dimensions During Small-sided Games Impacts the Technical and Physical Profiles of Australian Footballers. *J Strength Cond Res, 32*(7), 2039-2044. doi: 10.1519/JSC.0000000000002423

Gastin, P. B., Tangalos, C., Torres, L., & Robertson, S. (2017). Match running performance and skill execution improves with age but not the number of disposals in young Australian footballers. *J Sports Sci, 35*(24), 2397-2404. doi: 10.1080/02640414.2016.1271137

Hill-Haas, S. V., Dawson, B., Impellizzeri, F. M., & Coutts, A. J. (2011). Physiology of small-sided games training in football: a systematic review. *Sports Med, 41*(3), 199-220. doi: 10.2165/11539740-000000000-00000

Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive statistics for studies in sports medicine and exercise science. *Med Sci Sports Exerc, 41*(1), 3-13. doi: 10.1249/MSS.0b013e31818cb278

Keogh, J. (1999). The use of physical fitness scores and anthropometric data to predict selection in an elite under 18 Australian rules football team. *J Sci Med Sport, 2*(2), 125-133.

Koo, T. K., & Li, M. Y. (2016). A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *J Chiropr Med, 15*(2), 155-163. doi: 10.1016/j.jcm.2016.02.012

Larkin, P., Mesagno, C., Berry, J., & Spittle, M. (2014). Development of a valid and reliable video-based decision-making test for Australian football umpires. *J Sci Med Sport, 17*(5), 552-555. doi: 10.1016/j.jsams.2013.08.001

Malina, R. M., Ribeiro, B., Aroso, J., & Cumming, S. P. (2007). Characteristics of youth soccer players aged 13-15 years classified by skill level. *Br J Sports Med, 41*(5), 290-295; discussion 295. doi: 10.1136/bjsm.2006.031294

Mantle, B. (2017). *Profiling kicking skill demands in elite Under-18 Australian Football.* Honors, Victoria University, Melbourne.

Matthys, S. P., Vaeyens, R., Coelho, E. S. M. J., Lenoir, M., & Philippaerts, R. (2012). The contribution of growth and maturation in the functional capacity and skill performance of male adolescent handball players. *Int J Sports Med, 33*(7), 543-549. doi: 10.1055/s-0031-1298000

Olejnik, S., & Algina, J. (2003). Generalized eta and omega squared statistics: measures of effect size for some common research designs. *Psychol Methods, 8*(4), 434-447. doi: 10.1037/1082-989X.8.4.434

Peacock, J., Ball, K., & Taylor, S. (2017). The impact phase of drop punt kicking for maximal distance and accuracy. *J Sports Sci, 35*(23), 2289-2296. doi: 10.1080/02640414.2016.1266015

Robertson, S., Back, N., & Bartlett, J. D. (2015). Explaining match outcome in elite Australian Rules football using team performance indicators. *J Sports Sci*, 1-8. doi: 10.1080/02640414.2015.1066026

Robertson, S. J., Burnett, A. F., & Cochrane, J. (2014). Tests examining skill outcomes in sport: a systematic review of measurement properties and feasibility. *Sports Med, 44*(4), 501-518. doi: 10.1007/s40279-013-0131-0

Silva, C., Carvalho, H., Goncalves, C., Figueiredo, A., Elferink-Gemser, M., Philippaerts, R., et al. (2010). Growth, maturation, functional capacities and sport-specific skills in 12-13 year-old-basketball players. *Journal of Sports Medicine and Physical Fitness, 50*(2).

Thomas, J., Nelson, J., & Silverman, S. (2011). *Research Methods in Physical Activity, 6th edition*. Champaign: Human Kinetics.

Tribolet, R., Bennett, K. J. M., Watsford, M. L., & Fransen, J. (2018). A multidimensional approach to talent identification and selection in high-level youth Australian Football players. *J Sports Sci*, 1-7. doi: 10.1080/02640414.2018.1468301

Veale, J. P., Pearce, A. J., & Carlson, J. S. (2010). The Yo-Yo Intermittent Recovery Test (Level 1) to discriminate elite junior Australian football players. *J Sci Med Sport, 13*(3), 329-331. doi: 10.1016/j.jsams.2009.03.006

Williams, A. M., & Reilly, T. (2000). Talent identification and development in soccer. *J Sports Sci, 18*(9), 657-667. doi: 10.1080/02640410050120041

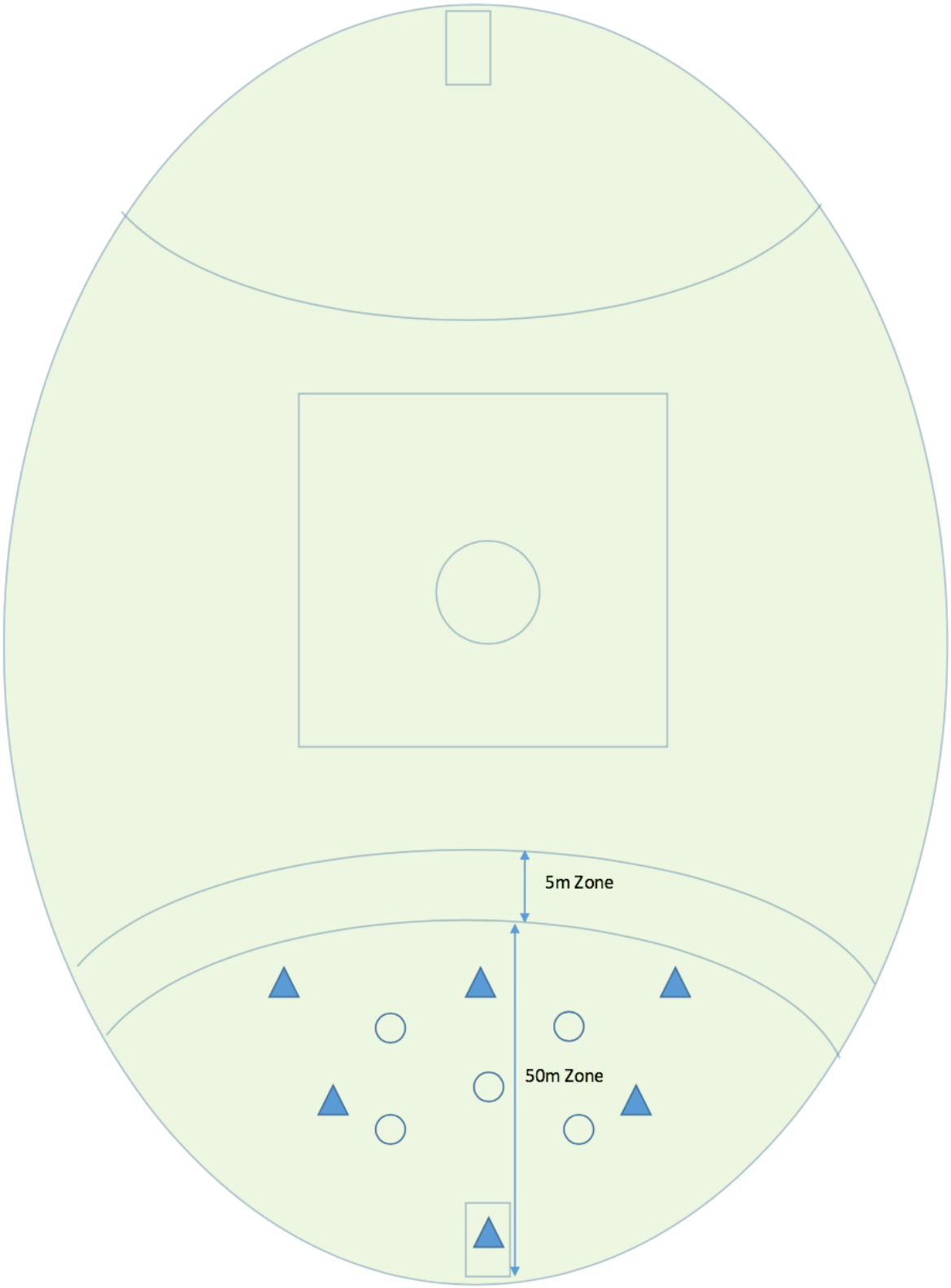
Woods, C. T., Raynor, A. J., Bruce, L., & McDonald, Z. (2016). Discriminating talent-identified junior Australian football players using a video decision-making task. *J Sports Sci, 34*(4), 342-347. doi: 10.1080/02640414.2015.1053512

Woods, C. T., Raynor, A. J., Bruce, L., McDonald, Z., & Robertson, S. (2016). The application of a multi-dimensional assessment approach to talent identification in Australian football. *J Sports Sci, 34*(14), 1340-1345. doi: 10.1080/02640414.2016.1142668

Woods, C. T., Raynor, J. A., Bruce, L., & McDonald, Z. (2015). The use of skill tests to predict status in junior Australian football. *J Sports Sci, 33*(11), 1132-1140. doi: 10.1080/02640414.2014.986501

Young, W., & Rogers, N. (2014). Effects of small-sided game and change-of-direction training on reactive agility and change-of-direction speed. *J Sports Sci, 32*(4), 307-314. doi: 10.1080/02640414.2013.823230

Figure 1. Schematic of the 5v6 Australian football small-sided kicking assessment *set up*



1

2

Table 1. *Age and skill level mean (95% CI), SD and SEM for kicking proficiency percentage, odometer, meters travelled per minute and percentage of high intensity running*

Age

	U13			U14			U16			U18		
	Mean (95% CI)	**SD**	**SEM**	**Mean (95% CI)**	**SD**	**SEM**	**Mean (95% CI)**	**SD**	**SEM**	**Mean (95% CI)**	**SD**	**SEM**
Technical												
Kicking Proficiency	44.23 (36.2-52.3)	18.1	5.3	49.22 (46.36-52.08)	9.1	3.9	62.76 (57.64-67.89)[a]	11.6	4.9	62.11 (57.49-66.72)[a]	6.9	2.9
Physical												
Odometer	395.4 (374-417)[a]	43.9	18.1	312.6 (299-326)[b]	40.4	16.9	383.5 (368-399)	35.6	14.8	420 (408-433)[ab]	47.5	20.5
Meters travelled per minute	131.8 (124-139)[a]	14.6	6.0	105.4 (101-110)[b]	13	5.5	127.8 (123-133)	11.9	4.9	140.9 (137-145)[ab]	15.3	6.8
Percentage of high intensity running	71.2 (67-75)[a]	8.0	3.3	56.1 (53-59)[b]	9	3.8	69.2 (66.8-71.7)	5.5	7.7	73.8 (72-76)[a]	6.5	3.0

Skill

	Novice			Sub-elite		
	Mean (95% CI)	**SD**	**SEM**	**Mean (95% CI)**	**SD**	**SEM**
Technical						
Kicking Proficiency	46.64 (42.1-51.2)*	6.8	2.9	66.75 (57.72-75.78)*	13.5	5.7
Physical						
Odometer	381.1 (347-415)*	48.2	20.5	432.0 (414-449)*	44.4	18.9
Meters travelled per minute	127.0 (115-138)*	16.1	6.8	147.1 (141.8-152.4)*	13.4	5.7
Percentage of high intensity running	68.0 (63-73)*	7.1	3.0	76.7 (74.6-78.8)*	5.3	2.2

CI = Confidence Interval; SD = Standard Deviation; SEM = Standard Error of Measurement

Letter indices denote a significant difference $p < .05$ level; a vs. U14; b vs U16.

* Denote a significant difference between novice and sub-elite

1

1