The Most Effective Statistics for Determining a Player's Success in the NFL

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Abstract:

The NFL (National Football League) has a wide variety of positions, each coming with hundreds of different statistics purposed to gauge success. As the number of statistics increases for each position, the most important values to determine a player's success should be singled out. The research consists of having 3 unique statistics for every position in the NFL, which are compared from week to week for all 18 weeks of the season. The values will then be used to correlate certain statistics to an individual player's success by seeing which specific statistic best relates to a player's performance during any given week using completely original research.

Keywords:

Sports, Football, Performance, Statistics.

Introduction:

The NFL has come a long way from its start in the 1920s. [1] The time period consisted of its own challenges, mostly struggling to get players on the field. [2] In a time when it was hard enough to assemble complete teams, [3] on-the-field information was negligible. Over the years, NFL data collection has drastically. The first account of official statistics being recorded was in the 1930s, [4] a time when technology was not used to gather information. Fast forward almost 100 years, and the NFL not only collects data in different ways but also uses the information to better their players and teams. [5] There is even a "Big Data Bowl" event to challenge analysts to find new ways to grow the NFL's evolution with analytics, [6] something that would have never happened if all analysts had were basic metrics stored on paper. The league has become more advanced than ever, installing tracking systems on every field and in every player's equipment. [7] As the advancement of technology continues to be one of the NFL's major focus through organizations like "The Future of Football Committee", [8] more statistics than ever have emerged on the field. With thousands of metrics being recorded using modern data-collection technology, [9] a common football watcher wanting to find the most valuable statistics is near-impossible. But, the truth from the days of collecting data on paper to the days where technology automates the entire process is there has never been a unanimous agreement on which data statistics should be used to gauge a player's performance. Some people argue only one statistic should be used; [10] others say a combination of multiple will provide the best outcome; [11] some even believe there is no definitive way to determine what values correlate to success, [12] but most claims are made without looking at data and more from the fans' infamous "eye test".

For the few claims that are made using data, the research is out of date with the modern NFL and narrow-minded with only focusing on one position, [13] instead of every position. In similar terms, the sample size used has been only of a few starting players for that position, [14] not the entire starting and bench players across the league. This attempt at research shows bias to the

handful of players that make it to the top of performance charts. The following research is completely original. The only way to settle the aforementioned debate and fix the problems with the research methodology of former truth-seekers is to do what no one has successfully done and use certain data metrics for each position to mathematically decide how related the success of any player across the league is to a given statistic.

Methodology:

All data gathered and used in this paper is collected from both Pro Football Focus, [15] and Pro-Football-Reference. [16] Each position will have three statistics that will be compared with an overall grade for each player of every week to correlate how important the chosen statistics are in determining how successful a player may be. The statistics for each position on offense and defense are chosen as values that are most commonly used in deciding how successful a player is. These metrics are key values that encapsulate the basics of a specific position's performance. These numbers are both general values that require little background knowledge as well as more specific data that requires understanding its relation with the position. A player has recorded an overall grade per week given by Pro Football Focus (PFF) that is used as the "success" metric. The weekly overall grade for each player is compared to the statistics for each position for that one week to produce a correlation. The results include the Pearson's Correlation Coefficient values between all the chosen statistics for each position and the overall PFF grade earned each week by every player of that position.

The following are the explanations of the three metrics chosen for each of the total nine positions on offense and defense.

Offensive Metrics:

PFF refers to Pro Football Focus. [15] *PFR refers to Pro-Football-Reference.* [16]

- Quarterback
  - PFR (Pro-Football-Reference) - Touchdown% (TD%) - Shows how often a quarterback throws a touchdown based on their pass attempts.
    - League Average Last Season: 4.6%
  - PFR - Interception% (Int%) - Shows how often a quarterback throws an interception based on their pass attempts.
    - League Average Last Season: 2.2%
  - PFR - Y/A (Yards per Attempt) - Shows how productive a quarterback is everytime they throw the ball.
    - League Average Last Season: 7.1
- Running Back
  - PFR - Y/A - Shows how productive a running back is everytime they run with the ball.
    - League Average Last Season: 4.5
  - PFR - 1D (1st Downs) - Shows how many times a running back is able to keep an offensive drive alive by getting a first down.
    - League High Last Season: 93

    - PFR - Yds/Tgt (Yards Per Target) - Shows what level of the field a running back is able to get open by running routes and throwing the ball at.
        - League High Last Season: 5.6
- Wide Receiver
    - PFR - Tgt (Target) - Shows how often a wide receiver is looked at and thrown the ball.
        - League High Last Season: 184
    - PFR - YAC/R (Yards After Catch Per Reception) - Shows how effective a wide receiver is after catching the ball.
        - League Average Last Season: 4.1
    - PFR - Catch% - Shows how reliable a wide receiver is at catching for their quarterback.
        - League High Last Season: 84.4%
- Tight End
    - PFR - Catch% - Shows how reliable a tight end is at catching for their quarterback.
        - League High Last Season: 89.5%
    - PFR - Yds/Tgt - Shows what level of the field a tight end is able to get open on and throw the ball at.
        - League Average Last Season: 7.5
    - PFF - Run Block Grade - Shows how effective a tight end is at blocking for a ball carrier.
        - League High Last Season: 74
- Offensive Line
    - PFF - Run Block Grade - Shows how effective an offensive lineman is at winning in run block reps and helping their team's ball carrier.
        - League High Last Season: 93.1
    - PFF - Pass Block Grade - Shows how effective an offensive lineman is at winning in pass block reps.
        - League High Last Season: 91.7
    - PFF - Pressures Allowed - Shows how effective an offensive lineman is at keeping defenders away from the quarterback.
        - League Low Last Season: 3

Defensive Metrics:

- Defensive Line
    - PFF - Run Defense Grade - Shows a defensive linemen's efficiency at defending the run.
        - League High Last Season: 81.9
    - PFF - Pass Rush Grade - Shows how effective a defensive lineman is at rushing the passer and beating their designated offensive lineman.
        - League High Last Season: 92.4
    - PFR - Pressures - Shows how frequent a defensive lineman is at pressuring the QB.
        - League Average Last Season: 72
- Linebacker

    - PFR - Cmp% (Completion%) allowed - Shows how effective a linebacker is at defending a skill position player in coverage.
        - League Average Last Season: 75.0%
    - PFR - MissedTackle% - Shows how effective a linebacker is at tackling a ball-carrier.
        - League Average Last Season: 7.1%
    - PFR - Yds/Cmp allowed (Yards Per Completion Allowed) - Shows how efficient a linebacker is on a snap to snap basis when they give up a completion.
        - League Average Last Season: 8.9
- Cornerback
    - PFR - Cmp% allowed - Shows how effective a cornerback is at defending a wide receiver in coverage.
        - League Average Last Season: 60.9%
    - PFR - Yards/Cmp allowed (Yards Per Completion Allowed) - Shows how efficient a cornerback is on a snap to snap basis when they give up a completion.
        - League Average Last Season: 11.6
    - PFR - Yards Allowed - Shows the number of yards allowed in coverage.
        - League High Last Season: 850
- Safety
    - PFR - Cmp% allowed - Shows how effective a safety is at defending a wide receiver in coverage.
        - League Average Last Season: 67.9%
    - PFR - Yards/Cmp allowed (Yards Per Completion Allowed) - Shows how efficient a safety is on a snap to snap basis when they give up a completion.
        - League Average Last Season: 13.0
    - PFR - Yards Allowed - Shows the number of yards allowed in coverage.
        - League High Last Season: 693

Results:

The following equation of Pearson's Correlation Coefficient was used to find the correlations between the chosen statistic for each position and the overall PFF grade:

$$r = \frac{\Sigma(xi-x)(yi-y)}{\sqrt{\Sigma(xi-x)^2(yi-y)^2}}$$

where the variables are defined as followed:

- r = Pearson's Correlation Coefficient
- xi = values of the x-variable (value of chosen statistic) in the sample
- x = mean of the values of the x-variable (value of chosen statistic)
- yi = values of the y-variable (value of overall grade) in the sample
- y = mean of the values of the y-variable (value of overall grade)

Table 1: Quarterback Performance vs PFF Grade

Quarterback Metrics vs. PFF Grade Correlation		
TD% vs. PFF	Int% vs. PFF	Y/A vs. PFF
0.268	-0.217	0.383

The metrics researched for the quarterback position are TD%, Int%, and Y/A. All values are vaguely correlated to the PFF "success" grade, but Y/A edges out the rest at 0.383 while the other values remain in the 0.200 realm. With no values having an overwhelming correlation to the weekly grade, it can be determined that a quarterback's success on the field correlates to a combination of multiple statistics, not a singular value.

Table 2: Running Back Performance vs PFF Grade

Running Back Metrics vs. PFF Grade Correlation		
Y/A vs. PFF	1D vs. PFF	Yds/Tgt vs. PFF
0.356	0.444	0.195

The statistics chosen for the running back position are Y/A (Yards Per Attempt), 1D (1st Down), and Yds/Tgt (Yards Per Target). The 1D metric is the closest in relation to the PFF grade at 0.444, but Y/A is recorded closeby at 0.356. In the end, only 1D had a clear high correlation with the overall grade, leading to the idea that the running back position's success can be found through the 1D metric or more accurately reached through a grouping of numerous other statistics.

Table 3: Wide Receiver Performance vs PFF Grade

Wide Receiver Metrics vs. PFF Grade Correlation		
Tgt vs. PFF	YAC/R vs. PFF	Catch% vs. PFF
0.397	0.149	0.339

The data metrics of Tgt (Targets), YAC/R (Yards After Catch Per Reception), and Catch% are all researched for the wide receiver position. The Tgt and Catch% values are very similar at 0.397 and 0.339, respectively, but neither those and the third metric are strongly correlated with the weekly grade. It can be determined that to analyze the performance of a wide receiver on the field, Tgt and Catch% should be used in a combination along with other metrics to have multiple similarly correlated values related to success.

Table 4: Tight End Performance vs. PFF Grade

Tight End Metrics vs. PFF Grade Correlation		
Catch% vs. PFF	Yds/Tgt vs. PFF	Run Block Grade vs. PFF
0.357	0.475	0.386

The researched statistics for the tight end position are Catch%, Yds/Tgt, and Run Block Grade. All values are almost equally correlated to the weekly overall grade, with Yds/Tgt at the top at 0.475, but the rest in the 0.300 area. This is a good indication that a tight end's performance does not rely on one value but multiple. To find the success of a tight end, a combination of all three chosen metrics is the best strategy.

Table 5: Offensive Line Performance vs. PFF Grade

Offensive Line Metrics vs. PFF Grade Correlation		
Run Block Grade vs. PFF	Pass Block Grade vs. PFF	Pressures Allowed vs. PFF
0.854	0.541	-0.344

For the offensive line, the chosen data metrics are Run Block Grade, Pass Block Grade, and Pressures Allowed. Each value had a largely different correlation, but Run Block Grade is the strongest correlation at 0.854. Pass Block Grade is at 0.541, a high correlation, but not as strong as the former. Both values seem to appear as the highest correlation for how well an offensive lineman performs, proving their success to be made up from both Run and Pass Block Grades.

Table 6: Defensive Line Performance vs PFF Grade

Defensive Line Metrics vs. PFF Grade Correlation		
Run Defense Grade vs. PFF	Pass Rush Grade vs. PFF	Pressures vs. PFF
0.672	0.649	0.302

The researched statistics for the defensive line are Run Defense Grade, Pass Rush Grade, and Pressures. Both the Run Defense and the Pass Rush Grade are almost equally high at 0.672 and 0.649, respectively. With both values having a high correlation to the overall grade, it can be reasonably determined that the Run Defense and Pass Rush Grades are equally responsible for making up a defensive lineman's success.

Table 7: Linebacker Performance vs PFF Grade

Linebacker Metrics vs. PFF Grade Correlation		
Cmp% allowed vs. PFF	MissedTackle% vs. PFF	Yds/Cmp vs. PFF
-0.099	-0.148	-0.255

The metrics chosen for the linebackers are Cmp% allowed (Completion%), MissedTackle%, and Yds/Cmp (Yards Per Completion). Cmp% had almost no correlation with the weekly grade, and the other ones fared similar with Yds/Cmp being the statistic with the highest correlation at -0.225. Based on the three values, the linebacker position's success is not determined by any of the chosen statistics but instead by other metrics not researched.

Table 8: Cornerback Performance vs PFF Grade

Cornerback Metrics vs. PFF Grade Correlation		
Cmp% vs. PFF	Yds/Cmp vs. PFF	Yards Allowed vs. PFF
-0.194	-0.311	-0.325

For the cornerback position, the researched statistics are Cmp%, Yds/Cmp, and Yards Allowed. Every recorded metric is loosely related, with Yards Allowed the most correlated at -0.325. As none of the the values showed any significant correlation to the overall grade, it can be reasonably said that the cornerback position's success has little to do with the three chosen statistics and may be more related to different metrics.

Table 9: Safety Performance vs PFF Grade

Safety Metrics vs. PFF Grade Correlation		
Cmp% vs. PFF	Yds/Cmp vs. PFF	Yards Allowed vs. PFF
-0.075	-0.349	-0.292

The statistics researched for the safety position are Cmp%, Yds/Cmp, and Yards Allowed. Cmp% had almost no correlation with the weekly grade, while Yds/Cmp and Yards Allowed only fared slightly better at -0.349 and -0.292, respectively. It can be determined that to figure out which statistics best relate to the safety position, it may be a combination of multiple statistics or a singular statistic, which in both cases is not researched as one of the three main metrics.

Discussion:

With all the data collected and analyzed, some positions have clear statistics that relate to the grade, while others require additional research to understand the extent of certain

statistics on a player's performance. The positions of running back, wide receiver, tight end, offensive line, and defensive line all have at least some correlation between the chosen metrics and the weekly grades. Of these five positions, running back and wide receiver are the only ones to not include any Pro Football Focus statistics in the research and had the weakest correlation among the group. Looking at the values, it can be determined that the three positions that used PFF metrics had the highest correlation with the PFF overall grade. This is most likely due to both values being gathered from PFF. The quarterback, linebacker, cornerback, and safety positions had next-to-none correlation with the player success value, indicating that additional research with different statistics would be needed to determine the metrics that best relate to a player's success. While some statistics that are chosen are clearly unrelated with a position's success, those that have a strong correlation will be used in the future as benchmarks to best understand what metrics lead to success of a player in the NFL.

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