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The Applicability of the Risk Score Approach to Competitive Sport: Development of a Physical Success Score for the Canadian Football League Combine

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Abstract

Matsuo, H, Funasaki, K, and Yamada, S. The applicability of the risk score approach to competitive sport: development of a physical success score for the Canadian football league combine. *J Strength Cond Res* 36(3): 695–701, 2022—In the scouting combine of the Canadian Football League (CFL), players are measured for 6 athletic abilities, including 2 measurements of body size. For coaches and their players who desire to play in the CFL, knowing the players metrics that are important for being drafted and their levels will help coaches plan and evaluate their training. Thus, the purpose of this study was to provide a simple scoring system using the predictors of CFL Combines identified by multivariate analysis and their regression coefficients, and reference values. In this study, authors created a scoring system to classify draft success and failure of CFL Combines based on the measurement results. This scoring system was named as the physical success score (PSS). To do so, a repeated grid-search cross-validation for variable selection algorithm was performed on the players (line: $n = 211$, big skill linebacker, running back and tight end: $n = 177$, skill [defensive back and wide receiver]: $n = 231$) who participated in the CFL Combines between 2011 and 2019. The final binary logistic regression models and the reference values were used to generate the PSS for each group. As a result, PSS of the line, big skill, and skill were developed. In each group, all possible total scores and the estimated draft success probability were shown. From the results of this study, it was concluded that the PSS approach can provide useful information for coaches in setting training goals.

Key Words: goal setting of training, multivariate analysis, scoring system

Introduction

The Canadian Football League (CFL) is the professional league of Canadian football, a growing sport in Canada. There are 9 teams in the league, divided into East and West divisions. Each year, the 19-week season that begins on Canada Day (July 1—National Day) ends in early November. Following that, 6 teams remain in the playoffs, and 2 teams compete in the finals for a championship game called the "Grey Cup" (4). As shown in Table 1, Canadian football has a larger field, 12-man play, and fewer downs than American football (5,13). But it is sometimes collectively referred to as "gridiron football" because the white lines, when the field is viewed from above, resemble the shape of an iron grill (gridiron) used in barbecues. In recent years, the CFL has been pursuing a globalization and international strategy. In June 2018, they presented the "CFL 2.0," which aims to acquire international players through partnerships with football leagues outside of Canada and the United States and the Global Combine, as well as expand the CFL's market worldwide (4).

In this context, the CFL has entered into a series of international partnerships with Mexico, Germany, France, Austria, Finland, Norway, Sweden, Denmark, Italy, and the United Kingdom before the start of the 2018–2019 season (4). Also, in December after the 2019 season, a signing ceremony was held for the launch of the International Gridiron Football Federation, an organization of 12 countries (Austria, England, Denmark, Finland, France, Germany, Italy, Mexico, Norway, Sweden, and Japan), including Canada, that seeks to promote the competition and linkages between leagues through international partnerships (4). The CFL continues to allow 2-player active roster for "global players" and up to 3 practice squad for each team in 2019 (4). Note that a "global player" is defined as a player who does not hold Canadian or U.S. citizenship or qualify as a player from Canada (20). Players invited to the CFL National Combine in Canada following the CFL Global Combine (Table 2), which is held around the world from February to March 2020, maybe drafted into CFL teams as "global players" (4). In other words, to be picked in the draft, players must show that they are fully capable of playing in the CFL. The draft for "global players" is conducted as the "CFL Global Draft," as distinguished from the "CFL National Draft" (4).

Thus, the study on these global players vis-à-vis a relationship between the records of the CFL Combine and draft results or football performance would be of great interest not only professionally to the CFL but also academically. Several studies have been done on college students playing in the National Collegiate Athletic Association and National Football League (NFL) players in the United States. Because the measurement disciplines used at the CFL Combine are similar to those used at the NFL Combine,

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Table 1
Major rule differences between the Canadian and American football.

	Canadian	American
No. of players	12 players on the field during a play.	11 players on the field during a play.
Field	110-yd long, plus two 20-yd end zones. Width is 65 yards. Goalposts are Tee shaped and are located over the goal line.	100-yd long, plus two 10-yd end zones. Width is 53.5 yards. Goalposts are Tee shaped and are placed on the end zone's farthest boundary line from the field of play, 10 yards behind the goal line.
First down	Three downs to make 10 yards.	Four downs to make 10 yards.
Points	6 points for a touchdown, 1 for a kicked convert, 2 for a passed or rushed convert, 3 for a field goal, 2 for a safety touch, 1 for a rouge. A rouge (also called a single) is awarded to a kicking or punting team (team A) if an opposing player (team B): (i) catches or recovers a punt or a missed field goal in his own end zone but is prevented by team A from returning the ball back out onto the field of play or (ii) elects to drop to one knee while still in the end zone before having returned the ball to the field of play or (iii) elects to run with the ball from the end zone out of bounds rather than enter the field of play.	6 points for a touchdown, 1 for a kicked convert, 2 for a run or pass convert, 3 for a field goal, 2 for a safety touch.
Motion	Before the snap of the ball: (i) All offensive backfielders and receivers, except the quarterback, are allowed unlimited motion provided that they remain more than one yard behind the line of scrimmage. (ii) offensive linemen must not move.	Before the snap of the ball, no member of the offence may move, with the exception of one eligible receiver, who may move only in parallel with the line of scrimmage.

the results of research on the NFL Combine can be used as a reference. Typically, the Combine consists of athletic performance measures and assessments of position-specific skills, physical examinations, interviews, and psychological tests (14). Among them, the results of measurements on athletic performance are publicly available (4,12) and treated as a subject of study by many researchers (3,8,17). The method of measuring athletic performance in combines has been standardized; moreover, the measurements are made under the same conditions. Therefore, the collected data have been considered as comparable (15). Although there is some criticism of the validity of combine measurements to assess performance in the field (11), a great deal of time, effort, and resources have been used on evaluating the measurements (1,2,6,7,10,16,20). As the NFL combine results are considered to be an essential factor for evaluation of draft candidates, the same can be considered for the CFL draft. Nevertheless, it is currently unknown what level of value is needed to be considered for a draft pick to the CFL; moreover, it is not easy to combine subjects to set goals. Therefore, if one could clarify the criteria for the Combine's measurements in CFL draft selection; it could be a useful resource for players who wish to have a future in the CFL. Thus, the purpose of this study was to "provide a goal for future players around the world to challenge the CFL by clarifying the standard for combine measurements that they should aim for to be drafted in the CFL." Additionally, this study designed to evaluate the risk scores that have evolved in clinical practice (18) was applied to competitive sports. Risk scores provide a simple scoring system using risk factors identified by multivariate analysis and their regression coefficients and reference values. Taken together, this study creates a scoring system to classify draft successes and failures based on the CFL Combine results, which assess the body size and athletic abilities. The scores created are named as the physical success scores (PSSs).

Methods

Experimental Approach to the Problem

The CFL Combine data and the CFL draft results of players who participated in CFL Combine between 2011 and 2019 were collected and analyzed in the present study. The CFL Combine data analyzed here consisted of 6 athletic abilities of 40-yard dash (40 yards), bench

Table 2
Dates and venue for the Canadian Football League global combine 2020.*

Date	Location	Player origins	Partnering league/Association
11/January	Helsinki, Finland	Scandinavia, Northern Europe	American Football Association of Finland
12/January	Norrköping, Sweden	Scandinavia, Northern Europe	Swedish American Football Federation
17/January	Paris, France	France	French American Football Federation
25/January	Florence, Italy	Italy	Italian Federation of American Football
25/January	Bristol, England	United Kingdom	British American Football Association
26/January	Frankfurt, Germany	Germany, Austria and GFL players	German Football League
01/February	Tokyo, Japan	Japan	Japan National Football Association
02/February	Osaka, Japan	Japan	Japan National Football Association
29/February	Copenhagen, Denmark	Scandinavia, Northern Europe	Danish American Football Federation
07/March	Belo Horizonte, Brazil	Brazil	Brazilian Confederation of American Football
March 14–15	Mexico City, Mexico	Mexico	Professional American Football League

*Combine in Mexico not held due to COVID-19.

press (BP), vertical jump (VJ), broad jump, shuttle run (SHUTTLE), and 3-cone drill (CONE) and consisted of 2 measurements of body size of height (HT) and mass (WT) (Table 3). These records were gathered from the last 5 years published on the CFL official website (https://www.cfl.ca/). The times at 10 and 20 yards, which are obtained simultaneously during the test of the 40 yards, were excluded from the analysis in this study because they are not published on the website. The CFL Combine data were used as candidate predictors in a statistical model to classify the results of CFL draft success or not success. The result of the CFL draft was defined as binary data where success of draft is 1 and fail of draft is 0, regardless of the rank of nomination. Only the complete data were used, and the data including the defect were excluded from this study. Because this study is a secondary analysis of data publicly available on the Internet (website) that does not disclose personal health information, the approval of the ethics review committee was not considered compulsory.

Subjects

The research subjects of this study were players who participated in the CFL Combine between 2011 and 2019 (2011, 2012, 2013, 2014, 2015, 2016: National Combine; 2017, 2018, 2019: National Combine, Eastern Combine, Western Combine, Ontario Combine) (line: $n = 221$, big skill: $n = 177$, skill: $n = 231$). In this study, we used the classification of Robbins and Young (17) based on the commonality of skills required for each position. The offense line and the defense line were called line; the running back, the linebacker, and the tight end were called big skill, and the wide receiver and the defense back were called skill. Specialists such as the quarterback and kicker were excluded from the analysis because of insufficient player numbers.

Procedures

The complete data collected from the website were classified into 3 groups according to the player's position: line, big skill, and skill. A descriptive analysis was performed to summarize the characteristics of subjects in each group. Because the candidate predictors were continuous values, the mean value and standard deviation were calculated. Because the outcome variable was binary, each frequency was counted. Next, this study employed cross-validation to evaluate the outcome prediction performance of PSS. Hastie et al. (9) recommended the process of selection of explanatory variables that is included in the cross-validation process and presented a method of correct cross-validation. To implement the cross-validation method of Hastie et al. (9) , Krstajic et al. (10) presented an algorithm for repeated grid-search cross-validation for variable selection and parameter tuning. In this study, because the tuning of the hyperparameter was not carried out, the algorithm that excluded the tuning part of the hyperparameter from repeated grid-search cross-validation for variable selection and parameter tuning algorithm was adopted. In the repeated grid-search cross-validation for variable selection algorithm, 5-folds cross-validation was performed for all combinations of variables. In a combination of variables, area under the curve (AUC) was calculated with the training data and the validation data to evaluate the performance of predicting the outcome. In addition, the mean value and variance of AUC in a combination of variables were calculated. The final combination of variables was the one with the highest mean AUC of the validation data. The final PSS was the PSS with the highest AUC among the AUC of the validation data of each fold. The prediction performance of PSS was compared with the classification tree that is the benchmark method. A success score was derived from the final logistic regression model based on the method of Sullivan et al. (18). First, continuous variables were organized into categories, and reference values of each variable were defined. In this study, we created 3 categories (i.e., $<$25th, $\geqq$ 25th and $<$75th, $\geqq$ 75th) for each continuous variable using percentiles. Second, reference values were defined to determine the points of each category. The reference values were assigned the median value in each category. Third, among the 3 categories of each variable mentioned above, a category of $\geqq$ 25th and $<$75th was determined to be the base category to which 0 points were assigned. Fourth, in the units of the final regression model, the success score was determined by how far each category was from the base category. The difference between the reference value of each category and the reference value of the base category was calculated and multiplied by the beta coefficient of the final regression model. In this part, Sullivan et al. (18) assumed that age would continue to have a constant influence on the risk of coronary heart disease and considered the constant to generate a risk score for predicting coronary heart disease. However, in this study, authors cannot make such assumptions and therefore excluded the constants. Fifth, all patterns of the possible total score were obtained from the developed PSS. Then, the draft success probability was estimated by substituting the total score of PSS into the equation of the logistic regression. All possible total scores were sorted from the smallest value to the largest value in ascending order and divided into 10 deciles In the results, the total score that was min value, 10 deciles, and max value and the corresponding draft success probability were shown. Statistical analysis used R version 3.6.1.

Statistical Analyses

The variables included in the final logistic regression model were different in each group (Table 5). The logistic regression model of the Line included HT, WT, VJ, 40 yards, and CONE. The logistic regression model of Big Skill included HT, WT, BP, 40 yards, and CONE. The logistic regression model of Skill included HT, WT, BP, and 40 yards. Since all the explanatory variables had VIF values of less than 3.8, the possibility of multicollinearity between the explanatory variables was not high. In each group, 5-folds cross-validation was performed to calculate the mean and variance of AUC in the training data and validation data. For the line, the mean value and the variance of AUC in the training data was 0.83 and 0.0002, and the mean value and the variance of AUC in the validation data was 0.81 and 0.0033. For big skills, the mean value and the variance of AUC in the training data was 0.80 and 0.0001, and the mean value and the variance of AUC in the validation data was 0.79 and 0.0023. For skills, the mean value and the variance of AUC in the training data was 0.875 and 0.0005, and the mean value and the variance of AUC in the validation data was 0.876 and 0.0067.

Results

Characteristics of Subjects

The players selected by the CFL Combine in the 3 groups to which the subjects of this study belonged were 118 out of 221 in the line, 68 out of 177 in the big skill, and 88 out of 231 in the skill. The mean and standard deviation of the 3 groups of candidate predictors were shown in Table 4.

Table 3

Canadian Football League Scouting combine workout drill.*

Drill	Measured athletic ability	Testing protocol
Vertical jump	Explosiveness and vertical leaping ability	Equipment: Vertec or tape measure Attempts: A player can jump as many times as he likes, as long as he improves each time he jumps. Spotters will be in place to ensure that this privilege is not abused Description: From a set position, players will perform a 2-footed jump and touch the highest slat-marker possible. Each player before his jump will have his vertical reach tested. This will be done using either your left or right hand (players choice but if tested with right hand must jump with right hand) 1—VJ Director will measure 18 or 24 inches down from the bottom marker on the Vertec and place a piece of tape at each mark 2—Player will stand with his right side (ankle, hip, shoulder; left side if left handed) against the Vertec and extend his arm upward as far as possible 3—Director will extend the Vertec to the top of the players' extended hand at the top edge of tape and tighten in place. The bottom marker will represent 18 or 24 inches for that player 4—Player starts jump with both feet planted on the ground 5—Player may swing arms and dip knees 6—Players may not shuffle feet before take-off as this will result in a scratch and jump will not count 7—Player attempts as many jumps as he would like (must improve each time), touching the highest slat-marker on the Vertec from the floor 8—That mark represents the players' vertical jump Measurements: Given in inches and 1/4 of inches e.g., 34 and 1/4 inches or 34 and 3/4 inches
Broad jump	Explosiveness, check for correlation to vertical jump, body control	Equipment: Cones marking 3, 6, 9 and 12 feet. Tape measure. Measuring stick Attempts: Two Description: A player stands behind a line and jumps forward as far as he can in a 3 foot lane and the measurement will be from the starting line (same place his toes started from) to the back of the foot (heal) that is closest to the starting line upon landing 1—When starting; both feet are behind starting line, flat footed, no steps before jump 2—Player can use arms for momentum and feet can be together or slightly apart 3—Players feet must remain behind the starting line until he leaves on his jump 4—Upon landing, as long as players foot closest to the starting line remains planted, the player may fall forward 5—Disqualification occurs if the player skips his feet across the starting line on jump or when a player falls back towards the starting line 6—Disqualification is at the discretion of the spotter Measurements: Taken to the nearest 1/4 inch and given in Feet & inches e.g., 9 ft and 1/4 inch or 9 ft and 3/4 inch
Bench press	Upper-body strength and balance	Equipment: Olympic style weights, bar, and collars. Heavy duty bench and rack. Warm-up area is provided Attempts: One attempt at doing as many repetitions as possible using 225 lbs on the bar Description: Test is done using Olympic style weights, bar, and collars. A professional heavy duty rack and spotter(s) is provided. (Anytime you are preparing for this test, you should always warm-up and have a qualified spotter behind you or 2—one on either side in case you fail in your last attempt. Also we suggest you use collars on the bar at all times.) 1—Take up your position with your back on the bench 2—Feet flat on either side of the bench 3—Once the bar is lifted from the rack, shoulders, mid-back, and tail bone should remain in contact with the bench at all times. 4—Lower the bar to the chest and back to full arm extension Minimal bouncing of bar off chest is permitted Must have full extension of arms on each rep Resting with arms fully extended during test is permitted
40-yd sprint	Quickness (10 and 20 times) and pure speed (40)	Attempts: Two (if ran outside, once with the wind and once against the wind) Description: 1—Must start in a 3 point stance (either hand down) 2—Must be set before start at least 1 s. 3—No rolling starts 4—Time starts on runner's first movement Times: Taken to the nearest 100th of a second (e.g., 40 = 4.46, 20 = 2.26, 10 = 1.26

Table 3

Canadian Football League Scouting combine workout drill.* *(Continued)*

Drill	Measured athletic ability	Testing protocol
Shuttle run	Lateral quickness, start or stop quickness, and agility	Attempts: Two (maximum 3 with 1 mulligan). Once going left and once going right. Runner will be given one mulligan if he falls, does not touch or improperly touches a line, or uses both hands to touch. He must run this attempt immediately after mulligan is awarded Description: Runner will start in the middle of the course starting in a 3-point stance with one hand down (either hand). He will run 5 yards to his left touching the line with his left hand and race 10 yards back across his starting point to another line touching the line with his right hand and then race back to the starting point. Second time through, process is repeated in the opposite direction 1—The runner will straddle the starting line, feet equal distance from the starting line 2—Must start in a 3-point stance with either hand down on the middle of the line 3—Must be set before start at least 1 s 4—No rolling starts 5—Time starts on runner's first movement 6—Only one can hand touch the ground at any given time 7—It is the responsibility of the player not to slip and adjust to the surface 8—Shuttle director will inform runner, if he has used his mulligan on a previous attempt, that this is his final attempt Times: Taken to the nearest 100th of a second. e.g., 4.05 s
3 cone drill	Evaluates player's change of direction, balance and ability to get up to speed quickly	Equipment: 18 inch cones Attempts: One (maximum 2 with 1 mulligan). Runner will be given 1 mulligan if he falls, knocks over a cone, or improperly runs drill. He must run this attempt immediately after mulligan is awarded Description: From the starting point, the player is in a 3-point stance (either hand down touching the line). He will run to the first line 5 yards straight ahead and touch the line with his right hand pivoting and coming back to the starting line touching the starting line with his right hand and proceed back in the same direction. He will run around the 18″ cone and head right 90° and to an 18″ cone 5 yards away running around the cone, keeping the cone on his left hand side, back to the second cone, keeping the cone to his left hand side, and on through the finish line 1—Start in a 3-point stance with either hand down, hand must be behind the starting line 2—Must be set before start at least 1 s. 3—No rolling starts 4—Time starts on runner's first movement 5—While rounding the 18″ cones the player can never lean over and touch the ground with his hands, he will be disqualified for that attempt 6—If, when rounding either cone, they are knocked over or displaced he will be disqualified for that attempt 7—It is the responsibility of the player not to slip and adjust to the surface 8—3 cone director will inform runner, if he fails to complete drill on first attempt, that his mulligan will be his final attempt

*From CFL Oficial website (https://www.cfl.ca/2018/03/20/combine-101-basics-behind-prospect-drill/).

Development of Physical Success Score for the Canadian Football League Combine

The simple scoring system shown in Table 6 was developed based on regression coefficients of multivariate analysis and reference values. In each group, 5-folds cross-validation was performed to calculate the mean and variance of AUC in the training data and validation data. For the line, the mean value and the variance of AUC in the training data was 0.772 and 0.0001, and the mean value and the variance of AUC in the validation data was 0.77 and 0.0055. For big skills, the mean value and the variance of AUC in the training data was 0.75 and 0.0002, and the mean value and the variance of AUC in the validation data was 0.76 and 0.0028. For skills, the mean value and the variance of AUC in the training data was 0.838 and 0.0003, and the mean value and the variance of AUC in the validation data was 0.831 and 0.0044. For each PSS, the possible total score and the corresponding estimated draft success probability are shown in Table 7. The total score and the draft success probability that were not shown exist in the corresponding interval (e.g., if the total score of players in a line is 2.0, the draft success probability is between 79.5 and 90.5%). The prediction performance of the classification tree, which is a benchmark method of PSS, was as follows. For the line, the mean value and the variance of AUC in the training data was 0.85 and 0.0002, and the mean value and the variance of AUC in the validation data was 0.71 and 0.0084. For big skills, the mean value and the variance of AUC in the training data was 0.84 and 0.0007, and the mean value and the variance of AUC in the validation data was 0.67 and 0.0092. For skills, the mean value and the variance of AUC in the training data was 0.86 and 0.0001, and the mean value and the variance of AUC in the validation data was 0.78 and 0.0046.

Table 4

Characteristics of subjects participated in this study.

Characteristics	Line (n = 221)	Big skill (n = 177)	Skill (n = 231)
Selected / non-selected (n)	118/103	68/109	88/143
Height (cm)	189.33 ± 5.03	181.26 ± 5.3	182.16 ± 5.72
Weight (kg)	128.09 ± 13.08	97.69 ± 7.07	88.56 ± 6.64
Vertical jump (cm)	68.7 ± 9.58	77.8 ± 8.6	82.83 ± 9.31
Broad jump (cm)	256.44 ± 21.38	280.91 ± 15.46	293.73 ± 16.12
Bench press (rep)	20.78 ± 6.81	16.11 ± 6.09	11.4 ± 5.43
40-yd sprint (sec)	5.3 ± 0.31	4.88 ± 0.18	4.74 ± 0.16
Shuttle run (sec)	4.79 ± 0.25	4.46 ± 0.15	4.38 ± 0.16
Characteristics	Line (n = 221)	Big skill (n = 177)	Skill (n = 231)

All data is in ±*SD*.

Table 5
Final model of logistic regression analyses for success factors of CFL combine in the present study.†

	Line		Big skill		Skill	
Variables	βkillkillK \ (standard error)	Odd ratio (95% CI)	βdd ratio (95 (standard error)	Odd ratio (95% CI)	βdd ratio (95 (standard error)	Odd ratio (95% CI)
Intercept	−12.59 (9.44)		3.87 (11.12)		11.59 (8.54)	
Height	0.14 (0.04) ***	1.15 (1.25–1.06)	0.10 (0.05)	1.1 (1.23–0.99)	0.12 (0.04) **	1.12 (1.23–1.02)
Mass	0.09 (0.02) ***	1.1 (1.15–1.05)	0.13 (0.04) **	1.14 (1.25–1.03)	0.06 (0.04)	1.07 (1.17–0.97)
Vertical jump	0.01 (0.02)	1.01 (1.07–0.96)				
Bench press			0.032 (0.046)	1.03 (1.13–0.94)	0.09 n.s (0.04)	1.09 (1.2–0.99)
40-yd sprint	−4.14 (1.15) ***	0.015 (0.153–0.001)	−6.48 (1.66) ***	0.00152 (0.03976–0.00005)	−8.73 (1.6) ***	0.00016 (0.003739–0.000006)
Shuttle run 3 cone drill	−0.83 (0.65)	0.43 (1.56–0.12)	−0.66 (0.87)	0.51 (2.87–0.09)		
n	176		141		185	
AIC	197.74		155.14		184.59	

†CFL = Canadian Football League; CI = confidence interval; AIC = Akaike information criterion.
***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Discussion

This study was the first to apply the risk score generation method to the CFL Combine to create a success score. Specifically, this study used data from the 2011–2019 CFL Combine to create a success score table for 3 groups: line, big skill, and skill. As a result, the PSS of each group differed in terms of success factors and contributed to the draft. This study is consistent with a previous study (16) that looked at American football, a sport similar to Canadian football, and showed that each position had different characteristics of athletic ability and body shape. This result means that each group focused differently on different measurements for success in the CFL Combine. The predictive performance of the PSS table described above was evaluated by cross-validation. Because the mean AUC in the validation data of all PSS was more than 0.7, the predictive performance of the PSS was not low. The prediction performance of the PSS was better than that of the benchmark method. Therefore, it can be argued that the risk score approach could be applied to the CFL Combines. The logistic regression model approach, predictors of draft success, was statistically selected. Each predictor and estimating the relationship to draft success after controlling for the effects of other factors that were put in the study by Teramoto et al. (19) show factors that increase the probability of draft success. This is indeed useful. On the other hand, it might be difficult for coaches and players to understand logistic regression models because of the statistical knowledge required to understand the mathematical background and results of logistic regression models. The approach adopted by this study to generate risk scores can present a simple system of scoring using the results of logistic regression models to overcome the difficulties of understanding the logistic regression models described earlier. This approach can also provide suggestions as to which measures are essential for each group of players to be drafted, what numbers are required to be achieved, and the final draft success probability. Success scores are an approach that allows one to add a predictive function to the value of each measure (e.g., mean, *SD*, percentile, etc.) that indicates the characteristics of a drafted player predictive function of draft success. However, such an approach is also possible in

Table 6
success score for CFL combine in the present study.

	Line		Big skill		Skill	
Success factor	Category	Score	Category	Score	Category	Score
Height (cm)	∼184	−0.9	∼177	−0.7	∼177	−1.1
	185∼192	0	178∼182	0	178∼184	0
	193∼	1.3	183∼	0.8	185∼	1.4
Mass (kg)	∼115	−1.7	∼92	−1.3	∼83	−0.6
	116∼136	0	93∼102	0	84∼91	0
	137∼	1.9	103∼	1.3	92∼	1
Vertical jump (cm)	∼61	−0.2				
	62∼74	0				
	75∼	0.2				
Bench press (rep)			∼12	−0.3	∼6	−0.5
			13∼19	0	7∼14	0
			20∼	0.3	15∼	0.6
40-yd sprint (s)	5.53∼	−1.9	4.99∼	−2.1	4.86∼	−2.7
	5.04∼5.52	0	4.75∼4.98	0	4.63∼4.85	0
	∼5.03	1.7	∼4.74	1.4	∼4.62	1.9
Shuttle run (s)						
3 cone drill (s)	8.3∼	−0.5	7.56∼	−0.3		
	7.66∼8.29	0	7.25∼7.55	0		
	∼7.65	0.5	∼7.24	0.3		

Table 7
Total score and approximate value of estimated success probability.

Line		Bigskill		Skill	
Total score	Estimate success	Total score	Estimate success	Total score	Estimate success
−5.2	0.6%	−4.7	0.4%	−4.4	0.4%
−4	2.0%	−3.5	1.4%	−3.2	1.6%
−2.9	6.0%	−2.5	3.9%	−2.1	4.7%
−1.8	16.2%	−1.8	7.6%	−1.5	8.2%
−0.9	32.2%	−1	15.6%	−0.6	18.1%
0.1	56.3%	−0.3	27.1%	0.0	28.7%
1.2	79.5%	0.5	45.3%	0.6	42.3%
2.1	90.5%	1.2	62.5%	1.3	59.7%
3.1	96.2%	2	78.8%	1.9	72.9%
4.1	98.6%	2.7	88.2%	2.8	86.9%
5.6	99.6%	4.1	96.8%	4.4	97.0%

the recursive partitioning decision tree analysis adopted by Mulholland and Jensen (13). Decision tree analysis by recursive partitioning provides a high degree of readability of the study results for coaches and players because the predictors can be binarily partitioned, and the threshold can be indicated. However, because the decision tree analysis cannot show the scoring method of this study, the benefit of success scores is that it can provide a standard value of measurement and the process of scoring that can be used by coaches in training. In this study, the prediction performance of the PSS was better than decision tree analysis. Therefore, it can be implied that the method for generating success scores in this study, which is based on the risk score approach, can provide a success factor and its scoring system derived from the CFL Combine data. Future research is required to accumulate research on the generation of success scores in various sports.

Practical Applications

This study aimed to identify the body size and athletic ability required to be selected in the draft based on previous CFL Combine and CFL drafts data. Utilizing the success scores presented here can provide players with a target value for becoming a CFL player. International players can effectively manage their training progress by using success scores because they do not have CFL players or aspiring CFL players around them. It is not easy for them to compare their abilities with others. These success scores can be easily calculated when the results are available and provide immediate evaluation and feedback to the players and coaches based on the results of the measurements, without the need for specialized knowledge or skills. Thus, coaches and strength trainers can provide goals for each player who aspires to the CFL and create training strategies to bridge the gap. This study also identifies the athletic abilities that need to be strengthened more based on positional characteristics and weighted to success scores, which allows for prioritization of training and helps in the planning of training strategies. However, it should be noted that this is a reference value in terms of body size and athletic ability, not in terms of skills. What the authors are discussing here is recognized as the minimum fundamental skills needed to be a draft candidate, and coaches should consider well the reinforcement of skills in addition to this success score. Besides, players from countries that do not have a professional football league can now make the CFL a career goal through current CFL partnerships. In addition to the partnership, clarity of athletic ability goals can motivate adult athletes as well as college, high school, and junior high school students to train toward those goals. For example, previous studies have shown that Japanese footballers are smaller in size and have better agility but have more inferior sprinting ability (25). Therefore, it is imperative to increase speed while increasing size and training strategies need to be more focused and enhanced on specific abilities. In doing so, it can be shown how much of a gap individual player need to fill to be drafted and track their progress to help them get closer to their goals. Furthermore, this study can contribute to the development of an environment in which training aimed at improving athletic ability is actively conducted by objectively communicating the reality that a high level of essential athletic ability is required to be drafted. Besides, it could be used for the selection and development of elite players in each country for the league as a whole. The success scores developed in this study could be used to identify players who are likely to be drafted in the CFL, allowing one to focus the limited resources on this strategy. A player who may be drafted into the CFL may have different characteristics than an elite player at the national level. It could be a player with high athletic potential and physical characteristics such as HT and WT. This result will likely lead to a shift in the identification and development of less skilled players, but with better physical attributes in essential athletic ability than the relatively small players. The latter has traditionally performed dominantly at the national level. This will increase the international competitiveness of gridiron football in each country and supply the CFL with quality global players and make it a more attractive league. Finally, it has the potential to contribute to the global development of gridiron football.

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