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COLD WEATHER TEAMS IN THE NATIONAL FOOTBALL LEAGUE AND HOME-FIELD ADVANTAGE

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Abstract. The National Football League (NFL) has long had this idea of home-field advantage when teams play at home where they win more of their games. However, home games entail many things such as home fan attendance and weather. In considering the mean winning percentage of home games played during the winter months of December, January, and February by Cold Weather Teams, and the mean winning percentage of all home games played and all December, January, and February home games played, the null hypothesis would be that there is no difference in the means. By rejecting the null hypothesis, it would lead to the conclusion that cold weather plays a factor in determining NFL games. This hypothesis testing is important because if teams in "colder weather climates" gain a significant advantage during the colder months of December, January, and February, the impacts of playing in an open grass stadium during these months will have a greater impact on the playoffs and draft, which is decided based on final NFL standings. The finding is that Cold Weather Teams have a significant advantage when compared to the other data found, which suggests that cold weather tends to impact NFL games more than expected.

1. Introduction

Before the start of the 2021 league year and since the 2002 season, the NFL has been composed of 32 teams, each team playing 16 games, 8 of which are considered home games [1]. From 2002-2019, the NFL would play a total of 266 games that included a home team, which included playoff games, but excluded the Super Bowl which is played on a neutral field; however, in 2020, the NFL expanded the playoff field by one team in the American Football Conference (AFC) and National Football Conference (NFC) to create 268 games that included a home team [2]. However, the 2020 NFL season is full of oddities, including changes to the schedule of 11 teams due to the Covid-19 pandemic [3], resulting in the Denver Broncos without a starting quarterback (QB) play a game [4], and it is also the first time the host

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city of Super Bowl game was the home stadium of a team that participated, which brings the number of home games of the first team to 269 [5]. In completion, this research project is trying to reject the null hypothesis that there is not a significant advantage for the Cold Weather Teams, during the months of December, January, and February.

2. Method and Materials

The research project defines home games as games that are played at a team's home-field or was voluntarily played at a neutral site in agreement with the NFL that the game would count as a home game for that team in order to include games played in London, Canada, and other places. The definition used to determine "cold weather games" was if the game was played in December, January, or February of any given league season. In reference to "cold weather teams" this is for teams that play in an outdoor environment (not a dome) above the 39°N latitude line. These teams include the Chicago Bears (Memorial Stadium used in 2002 at 40.099365234°N [6], Soldier Field used from 2003-Present at 41.8625332°N) [7], Green Bay Packers (Lambeau Field used from 1957-Present at 44.501389°N)[8], Kansas City Chiefs (Arrowhead Stadium used from 1972-Present at 39.048889°N) [9], Buffalo Bills (Bills Stadium used from 1973-Present at 42.774°N [10] and "Toronto Series" from 2008-2011 at the Rogers Centre, Toronto Canada [11] at 43.641438°N)[12], Cleveland Browns (FirstEnergy Stadium used from 1999-Present at 41.506111°N)[13], Cincinnati Bengals (Paul Brown Stadium used from 2000-Present at 39.095°N)[14], Denver Broncos (Empower Field at Mile High used from 2001-Present at 39.743952°N)[15], New England Patriots (Gillette Stadium used from 2002-Present at 42.091°N)[16], Pittsburgh Steelers (Heinz Field used from 2001-Present at 40.446667°N)[17], Philadelphia Eagles (Veterans Stadium used from 1971-2002 at 39.906667°N[18], Lincoln Financial Field used from 2003-Present at 39.900833°N)[19], Seattle Seahawks (Lumen Field used from 2002-Present at 47.5952°N) [20], Baltimore Ravens (M&T Bank Stadium used from 1998-Present at 39.278056°N)[21], New York Jets and Giants (Giants Stadium used from 1984-2009 at 40.812222°N [22], MetLife Stadium used from 2010-Present at 40.813528°N)[23], and Minnesota Vikings (TCF Bank Stadium [64] used from 2014-2015 at 44.976°N)[24]. The research only takes into account home games from the 2002 season and onwards because that is when the Houston Texans became the 32nd team in the NFL [25].

3. Results

Between the years 2002-2020, there were 5057 games in this time period. The overall record of all teams was 5046-5046-22 which gives you an overall winning percentage of 50% or 0.50. This will allow this study to assume the odds of winning or losing a football game in the NFL is 50/50 probability and is random which is defined by "events that cannot be predicted with certainty, but the relative frequency with which they occur in a long series of trials is often remarkably stable," [26]. The table and graph below shows this phenomenon is associated with NFL teams and their winning percentage, home-field winning percentage, and cold weather winning percentage from 2002-2019 and 2002-2020. *Winning percentage was calculated by taking (wins + (ties*0.5))/(total number of games).*

Table 1: NFL Teams Winning Percentages Table.

NFL Winning Percentages [27]						
Team	2002-2019	2002-2020	Home-field 2002-2019	Home-field 2002-2020	Cold Weather 2002-2019	Cold Weather 2002-2020
Atlanta Falcons (Atl) [28]	0.528	0.514	0.587	0.570	0.587	0.562
Arizona Cardinals (Ari) [29]	0.448	0.450	0.568	0.564	0.640	0.623
Baltimore Ravens (Bal) [30]	0.580	0.585	0.720	0.715	0.673	0.691
Buffalo Bills (Buf) [31]	0.434	0.456	0.521	0.545	0.489	0.531
Carolina Panthers (Car) [32]	0.522	0.511	0.567	0.551	0.660	0.633
Cincinnati Bengals (Cin) [33]	0.463	0.453	0.537	0.529	0.553	0.540
Chicago Bears (Chi) [34]	0.481	0.481	0.547	0.538	0.500	0.491
Cleveland Browns (Cle) [35]	0.310	0.331	0.378	0.398	0.351	0.364
Dallas Cowboys (Dal) [36]	0.540	0.531	0.584	0.580	0.462	0.488
Denver Broncos (Den) [37]	0.563	0.550	0.647	0.627	0.66	0.635
Detroit Lions (Det) [38]	0.356	0.353	0.444	0.428	0.333	0.310
Houston Texans (Hou) [39]	0.453	0.443	0.540	0.525	0.542	0.510
Green Bay Packers (GB) [40]	0.606	0.615	0.697	0.703	0.745	0.750
Indianapolis Colts (Ind) [41]	0.620	0.621	0.697	0.699	0.759	0.768

Continuation of Table 6

Team	2002-2019	2002-2020	Home-field 2002-2019	Home-field 2002-2020	Cold Weather 2002-2019	Cold Weather 2002-2020
Jacksonville Jaguars (Jax) [42]	0.398	0.381	0.483	0.464	0.500	0.479
Kansas City Chiefs (KC) [43]	0.525	0.544	0.592	0.605	0.630	0.644
Las Vegas Raiders (LVR) [44]	0.360	0.367	0.432	0.422	0.422	0.396
Los Angeles Chargers (LAC) [45]	0.537	0.532	0.591	0.586	0.588	0.593
Los Angeles Rams (LAR) [46]	0.419	0.430	0.476	0.490	0.422	0.447
Miami Dolphins (Mia) [47]	0.438	0.448	0.503	0.510	0.551	0.558
Minnesota Vikings (Min) [48]	0.515	0.511	0.649	0.635	0.592	0.588
New England Patriots (NE) [49]	0.761	0.746	0.838	0.829	0.838	0.829
New York Giants (NYG) [50]	0.488	0.483	0.490	0.484	0.404	0.400
New York Jets (NYJ) [51]	0.452	0.435	0.531	0.510	0.581	0.578
Philadelphia Eagles (Phi) [52]	0.580	0.565	0.609	0.601	0.600	0.596
Pittsburgh Steelers (Pit) [53]	0.637	0.640	0.706	0.710	0.724	0.710
San Francisco 49ers (SF) [54]	0.460	0.456	0.557	0.535	0.630	0.592
Seattle Seahawks (Sea) [55]	0.578	0.585	0.703	0.707	0.702	0.689

Continuation of Table 6						
Team	2002-2019	2002-2020	Home-field 2002-2019	Home-field 2002-2020	Cold Weather 2002-2019	Cold Weather 2002-2020
Tampa Bay Buccaneers (TB) [56]	0.416	0.438	0.449	0.462	0.333	0.375
Tennessee Titans (Ten) [57]	0.485	0.494	0.534	0.535	0.571	0.558
Washington Football Team (WFT) [58]	0.401	0.402	0.445	0.439	0.311	0.292
New Orleans Saints (NO) [59]	0.574	0.583	0.612	0.617	0.509	0.517
End of Table-*all decimals were rounded to the nearest thousandth*						

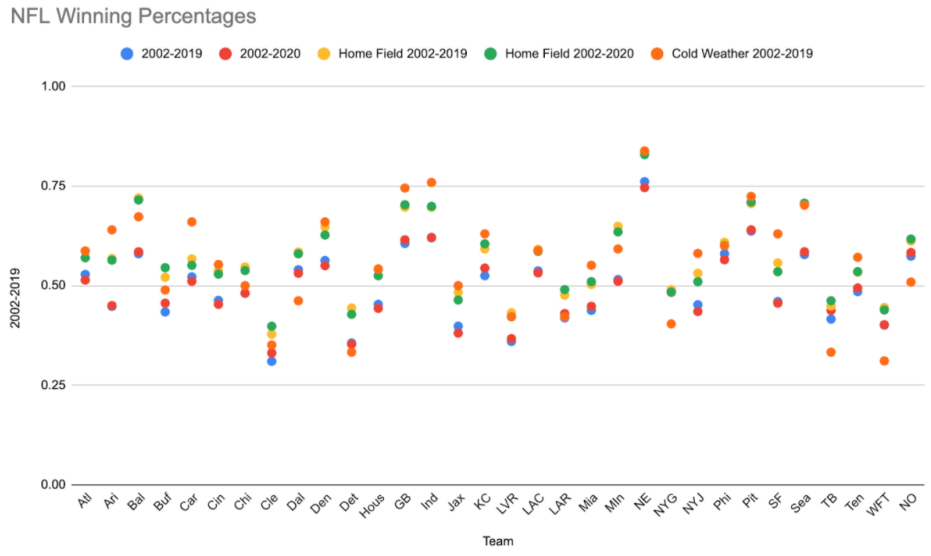

FIGURE 1. Graph: Scatterplot showing teams winning percentages.

This data was used and then compiled on a season by season basis to construct the following table and graph.

Table 2: Entire NFL Winning Percentage Season By Season Table.

Entire NFL Winning Percentage Season By Season		
Year	Home Games	Cold Weather Team Games at Home During December, January, and February
2002	0.5883458647	0.6829268293
2003	0.6127819549	0.7105263158
2004	0.5676691729	0.625
2005	0.5827067669	0.6363636364
2006	0.5413533835	0.575
2007	0.5714285714	0.6315789474
2008	0.5695488722	0.6129032258
2009	0.5751879699	0.5526315789
2010	0.5526315789	0.5909090909
2011	0.5751879699	0.619047619
2012	0.5733082707	0.5853658537
2013	0.5996240602	0.6097560976
2014	0.5770676692	0.6216216216
2015	0.5413533835	0.5652173913
2016	0.5864661654	0.6888888889
2017	0.5714285714	0.5609756098
2018	0.5977443609	0.6341463415
2019	0.5206766917	0.6341463415
2020	0.5	0.5909090909
End of Table		

The overall winning percentages for home games including the 2020 NFL season is 0.5686177576 and without the 2020 season is 0.5724728488. Similarly, the overall winning percentages for Cold Weather Teams including the 2020 season is 0.617076326 and without 0.6186556927. These numbers will vary from the mean due to a different number of games being played every season. For this set of data we found the mean ($\bar{x}$), population standard deviation (σ), and sample standard deviation (s) for home games, Cold Weather Team games at home during December, January, and February, and all team games at home during December, January, and February for with data that included and was without the 2020 NFL season.

Table of Standard Deviations and Arithmetic Means with the 2020 Season			
Mathematical Method	Home games	Cold Weather Team Games at Home During December, January	All Team Games at Home During December, January, and February
$\bar{x}$ arithmetic mean	0.5686584883	0.6172586568	0.566979456
s sample standard deviation	0.02750025926	0.04325904819	0.05386899073
σ population standard deviation	0.02676678683	0.04210526565	0.05243222539

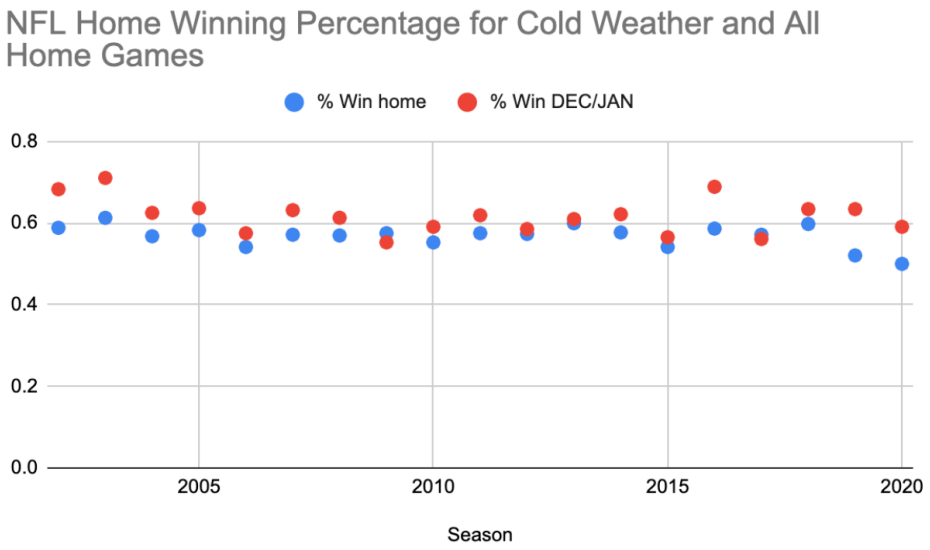

FIGURE 2. Graph 2: This is the NFL winning percentages for all home teams and cold weather teams including the 2020 season.

Table of Standard Deviations and Arithmetic Means without the 2020 Season			
Mathematical Method	Home games	Cold Weather Team Games at Home During December, January	All Team Games at Home During December, January, and February
$\bar{x}$ arithmetic mean	0.5724728488	0.6187225216	0.5715965942
s sample standard deviation	0.0225400042	0.04402629073	0.0514169134
σ population standard deviation	0.0219049467	0.04278586389	0.04996825811

The formula used for the arithmetic mean ($\bar{x}$) was $\bar{x}=\frac{1}{n}\sum_{i=1}^{n} x_i$, where n= number of values and x_i= data set values.

The formula used for sample standard deviation (s) was $s=\sqrt{\frac{\sum_{i=1}^{N}(x_i-\bar{x})^2}{N-1}}$ where N=the number of observations, x_i= data set values, and ($\bar{x}$) is the arithmetic mean.

The formula used for population standard deviation (σ) was $\sigma = \sqrt{\frac{\sum_{i=1}^{N}(x_i-\mu)^2}{N-1}}$ N=the number of observations, x_i= data set values, and (μ) is the population mean.

In this case, $\mu = \bar{x}$ because the study has a set number of data points. For the purpose of this study, the study will run 4 hypotheses tests because the 2020 NFL season was considered an outlier. An outlier is "data values that are very different from other measurements in the data set." [60] The study assumes based on Las Vegas and the gambling markets assumption in making their lines and odds that home-field advantage exists within the NFL and is shown through home teams having a winning percentage of 0.5686177576 and 0.5724728488 (when you don't include the 2020 NFL season) [61]. The tests run will be a right-tailed dependent samples paired differences test because the samples can be deemed to be dependent

on the other since a home game of cold weather teams during December, January, and February will also be included in the sample of all team games at home during December, January, and February and all home games. Thus, this clearly passes the definition of dependent samples being "each data value in one sample can be paired with a corresponding data value in the other sample," [60]. Using the test outlines and tables provided by Brasse and Brasse (2009), the tests were done as follows.

3.1. **Test 1: Cold Weather Teams Games at Home During December, January, and February, and All Team Games at Home During December, January, and February (including the 2020 NFL Season).** .

$H_0 : \mu_d = 0$, $H_1 : \mu_d > 0$, $\alpha = 0.01$

The study begins by pairing the seasons together as a pair. For instance, 2002 Cold Weather Team Winning Percentage with All Team Home Games During December, January, and February Winning Percentage which leaves the following table.

Table 3: Paired Differences Table for Test 1.

Paired Differences Table			
Season	Cold Weather Team Games at Home During December, January, and February (B)	All Team Games at Home during December, January, and February (A)	D=B-A
2002	0.6829268293	0.6136363636	0.06929046563
2003	0.7105263158	0.6623376623	0.04818865345
2004	0.625	0.5888888889	0.03611111111
2005	0.6363636364	0.5444444444	0.09191919192
2006	0.575	0.4494382022	0.1255617978
2007	0.6315789474	0.606741573	0.02483737433
2008	0.6129032258	0.64	-0.02709677419
2009	0.5526315789	0.5444444444	0.008187134503
2010	0.5909090909	0.5222222222	0.06868686869
2011	0.619047619	0.5888888889	0.03015873016
2012	0.5853658537	0.5730337079	0.01233214579
2013	0.6097560976	0.5862068966	0.02354920101
2014	0.6216216216	0.5466666667	0.07495495495
2015	0.5652173913	0.5161290323	0.04908835905
2016	0.6888888889	0.6	0.08888888889
2017	0.5609756098	0.6153846154	-0.05440900563
2018	0.6341463415	0.5730337079	0.0611126336
2019	0.6341463415	0.5172413793	0.1169049622
2020	0.5909090909	0.4838709677	0.1070381232

From the table, the study finds that $\bar{d} = 0.05027920086$ and $s_d = 0.04720562542$. n=19.

$t = \frac{\bar{d}}{\frac{s_d}{\sqrt{n}}} = \frac{0.05027920086}{\frac{0.04720562542}{\sqrt{19}}} = 4.64241$

d.f.=n-1=19-1=18

The P-value falls to the right of 3.922 from the "Critical Values for Student's t distribution." 3.922 < P-Value for the sample t.

Since the interval containing the P-Value of sample t lies to the right of $\alpha = 0.01$, we reject H_0.

At the 1% level of significance and even the 0.1% level of significance, we conclude that the Cold Weather Team Games at Home During December, January have an advantage over All Team Games at Home During December, January, and February which includes the 2020 season.

3.2. **Test 2: Cold Weather Teams Games at Home During December, January, and February, and All Team Games at Home During December, January, and February (without the 2020 NFL Season).** .

$H_0 : \mu_d = 0$, $H_1 : \mu_d > 0$, $\alpha = 0.01$

The study begins by pairing the seasons together as a pair. For instance, 2002 Cold Weather Team Winning Percentage with All Team Home Games During December, January, and February Winning Percentage which leaves the following table.

Table 4: Paired Differences Table for Test 2.

Paired Differences Table			
Season	Cold Weather Team Games at Home During December, January, and February (B)	All Team Games at Home during December, January, and February (A)	D=B-A
2002	0.6829268293	0.6136363636	0.06929046563
2003	0.7105263158	0.6623376623	0.04818865345
2004	0.625	0.5888888889	0.03611111111
2005	0.6363636364	0.5444444444	0.09191919192
2006	0.575	0.4494382022	0.1255617978
2007	0.6315789474	0.606741573	0.02483737433
2008	0.6129032258	0.64	-0.02709677419
2009	0.5526315789	0.5444444444	0.008187134503
2010	0.5909090909	0.5222222222	0.06868686869
2011	0.619047619	0.5888888889	0.03015873016
2012	0.5853658537	0.5730337079	0.01233214579
2013	0.6097560976	0.5862068966	0.02354920101
2014	0.6216216216	0.5466666667	0.07495495495
2015	0.5652173913	0.5161290323	0.04908835905
2016	0.6888888889	0.6	0.08888888889
2017	0.5609756098	0.6153846154	-0.05440900563
2018	0.6341463415	0.5730337079	0.0611126336
2019	0.6341463415	0.5172413793	0.1169049622

From the table, the study finds that $\bar{d} = 0.0471259274$ and $s_d = 0.04646955209$. n=18.

$t = \frac{\bar{d}}{\frac{s_d}{\sqrt{n}}} = \frac{0.0471259274}{\frac{0.04646955209}{\sqrt{18}}} = 4.30345$

d.f.=n-1=18-1=17

The P-value falls to the right of 3.965 from the "Critical Values for Student's t distribution." 3.965< P-Value for the sample t.

Since the interval containing the P-Value of sample t lies to the right of $\alpha = 0.01$, we reject H_0.

At the 1% level of significance and even the 0.1% level of significance, we conclude that the Cold Weather Team Games at Home During December, January have an advantage over All Team Games at Home During December, January, and February which does not include the 2020 season.

3.3. **Test 3:Cold Weather Teams Games at Home During December, January, and February, and All Home Games (including the 2020 NFL Season).** .

$H_0 : \mu_d = 0$, $H_1 : \mu_d > 0$, $\alpha = 0.01$

The study begins by pairing the seasons together as a pair. For instance, 2002 Cold Weather Team Winning Percentage with All Team Home Games Winning Percentage which leaves the following table.

Table 5: Paired Differences Table for Test 3.

Paired Differences Table			
Season	Cold Weather Team Games at Home During December, January, and February (B)	All Team Games at Home (A)	D=B-A
2002	0.6829268293	0.5883458647	0.09458096461
2003	0.7105263158	0.6127819549	0.0977443609
2004	0.625	0.5676691729	0.05733082707
2005	0.6363636364	0.5827067669	0.05365686945
2006	0.575	0.5413533835	0.03364661654
2007	0.6315789474	0.5714285714	0.06015037594
2008	0.6129032258	0.5695488722	0.04335435363
2009	0.5526315789	0.5751879699	-0.02255639098
2010	0.5909090909	0.5526315789	0.03827751196
2011	0.619047619	0.5751879699	0.04385964912
2012	0.5853658537	0.5733082707	0.01205758298
2013	0.6097560976	0.5996240602	0.01013203741
2014	0.6216216216	0.5770676692	0.04455395245
2015	0.5652173913	0.5413533835	0.02386400785
2016	0.6888888889	0.5864661654	0.1024227235
2017	0.5609756098	0.5714285714	-0.01045296167
2018	0.6341463415	0.5977443609	0.03640198056
2019	0.6341463415	0.5206766917	0.1134696497
2020	0.5909090909	0.5	0.09090909091

From the table, the study finds that $\bar{d} = 0.04860016852$ and $s_d = 0.03813895447$. n=19.

$t = \frac{\bar{d}}{\frac{s_d}{\sqrt{n}}} = \frac{0.04860016852}{\frac{0.03813895447}{\sqrt{19}}} = 5.55579$

d.f.=n-1=19-1=18

The P-value falls to the right of 3.922 from the "Critical Values for Student's t distribution." 3.922 < P-Value for the sample t.

Since the interval containing the P-Value of sample t lies to the right of $\alpha = 0.01$, we reject H_0.

At the 1% level of significance and even the 0.1% level of significance, we conclude that the Cold Weather Team Games at Home During December, January have an advantage over All Home Games which includes the 2020 season.

3.4. **Test 4:Cold Weather Teams Games at Home During December, January, and February, and All Home Games (without the 2020 NFL Season).** .

$H_0 : \mu_d = 0$, $H_1 : \mu_d > 0$, $\alpha = 0.01$

The study begins by pairing the seasons together as a pair. For instance, 2002 Cold Weather Team Winning Percentage with All Team Home Games Winning Percentage which leaves the following table.

Table 6: Paired Differences Table for Test 4.

Paired Differences Table			
Season	Cold Weather Team Games at Home During December, January, and February (B)	All Team Games at Home (A)	D=B-A
2002	0.6829268293	0.5883458647	0.09458096461
2003	0.7105263158	0.6127819549	0.0977443609
2004	0.625	0.5676691729	0.05733082707
2005	0.6363636364	0.5827067669	0.05365686945
2006	0.575	0.5413533835	0.03364661654
2007	0.6315789474	0.5714285714	0.06015037594
2008	0.6129032258	0.5695488722	0.04335435363
2009	0.5526315789	0.5751879699	-0.02255639098
2010	0.5909090909	0.5526315789	0.03827751196
2011	0.619047619	0.5751879699	0.04385964912
2012	0.5853658537	0.5733082707	0.01205758298
2013	0.6097560976	0.5996240602	0.01013203741
2014	0.6216216216	0.5770676692	0.04455395245
2015	0.5652173913	0.5413533835	0.02386400785
2016	0.6888888889	0.5864661654	0.1024227235
2017	0.5609756098	0.5714285714	-0.01045296167
2018	0.6341463415	0.5977443609	0.03640198056
2019	0.6341463415	0.5206766917	0.1134696497

From the table, the study finds that $\bar{d} = 0.04624967283$ and $s_d = 0.03780207387$. n=18.

$t = \frac{\bar{d}}{\frac{s_d}{\sqrt{n}}} = \frac{0.04624967283}{\frac{0.03780207387}{\sqrt{18}}} = 5.18993$

d.f.=n-1=18-1=17

The P-value falls to the right of 3.965 from the "Critical Values for Student's t distribution." 3.965 < P-Value for the sample t.

Since the interval containing the P-Value of sample t lies to the right of $\alpha = 0.01$, we reject H_0.

At the 1% level of significance and even the 0.1% level of significance, we conclude that the Cold Weather Team Games at Home During December, January have an advantage over All Home Games which does not include the 2020 season.

4. Discussion

These results mean that although prior studies conclusions have shown that the impact of home-field advantage decreases year over year, it has been shown that NFL teams playing in an outdoor environment (not a dome) above the 39°N latitude line have a statistically significant advantage over teams whose home stadiums is below the the 39°N latitude line or play in a controlled playing environment (a dome) [62,63]. The results suggest that Cold Weather Teams have been more successful on average at home than non cold weather teams. This would imply these teams win more division titles, Wild Card Round games, Divisional Round games, Conference Championships, and participate in more Super Bowls. As for this data, of the 19 years studied, 15 of 19 of the years included Cold Weather Teams winning the Super Bowl or World Championship Game of the NFL (New England Patriots with 5 Super Bowls in 2003, 2004, 2014, 2016, and 2018 seasons, New York Giants with 2 Super Bowls in 2007 and 2011 seasons, Pittsburgh Steelers with 2 Super Bowls in 2005 and 2008, and 6 teams with 1 Super Bowl title), 10 of 19 Super Bowl Runner Ups, 28 of 38 American Football Conference (AFC) Championship Game teams, and 17 of 38 National Football Conference (NFC) Championship Game Teams. These results matter because this could change how betting services such as DraftKings and FanDuel set the lines for games in December, January, and February. These results could also be used so that the average fan could understand how much weather and more specifically colder weather and snow plays a factor in the outcome of a game. The data gathered is very reliable as it is winning percentages that are based off of NFL data. The potential mistake comes as there are a different amount of cold weather games every year which could cause varying differences in the means. Other reasons for limitations on results are that Colder Weather Teams have been very successful which could have skewed the results as playoff games are held at the stadium of the higher seeded team and these teams were successful during December, January, and February to reach these points. The limitation to only 19 years also affects the results and this data could be expanded to the entire Super Bowl era of the NFL beginning in 1967 for a larger sample size of results. More research could go into what types of weather have a larger impact on games or try to determine the full causes of weather on playing capacity of NFL players.

5. Conclusion

By the results of this article, the research project rejected the null hypothesis and left no doubt that Cold Weather Teams have a mathematically significant advantage over all other NFL teams during December, January, and February and in comparison to all other times of the year. However, the NFL is constantly changing to bigger and better stadiums with teams shifting to more indoor environments for playing games. For that reason, these results may be ever changing and with players such as Tom Brady who has played through the duration of this study with mainly

the New England Patriots and contributed to 5 Super Bowls during this period, the ebb and flow of the NFL success was not able to be adequately seen. Yet, the NFL's Cold Weather Teams thrived in late season games and provided for lots of success which resulted in the conclusion of a statistical advantage for them. 2020 was the perfect year for weather to play the biggest factor as many teams had the second biggest d value because fans and their impact was in a sense controlled. Since 2020 had a big d value and all of the paired differences tests rejected the null hypothesis, this research project ultimately concluded that Cold Weather Teams during December, January, and February have a statistically significant advantage over other teams.

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