MATH232FinalProject

2025-04-26

#https://jaseziv.github.io/worldfootballR/articles/extract-fbref-data.html#get-player-scouting-report  
  
library(worldfootballR)  
  
pull\_team\_data <- function(team\_url){  
 team\_standard <- na.omit(fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "standard"))  
 fullgames\_player <- (team\_standard["Min\_Playing\_Time"] / 90)  
 fullgames\_player <- as.vector(fullgames\_player)  
 #head(team\_standard, 10)  
   
 #Player,  
 #Pos,  
 #Age,  
 #Min\_Playing\_Time,  
 #CrdY / games (Not red cards)  
 #npxG\_Expected / games  
 #xAG\_Expected / games  
 #PrgC\_Progression / games  
 #PrgR\_Progression / games  
   
 standard\_cols\_unadj <- c("Player", "Pos", "Age", "Min\_Playing\_Time")  
 standard\_cols\_unadj <- team\_standard[, standard\_cols\_unadj]  
 standard\_cols\_adj <- c("CrdY", "npxG\_Expected", "xAG\_Expected", "PrgC\_Progression", "PrgR\_Progression")  
   
 standard\_cols\_adj <- team\_standard[, standard\_cols\_adj] / fullgames\_player  
 team\_standard\_clean <- cbind(standard\_cols\_unadj, standard\_cols\_adj)  
   
 #head(team\_standard\_clean)  
   
 team\_shooting <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "shooting")  
 #head(team\_shooting, 10)  
   
 #SoT\_percent\_Standard  
 #Sh\_per\_90\_Standard  
 #SoT\_per\_90\_Standard  
 #Dist\_Standard  
 #npxG\_per\_Sh\_Expected NO  
 #np:G\_minus\_xG\_Expected / games  
   
 shooting\_cols\_unadj <- c("SoT\_percent\_Standard", "Sh\_per\_90\_Standard", "SoT\_per\_90\_Standard", "Dist\_Standard", "npxG\_per\_Sh\_Expected")  
 shooting\_cols\_unadj <- team\_shooting[, shooting\_cols\_unadj]  
 shooting\_cols\_unadj[is.na(shooting\_cols\_unadj)] <- 0  
 shooting\_cols\_adj <- c("np:G\_minus\_xG\_Expected")  
   
   
 #shooting\_cols\_adj <- lapply(team\_shooting[, shooting\_cols\_adj], as.numeric) / fullgames\_player  
 #team\_shooting\_clean <- cbind(shooting\_cols\_unadj, shooting\_cols\_adj)  
   
 team\_shooting\_clean <- na.omit(shooting\_cols\_unadj)  
   
 team\_passing <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "passing")  
 #head(team\_passing, 10)  
   
 #TotDist\_Total / games  
 #PrgDist\_Total / games  
 #Cmp\_Short / games  
 #Att\_Short / games  
 #Cmp\_percent\_Short  
 #Cmp\_Medium / games  
 #Att\_Medium / games  
 #Cmp\_percent\_Medium  
 #Cmp\_Long / games  
 #Att\_Long / games  
 #Cmp\_percent\_Long  
 #A\_minus\_xAG\_Expected / games NO  
 #KP / games  
 #Final\_Third / games  
 #PPA / games  
 #CrsPA / games  
 #PrgP / games  
   
   
 passing\_cols\_unadj <- c("Cmp\_percent\_Short", "Cmp\_percent\_Medium", "Cmp\_percent\_Long")  
 passing\_cols\_unadj <- team\_passing[, passing\_cols\_unadj]  
 passing\_cols\_unadj[is.na(passing\_cols\_unadj)] <- 0  
   
   
 passing\_cols\_adj <- c("TotDist\_Total", "PrgDist\_Total", "Cmp\_Short", "Att\_Short", "Cmp\_Medium", "Att\_Medium", "Cmp\_Long", "Att\_Long", "KP", "Final\_Third", "PPA", "CrsPA", "PrgP")  
 passing\_cols\_adj <- na.omit(team\_passing[, passing\_cols\_adj]) / fullgames\_player  
   
 team\_passing\_clean <- na.omit(cbind(passing\_cols\_unadj, passing\_cols\_adj))  
   
   
 team\_passing\_types <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "passing\_types")  
 #head(team\_passing\_types, 10)  
   
 #TB\_Pass\_Types / games  
 #SW\_Pass\_Types / games  
 #Crs\_Pass\_Types / games  
 #TI\_Pass\_types / games  
   
 #head(team\_passing\_types, 10)  
   
 passing\_types\_cols\_adj <- c("TB\_Pass\_Types", "Sw\_Pass\_Types", "Crs\_Pass\_Types", "TI\_Pass\_Types")  
 passing\_types\_cols\_adj <- team\_passing\_types[, passing\_types\_cols\_adj] / fullgames\_player  
 team\_passing\_types\_clean <- passing\_types\_cols\_adj  
   
   
 team\_gca <- na.omit(fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "gca"))  
 #head(team\_gca, 10)  
   
 #SCA90\_SCA  
 #PassLive\_SCA\_Types / games  
 #TO\_SCA\_Types / games  
 #Sh\_SCA\_Types / games  
 #Fld\_SCA\_Types / games  
 #Def\_SCA\_Types / games  
   
 gca\_cols\_unadj <- c("SCA90\_SCA")  
 gca\_cols\_unadj <- team\_gca[, gca\_cols\_unadj]  
 gca\_cols\_adj <- c("PassLive\_SCA\_Types", "TO\_SCA\_Types", "Sh\_SCA\_Types", "Fld\_SCA\_Types", "Def\_SCA\_Types")  
   
 gca\_cols\_adj <- team\_gca[, gca\_cols\_adj] / fullgames\_player  
 team\_gca\_clean <- cbind(gca\_cols\_unadj, gca\_cols\_adj)  
   
 #No GCA because really sparse, high colinearity  
   
 team\_defense <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "defense")  
 #head(team\_defense, 10)  
   
 #TklW\_Tackles / games  
 #"Def 3rd\_Tackles" / games  
 #"Mid 3rd\_Tackles" / games  
 #"Att 3rd\_Tackles" / games  
 #Tkl\_Challenges / games  
 #Att\_Challenges / games  
 #Tkl\_percent\_Challenges  
 #Sh\_Blocks / games  
 #Pass\_Blocks / games  
 #Int / games  
 #Clr / games  
 #Err / games  
   
 defense\_cols\_unadj <- c("Tkl\_percent\_Challenges")  
 defense\_cols\_unadj <- team\_defense[, defense\_cols\_unadj]  
 defense\_cols\_unadj[is.na(defense\_cols\_unadj)] <- 0  
   
 defense\_cols\_adj <- c("TklW\_Tackles", "Def 3rd\_Tackles", "Mid 3rd\_Tackles", "Att 3rd\_Tackles", "Tkl\_Challenges", "Att\_Challenges", "Sh\_Blocks", "Pass\_Blocks", "Int", "Clr", "Err")  
   
 defense\_cols\_adj <- na.omit(team\_defense[, defense\_cols\_adj]) / fullgames\_player  
 team\_defense\_clean <- na.omit(cbind(defense\_cols\_unadj, defense\_cols\_adj))  
   
  
 team\_possession <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "possession")  
 #head(team\_possession, 10)  
   
 #Def Pen\_Touches / games  
 #Def 3rd\_Touches / games  
 #Mid 3rd\_Touches / games  
 #Att 3rd\_Touches / games  
 #Att Pen\_Touches / games  
 #Att\_Take\_Ons / games  
 #Succ\_Take\_Ons / games  
 #Succ\_percent\_Take\_Ons  
 #Carries\_Carries / games  
 #TotDist\_Carries / games  
 #PrgDist\_Carries / games  
 #PrgC\_Carries / games  
 #Final\_Third\_Carries / games  
 #CPA\_Carries / games  
 #Mis\_Carries / games  
 #Rec\_Receiving / games  
 #PrgR\_Receiving / games  
   
 possession\_cols\_unadj <- c("Succ\_percent\_Take\_Ons")  
 possession\_cols\_unadj <- team\_possession[, possession\_cols\_unadj]  
 possession\_cols\_unadj[is.na(possession\_cols\_unadj)] <- 0  
   
 possession\_cols\_adj <- c("Def Pen\_Touches", "Def 3rd\_Touches", "Mid 3rd\_Touches", "Att 3rd\_Touches", "Att Pen\_Touches", "Att\_Take\_Ons", "Succ\_Take\_Ons", "Carries\_Carries", "TotDist\_Carries", "PrgDist\_Carries", "PrgC\_Carries", "Final\_Third\_Carries", "CPA\_Carries", "Mis\_Carries", "Rec\_Receiving", "PrgR\_Receiving")  
   
 possession\_cols\_adj <- na.omit(team\_possession[, possession\_cols\_adj]) / fullgames\_player  
 team\_possession\_clean <- na.omit(cbind(possession\_cols\_unadj, possession\_cols\_adj))  
   
   
   
   
 team\_misc <- fb\_team\_player\_stats(team\_urls = team\_url, stat\_type = "misc")  
 #head(team\_misc, 10)  
   
 #Fls / games  
 #Fld / games  
 #Off / games  
 #Recov / games  
 #Won\_Aerial\_Duels / games  
 #Lost\_Aerial\_Duels / games  
 #Won\_percent\_Aerial\_Duels  
   
 misc\_cols\_unadj <- c("Won\_percent\_Aerial\_Duels")  
 misc\_cols\_unadj <- team\_misc[, misc\_cols\_unadj]  
 misc\_cols\_unadj[is.na(misc\_cols\_unadj)] <- 0  
   
 misc\_cols\_adj <- c("Fls", "Fld", "Off", "Recov", "Won\_Aerial\_Duels", "Lost\_Aerial\_Duels")  
   
 misc\_cols\_adj <- na.omit(team\_misc[, misc\_cols\_adj] / fullgames\_player)  
 team\_misc\_clean <- na.omit(cbind(misc\_cols\_unadj, misc\_cols\_adj))  
   
 final\_result <- cbind(team\_standard\_clean, team\_shooting\_clean, team\_passing\_clean, team\_passing\_types\_clean, team\_gca\_clean, team\_defense\_clean, team\_possession\_clean, team\_misc\_clean)  
 #final\_result <- team\_passing\_clean  
   
 final\_result <- subset(final\_result, final\_result$Pos != "GK")  
 final\_result <- subset(final\_result, final\_result$Min\_Playing\_Time >= 500)  
 final\_result$Pos <- substr(final\_result$Pos, 1, 2)  
   
   
   
   
 return(final\_result)  
   
   
}  
  
liverpool\_2425\_url <- "https://fbref.com/en/squads/822bd0ba/Liverpool-Stats"  
liverpool\_2425\_logs <- pull\_team\_data(liverpool\_2425\_url)  
  
liverpool\_2425\_logs

## Player Pos Age Min\_Playing\_Time CrdY npxG\_Expected  
## 1 Virgil van Dijk DF 33-294 3060 0.08823529 0.05882353  
## 2 Mohamed Salah FW 32-317 3011 0.02989040 0.50514779  
## 3 Ryan Gravenberch MF 22-347 2921 0.15405683 0.03081137  
## 4 Alexis Mac Allister MF 26-125 2553 0.21151586 0.09870740  
## 5 Ibrahima Konaté DF 25-338 2320 0.19396552 0.06594828  
## 6 Andrew Robertson DF 31-048 2308 0.11698440 0.03899480  
## 7 Trent Alexander-Arnold DF 26-203 2240 0.20089286 0.07232143  
## 8 Dominik Szoboszlai MF 24-185 2257 0.23925565 0.28311918  
## 9 Luis Díaz FW 28-105 2225 0.08089888 0.40449438  
## 11 Cody Gakpo FW 25-356 1627 0.27658267 0.35402581  
## 12 Curtis Jones MF 24-088 1438 0.18776078 0.25660640  
## 13 Diogo Jota FW 28-145 1097 0.16408387 0.59890611  
## 15 Darwin Núñez FW 25-308 1018 0.70726916 0.44204322  
## 16 Kostas Tsimikas DF 28-351 666 0.27027027 0.05405405  
## 17 Joe Gomez DF 27-340 519 0.17341040 0.05202312  
## 18 Conor Bradley DF 21-293 533 0.50656660 0.10131332  
## xAG\_Expected PrgC\_Progression PrgR\_Progression SoT\_percent\_Standard  
## 1 0.02058824 0.5294118 0.1764706 29.2  
## 2 0.38259714 4.2444371 12.7034208 42.3  
## 3 0.08935296 2.0027388 1.6638138 27.8  
## 4 0.15511163 1.1985899 2.7497062 34.2  
## 5 0.03879310 0.8146552 0.1163793 16.7  
## 6 0.15987868 2.2616984 3.7045061 15.4  
## 7 0.26919643 1.9687500 3.4955357 19.0  
## 8 0.24723084 2.5919362 4.7851130 32.3  
## 9 0.19820225 4.1662921 10.8808989 41.5  
## 11 0.19360787 2.6551936 13.2759680 40.0  
## 12 0.06258693 1.4394993 4.1933241 38.7  
## 13 0.14767548 2.9535096 7.0556062 28.3  
## 15 0.10609037 1.9449902 5.9233792 37.5  
## 16 0.24324324 2.0270270 5.1351351 50.0  
## 17 0.01734104 0.8670520 0.3468208 66.7  
## 18 0.08442777 4.3902439 4.5590994 33.3  
## Sh\_per\_90\_Standard SoT\_per\_90\_Standard Dist\_Standard npxG\_per\_Sh\_Expected  
## 1 0.71 0.21 13.6 0.08  
## 2 3.32 1.40 14.8 0.15  
## 3 0.55 0.15 24.7 0.06  
## 4 1.34 0.46 18.1 0.07  
## 5 0.70 0.12 10.5 0.10  
## 6 0.51 0.08 14.5 0.08  
## 7 1.69 0.32 23.5 0.04  
## 8 2.47 0.80 18.5 0.12  
## 9 2.63 1.09 13.5 0.15  
## 11 2.77 1.11 15.1 0.13  
## 12 1.94 0.75 16.9 0.13  
## 13 3.77 1.07 12.5 0.16  
## 15 2.83 1.06 14.5 0.16  
## 16 0.54 0.27 16.1 0.10  
## 17 0.52 0.35 11.9 0.11  
## 18 1.52 0.51 14.3 0.07  
## Cmp\_percent\_Short Cmp\_percent\_Medium Cmp\_percent\_Long TotDist\_Total  
## 1 96.0 95.4 67.9 1317.0588  
## 2 83.7 69.9 58.9 360.3886  
## 3 92.5 91.7 60.8 732.5094  
## 4 90.1 88.3 55.2 699.5182  
## 5 93.7 95.1 55.7 1135.0474  
## 6 94.1 86.8 46.8 956.1915  
## 7 89.8 76.1 49.3 1046.7723  
## 8 89.2 88.1 71.9 625.1750  
## 9 88.6 86.0 82.4 449.9596  
## 11 86.5 67.2 55.2 327.1973  
## 12 96.9 92.5 75.6 746.7872  
## 13 76.1 74.2 61.9 250.2279  
## 15 80.6 73.8 66.7 194.7642  
## 16 94.3 88.3 51.2 1037.2973  
## 17 91.2 93.6 61.9 1159.9422  
## 18 91.6 88.2 35.5 901.5197  
## PrgDist\_Total Cmp\_Short Att\_Short Cmp\_Medium Att\_Medium Cmp\_Long Att\_Long  
## 1 517.47059 29.323529 30.558824 35.735294 37.441176 6.1470588 9.058824  
## 2 102.88276 13.839256 16.529392 7.980737 11.418134 1.5841913 2.690136  
## 3 182.86546 26.898322 29.085929 18.764122 20.458747 1.8178706 2.988702  
## 4 197.48531 22.737955 25.240893 16.991774 19.247944 2.9964747 5.428907  
## 5 390.06466 21.219828 22.655172 36.349138 38.211207 3.4137931 6.129310  
## 6 303.41854 27.803293 29.558059 24.293761 27.998267 4.0164645 8.578856  
## 7 429.42857 23.785714 26.477679 22.258929 29.250000 7.5535714 15.308036  
## 8 124.89145 22.171023 24.842712 13.039433 14.793974 3.2698272 4.545857  
## 9 97.32135 15.128090 17.069663 9.667416 11.244944 2.2651685 2.750562  
## 11 83.30670 14.161033 16.373694 7.135833 10.620774 0.8850645 1.604179  
## 12 149.33241 29.666203 30.605007 18.463143 19.965229 1.9401947 2.566064  
## 13 61.53145 8.860529 11.649954 5.660893 7.629900 1.0665451 1.722881  
## 15 48.27112 6.984283 8.664047 3.978389 5.392927 1.0609037 1.591356  
## 16 341.08108 28.918919 30.675676 24.594595 27.837838 5.6756757 11.081081  
## 17 398.67052 26.878613 29.479769 33.121387 35.375723 4.5086705 7.283237  
## 18 232.34522 34.784240 37.992495 22.626642 25.666041 1.8574109 5.234522  
## KP Final\_Third PPA CrsPA PrgP TB\_Pass\_Types  
## 1 0.3529412 7.7941176 0.1764706 0.00000000 5.176471 0.02941176  
## 2 2.3912321 1.4646297 2.4510130 0.38857522 3.855862 0.44835603  
## 3 0.7702841 4.3135912 0.9859637 0.03081137 5.176309 0.24649093  
## 4 1.5158637 4.1598120 1.1985899 0.07050529 5.992949 0.21151586  
## 5 0.3879310 4.8491379 0.3103448 0.00000000 3.995690 0.03879310  
## 6 1.4818024 5.6152513 1.0918544 0.62391681 6.434142 0.15597920  
## 7 2.0089286 7.7142857 2.4910714 0.80357143 8.477679 0.36160714  
## 8 2.0336730 3.1103234 1.2361542 0.19937971 4.545857 0.15950377  
## 9 2.1842697 1.8202247 1.7393258 0.24269663 4.166292 0.08089888  
## 11 1.8254456 1.2169637 1.4382299 0.44253227 2.821143 0.11063307  
## 12 1.1891516 3.7552156 1.0013908 0.00000000 5.319889 0.12517385  
## 13 0.9024613 2.3792160 0.2461258 0.08204193 2.707384 0.08204193  
## 15 0.7956778 0.7956778 0.1768173 0.00000000 2.387033 0.08840864  
## 16 1.4864865 5.2702703 1.2162162 0.40540541 9.054054 0.13513514  
## 17 0.3468208 5.0289017 0.0000000 0.00000000 6.069364 0.17341040  
## 18 0.8442777 3.3771107 0.5065666 0.16885553 4.221388 0.00000000  
## Sw\_Pass\_Types Crs\_Pass\_Types TI\_Pass\_Types gca\_cols\_unadj PassLive\_SCA\_Types  
## 1 0.58823529 0.02941176 0.23529412 1.35 1.1470588  
## 2 0.08967121 2.00265692 0.50813683 4.57 3.3477250  
## 3 0.21567956 0.18486820 0.30811366 2.00 1.7562479  
## 4 0.10575793 2.96122209 0.31727380 4.16 2.8907168  
## 5 0.19396552 0.00000000 0.11637931 1.16 0.9698276  
## 6 0.19497400 5.30329289 6.90207972 2.92 2.4566724  
## 7 1.24553571 5.70535714 7.03125000 3.73 2.8526786  
## 8 0.47851130 1.35578201 1.35578201 4.31 3.3495791  
## 9 0.32359551 1.21348315 0.52584270 4.69 3.5191011  
## 11 0.22126613 3.54025814 0.60848187 3.87 2.8764597  
## 12 0.12517385 0.37552156 1.43949930 2.57 2.2531293  
## 13 0.16408387 0.65633546 0.08204193 2.87 1.8049225  
## 15 0.53045187 0.17681729 0.17681729 2.29 1.5029470  
## 16 0.13513514 7.16216216 7.43243243 3.10 2.1621622  
## 17 0.86705202 0.34682081 1.04046243 0.87 0.8670520  
## 18 0.33771107 0.84427767 8.10506567 2.71 1.8574109  
## TO\_SCA\_Types Sh\_SCA\_Types Fld\_SCA\_Types Def\_SCA\_Types defense\_cols\_unadj  
## 1 0.02941176 0.08823529 0.02941176 0.05882353 55.0  
## 2 0.59780804 0.41846563 0.11956161 0.05978080 43.8  
## 3 0.15405683 0.06162273 0.00000000 0.03081137 58.8  
## 4 0.07050529 0.21151586 0.07050529 0.10575793 54.5  
## 5 0.00000000 0.15517241 0.00000000 0.03879310 70.6  
## 6 0.03899480 0.03899480 0.00000000 0.03899480 63.8  
## 7 0.16071429 0.16071429 0.00000000 0.00000000 47.5  
## 8 0.15950377 0.47851130 0.07975188 0.03987594 38.5  
## 9 0.64719101 0.36404494 0.16179775 0.00000000 38.2  
## 11 0.44253227 0.27658267 0.16594960 0.11063307 47.8  
## 12 0.00000000 0.18776078 0.12517385 0.00000000 65.2  
## 13 0.49225160 0.41020966 0.08204193 0.08204193 36.8  
## 15 0.35363458 0.08840864 0.17681729 0.17681729 33.3  
## 16 0.00000000 0.00000000 0.13513514 0.00000000 68.4  
## 17 0.00000000 0.00000000 0.00000000 0.00000000 68.8  
## 18 0.67542214 0.00000000 0.16885553 0.00000000 50.0  
## TklW\_Tackles Def 3rd\_Tackles Mid 3rd\_Tackles Att 3rd\_Tackles Tkl\_Challenges  
## 1 0.5000000 0.5000000 0.4705882 0.05882353 0.3235294  
## 2 0.3287944 0.2092328 0.1494520 0.23912321 0.2092328  
## 3 1.0475864 0.7702841 0.8935296 0.33892503 0.9243410  
## 4 2.0446533 0.9870740 1.7978848 0.56404230 1.9388954  
## 5 0.9698276 0.9310345 0.4267241 0.03879310 0.9310345  
## 6 0.8578856 0.9358752 0.3899480 0.15597920 1.1698440  
## 7 1.9687500 1.7276786 0.7232143 0.36160714 1.9285714  
## 8 0.7975188 0.3987594 0.6380151 0.19937971 0.5981391  
## 9 0.8494382 0.4044944 0.6876404 0.24269663 0.5258427  
## 11 0.7744315 0.2765827 0.6637984 0.49784880 0.6084819  
## 12 1.1265647 0.3755216 1.3143255 0.43810848 0.9388039  
## 13 0.6563355 0.1640839 0.6563355 0.32816773 0.5742935  
## 15 1.3261297 0.8840864 0.2652259 0.44204322 0.4420432  
## 16 2.2972973 1.7567568 1.4864865 0.40540541 1.7567568  
## 17 1.7341040 0.8670520 1.2138728 0.17341040 1.9075145  
## 18 1.3508443 0.8442777 0.6754221 0.33771107 1.3508443  
## Att\_Challenges Sh\_Blocks Pass\_Blocks Int Clr Err  
## 1 0.5882353 0.3823529 0.3235294 1.5294118 5.1470588 0.11764706  
## 2 0.4782464 0.0000000 0.3287944 0.2092328 0.1494520 0.00000000  
## 3 1.5713797 0.3081137 0.7394728 1.7562479 1.7254365 0.03081137  
## 4 3.5605170 0.2115159 1.9036428 0.7755582 1.0223267 0.03525264  
## 5 1.3189655 0.5818966 0.4655172 0.4655172 4.8103448 0.07758621  
## 6 1.8327556 0.1559792 0.1949740 0.7798960 1.9887348 0.07798960  
## 7 4.0580357 0.3214286 0.6830357 1.2053571 2.1696429 0.16071429  
## 8 1.5551617 0.1595038 1.2361542 0.3588835 0.6778910 0.07975188  
## 9 1.3752809 0.0000000 0.7280899 0.2831461 0.2831461 0.04044944  
## 11 1.2722803 0.1106331 0.9403811 0.6084819 0.8850645 0.05531653  
## 12 1.4394993 0.4381085 0.5006954 0.3129346 0.5006954 0.12517385  
## 13 1.5587967 0.0000000 0.7383774 0.5742935 0.4922516 0.00000000  
## 15 1.3261297 0.0000000 0.5304519 0.2652259 1.0609037 0.00000000  
## 16 2.5675676 0.2702703 0.4054054 1.3513514 2.1621622 0.00000000  
## 17 2.7745665 1.0404624 0.5202312 1.2138728 3.4682081 0.34682081  
## 18 2.7016886 0.0000000 0.6754221 0.5065666 3.5459662 0.00000000  
## possession\_cols\_unadj Def Pen\_Touches Def 3rd\_Touches Mid 3rd\_Touches  
## 1 60.0 11.7647059 35.382353 48.94118  
## 2 44.7 0.2989040 2.630355 13.86915  
## 3 48.0 3.2043821 13.741869 39.25368  
## 4 38.1 1.9388954 9.835488 33.27850  
## 5 50.0 8.1853448 33.129310 40.61638  
## 6 38.9 3.3535529 19.497400 34.39341  
## 7 45.2 3.4151786 22.700893 37.84821  
## 8 54.3 0.9171467 7.297297 27.75366  
## 9 45.9 0.6067416 3.155056 15.45169  
## 11 58.3 1.1063307 3.982790 12.00369  
## 12 62.5 1.6898470 10.013908 34.73574  
## 13 36.7 0.4102097 2.461258 15.17776  
## 15 38.1 0.8840864 3.801572 9.81336  
## 16 50.0 3.2432432 18.378378 37.83784  
## 17 0.0 9.3641618 31.734104 45.78035  
## 18 37.5 2.8705441 23.977486 40.18762  
## Att 3rd\_Touches Att Pen\_Touches Att\_Take\_Ons Succ\_Take\_Ons Carries\_Carries  
## 1 4.441176 1.2941176 0.1470588 0.08823529 49.47059  
## 2 29.681169 9.5649286 3.6765194 1.64397210 31.26536  
## 3 14.943512 0.7086614 2.3108524 1.10920917 39.62342  
## 4 21.997650 2.1151586 1.4806110 0.56404230 31.48061  
## 5 4.267241 0.8534483 0.1551724 0.07758621 45.93103  
## 6 22.538995 1.9497400 0.7019064 0.27296360 40.08666  
## 7 24.830357 1.6875000 1.2455357 0.56250000 44.55804  
## 8 22.888790 3.8280904 1.3956580 0.75764289 29.18919  
## 9 27.020225 6.2696629 4.4898876 2.06292135 29.64944  
## 11 26.883835 4.8125384 2.6551936 1.54886294 28.21143  
## 12 20.716273 3.1293463 1.0013908 0.62586926 39.55494  
## 13 19.690064 7.3837739 2.4612580 0.90246126 20.26436  
## 15 16.444008 5.4813360 1.8565815 0.70726916 15.73674  
## 16 26.351351 1.4864865 1.0810811 0.54054054 40.27027  
## 17 6.416185 0.8670520 0.0000000 0.00000000 52.54335  
## 18 23.639775 5.5722326 2.7016886 1.01313321 47.61726  
## TotDist\_Carries PrgDist\_Carries PrgC\_Carries Final\_Third\_Carries CPA\_Carries  
## 1 236.97059 129.35294 0.5294118 0.5882353 0.08823529  
## 2 188.54865 98.72800 4.2444371 1.6140817 3.37761541  
## 3 207.97672 105.00514 2.0027388 2.1876070 0.27730229  
## 4 128.53114 67.82609 1.1985899 1.4453584 0.17626322  
## 5 212.19828 122.58621 0.8146552 0.5043103 0.00000000  
## 6 175.90555 100.91854 2.2616984 1.8717504 0.23396880  
## 7 205.79464 109.76786 1.9687500 1.4062500 0.32142857  
## 8 149.13602 83.77935 2.5919362 1.8342933 0.67789101  
## 9 217.01124 113.37978 4.1662921 2.1438202 2.22471910  
## 11 197.59066 100.67609 2.6551936 1.6594960 0.99569760  
## 12 189.26287 86.55772 1.4394993 0.9388039 0.31293463  
## 13 118.14038 61.77758 2.9535096 1.7228806 1.64083865  
## 15 86.55206 46.67976 1.9449902 1.5029470 1.06090373  
## 16 170.54054 90.67568 2.0270270 0.6756757 0.27027027  
## 17 284.04624 164.21965 0.8670520 0.3468208 0.17341040  
## 18 292.12008 170.88180 4.3902439 2.8705441 1.18198874  
## Mis\_Carries Rec\_Receiving PrgR\_Receiving misc\_cols\_unadj Fls Fld  
## 1 0.2647059 60.67647 0.1764706 71.0 0.4411765 0.3529412  
## 2 3.1384922 38.14015 12.7034208 42.9 0.6575888 0.9863833  
## 3 1.4789456 47.69599 1.6638138 65.0 1.2940774 1.4173228  
## 4 1.0928320 42.40893 2.7497062 35.8 2.1151586 1.3748531  
## 5 0.3103448 56.40517 0.1163793 72.0 1.0086207 0.6982759  
## 6 0.9748700 50.77123 3.7045061 33.3 0.4289428 0.3119584  
## 7 0.7633929 53.91964 3.4955357 18.8 0.4419643 0.2812500  
## 8 1.3557820 39.07842 4.7851130 45.0 1.4754098 0.9171467  
## 9 2.0629213 35.51461 10.8808989 26.7 1.9415730 1.2134831  
## 11 2.1020283 31.53042 13.2759680 40.5 0.9403811 1.2722803  
## 12 1.3769124 48.88039 4.1933241 52.0 0.9388039 1.4394993  
## 13 2.9535096 25.51504 7.0556062 41.2 1.4767548 0.9845032  
## 15 1.8565815 19.44990 5.9233792 35.6 2.3870334 1.2377210  
## 16 0.5405405 51.62162 5.1351351 45.5 1.2162162 0.8108108  
## 17 0.1734104 58.09249 0.3468208 69.2 0.3468208 0.5202312  
## 18 1.3508443 54.37148 4.5590994 53.8 1.3508443 1.6885553  
## Off Recov Won\_Aerial\_Duels Lost\_Aerial\_Duels  
## 1 0.00000000 3.176471 3.2352941 1.3235294  
## 2 0.47824643 2.779807 0.2690136 0.3586848  
## 3 0.00000000 5.607669 0.8010955 0.4313591  
## 4 0.07050529 5.111633 0.6698002 1.1985899  
## 5 0.00000000 3.336207 2.7931034 1.0862069  
## 6 0.07798960 3.548527 0.2339688 0.4679376  
## 7 0.04017857 5.062500 0.1205357 0.5223214  
## 8 0.15950377 4.785113 0.7177669 0.8772707  
## 9 0.40449438 3.964045 0.4853933 1.3348315  
## 11 0.27658267 3.429625 0.8297480 1.2169637  
## 12 0.06258693 4.881780 0.8136300 0.7510431  
## 13 0.08204193 3.281677 1.7228806 2.4612580  
## 15 0.97249509 3.359528 1.4145383 2.5638507  
## 16 0.13513514 3.513514 0.6756757 0.8108108  
## 17 0.00000000 5.895954 1.5606936 0.6936416  
## 18 0.00000000 5.741088 1.1819887 1.0131332

#set.seed(123) #reproducibility  
  
liverpool\_2425\_logs

## Player Pos Age Min\_Playing\_Time CrdY npxG\_Expected  
## 1 Virgil van Dijk DF 33-294 3060 0.08823529 0.05882353  
## 2 Mohamed Salah FW 32-317 3011 0.02989040 0.50514779  
## 3 Ryan Gravenberch MF 22-347 2921 0.15405683 0.03081137  
## 4 Alexis Mac Allister MF 26-125 2553 0.21151586 0.09870740  
## 5 Ibrahima Konaté DF 25-338 2320 0.19396552 0.06594828  
## 6 Andrew Robertson DF 31-048 2308 0.11698440 0.03899480  
## 7 Trent Alexander-Arnold DF 26-203 2240 0.20089286 0.07232143  
## 8 Dominik Szoboszlai MF 24-185 2257 0.23925565 0.28311918  
## 9 Luis Díaz FW 28-105 2225 0.08089888 0.40449438  
## 11 Cody Gakpo FW 25-356 1627 0.27658267 0.35402581  
## 12 Curtis Jones MF 24-088 1438 0.18776078 0.25660640  
## 13 Diogo Jota FW 28-145 1097 0.16408387 0.59890611  
## 15 Darwin Núñez FW 25-308 1018 0.70726916 0.44204322  
## 16 Kostas Tsimikas DF 28-351 666 0.27027027 0.05405405  
## 17 Joe Gomez DF 27-340 519 0.17341040 0.05202312  
## 18 Conor Bradley DF 21-293 533 0.50656660 0.10131332  
## xAG\_Expected PrgC\_Progression PrgR\_Progression SoT\_percent\_Standard  
## 1 0.02058824 0.5294118 0.1764706 29.2  
## 2 0.38259714 4.2444371 12.7034208 42.3  
## 3 0.08935296 2.0027388 1.6638138 27.8  
## 4 0.15511163 1.1985899 2.7497062 34.2  
## 5 0.03879310 0.8146552 0.1163793 16.7  
## 6 0.15987868 2.2616984 3.7045061 15.4  
## 7 0.26919643 1.9687500 3.4955357 19.0  
## 8 0.24723084 2.5919362 4.7851130 32.3  
## 9 0.19820225 4.1662921 10.8808989 41.5  
## 11 0.19360787 2.6551936 13.2759680 40.0  
## 12 0.06258693 1.4394993 4.1933241 38.7  
## 13 0.14767548 2.9535096 7.0556062 28.3  
## 15 0.10609037 1.9449902 5.9233792 37.5  
## 16 0.24324324 2.0270270 5.1351351 50.0  
## 17 0.01734104 0.8670520 0.3468208 66.7  
## 18 0.08442777 4.3902439 4.5590994 33.3  
## Sh\_per\_90\_Standard SoT\_per\_90\_Standard Dist\_Standard npxG\_per\_Sh\_Expected  
## 1 0.71 0.21 13.6 0.08  
## 2 3.32 1.40 14.8 0.15  
## 3 0.55 0.15 24.7 0.06  
## 4 1.34 0.46 18.1 0.07  
## 5 0.70 0.12 10.5 0.10  
## 6 0.51 0.08 14.5 0.08  
## 7 1.69 0.32 23.5 0.04  
## 8 2.47 0.80 18.5 0.12  
## 9 2.63 1.09 13.5 0.15  
## 11 2.77 1.11 15.1 0.13  
## 12 1.94 0.75 16.9 0.13  
## 13 3.77 1.07 12.5 0.16  
## 15 2.83 1.06 14.5 0.16  
## 16 0.54 0.27 16.1 0.10  
## 17 0.52 0.35 11.9 0.11  
## 18 1.52 0.51 14.3 0.07  
## Cmp\_percent\_Short Cmp\_percent\_Medium Cmp\_percent\_Long TotDist\_Total  
## 1 96.0 95.4 67.9 1317.0588  
## 2 83.7 69.9 58.9 360.3886  
## 3 92.5 91.7 60.8 732.5094  
## 4 90.1 88.3 55.2 699.5182  
## 5 93.7 95.1 55.7 1135.0474  
## 6 94.1 86.8 46.8 956.1915  
## 7 89.8 76.1 49.3 1046.7723  
## 8 89.2 88.1 71.9 625.1750  
## 9 88.6 86.0 82.4 449.9596  
## 11 86.5 67.2 55.2 327.1973  
## 12 96.9 92.5 75.6 746.7872  
## 13 76.1 74.2 61.9 250.2279  
## 15 80.6 73.8 66.7 194.7642  
## 16 94.3 88.3 51.2 1037.2973  
## 17 91.2 93.6 61.9 1159.9422  
## 18 91.6 88.2 35.5 901.5197  
## PrgDist\_Total Cmp\_Short Att\_Short Cmp\_Medium Att\_Medium Cmp\_Long Att\_Long  
## 1 517.47059 29.323529 30.558824 35.735294 37.441176 6.1470588 9.058824  
## 2 102.88276 13.839256 16.529392 7.980737 11.418134 1.5841913 2.690136  
## 3 182.86546 26.898322 29.085929 18.764122 20.458747 1.8178706 2.988702  
## 4 197.48531 22.737955 25.240893 16.991774 19.247944 2.9964747 5.428907  
## 5 390.06466 21.219828 22.655172 36.349138 38.211207 3.4137931 6.129310  
## 6 303.41854 27.803293 29.558059 24.293761 27.998267 4.0164645 8.578856  
## 7 429.42857 23.785714 26.477679 22.258929 29.250000 7.5535714 15.308036  
## 8 124.89145 22.171023 24.842712 13.039433 14.793974 3.2698272 4.545857  
## 9 97.32135 15.128090 17.069663 9.667416 11.244944 2.2651685 2.750562  
## 11 83.30670 14.161033 16.373694 7.135833 10.620774 0.8850645 1.604179  
## 12 149.33241 29.666203 30.605007 18.463143 19.965229 1.9401947 2.566064  
## 13 61.53145 8.860529 11.649954 5.660893 7.629900 1.0665451 1.722881  
## 15 48.27112 6.984283 8.664047 3.978389 5.392927 1.0609037 1.591356  
## 16 341.08108 28.918919 30.675676 24.594595 27.837838 5.6756757 11.081081  
## 17 398.67052 26.878613 29.479769 33.121387 35.375723 4.5086705 7.283237  
## 18 232.34522 34.784240 37.992495 22.626642 25.666041 1.8574109 5.234522  
## KP Final\_Third PPA CrsPA PrgP TB\_Pass\_Types  
## 1 0.3529412 7.7941176 0.1764706 0.00000000 5.176471 0.02941176  
## 2 2.3912321 1.4646297 2.4510130 0.38857522 3.855862 0.44835603  
## 3 0.7702841 4.3135912 0.9859637 0.03081137 5.176309 0.24649093  
## 4 1.5158637 4.1598120 1.1985899 0.07050529 5.992949 0.21151586  
## 5 0.3879310 4.8491379 0.3103448 0.00000000 3.995690 0.03879310  
## 6 1.4818024 5.6152513 1.0918544 0.62391681 6.434142 0.15597920  
## 7 2.0089286 7.7142857 2.4910714 0.80357143 8.477679 0.36160714  
## 8 2.0336730 3.1103234 1.2361542 0.19937971 4.545857 0.15950377  
## 9 2.1842697 1.8202247 1.7393258 0.24269663 4.166292 0.08089888  
## 11 1.8254456 1.2169637 1.4382299 0.44253227 2.821143 0.11063307  
## 12 1.1891516 3.7552156 1.0013908 0.00000000 5.319889 0.12517385  
## 13 0.9024613 2.3792160 0.2461258 0.08204193 2.707384 0.08204193  
## 15 0.7956778 0.7956778 0.1768173 0.00000000 2.387033 0.08840864  
## 16 1.4864865 5.2702703 1.2162162 0.40540541 9.054054 0.13513514  
## 17 0.3468208 5.0289017 0.0000000 0.00000000 6.069364 0.17341040  
## 18 0.8442777 3.3771107 0.5065666 0.16885553 4.221388 0.00000000  
## Sw\_Pass\_Types Crs\_Pass\_Types TI\_Pass\_Types gca\_cols\_unadj PassLive\_SCA\_Types  
## 1 0.58823529 0.02941176 0.23529412 1.35 1.1470588  
## 2 0.08967121 2.00265692 0.50813683 4.57 3.3477250  
## 3 0.21567956 0.18486820 0.30811366 2.00 1.7562479  
## 4 0.10575793 2.96122209 0.31727380 4.16 2.8907168  
## 5 0.19396552 0.00000000 0.11637931 1.16 0.9698276  
## 6 0.19497400 5.30329289 6.90207972 2.92 2.4566724  
## 7 1.24553571 5.70535714 7.03125000 3.73 2.8526786  
## 8 0.47851130 1.35578201 1.35578201 4.31 3.3495791  
## 9 0.32359551 1.21348315 0.52584270 4.69 3.5191011  
## 11 0.22126613 3.54025814 0.60848187 3.87 2.8764597  
## 12 0.12517385 0.37552156 1.43949930 2.57 2.2531293  
## 13 0.16408387 0.65633546 0.08204193 2.87 1.8049225  
## 15 0.53045187 0.17681729 0.17681729 2.29 1.5029470  
## 16 0.13513514 7.16216216 7.43243243 3.10 2.1621622  
## 17 0.86705202 0.34682081 1.04046243 0.87 0.8670520  
## 18 0.33771107 0.84427767 8.10506567 2.71 1.8574109  
## TO\_SCA\_Types Sh\_SCA\_Types Fld\_SCA\_Types Def\_SCA\_Types defense\_cols\_unadj  
## 1 0.02941176 0.08823529 0.02941176 0.05882353 55.0  
## 2 0.59780804 0.41846563 0.11956161 0.05978080 43.8  
## 3 0.15405683 0.06162273 0.00000000 0.03081137 58.8  
## 4 0.07050529 0.21151586 0.07050529 0.10575793 54.5  
## 5 0.00000000 0.15517241 0.00000000 0.03879310 70.6  
## 6 0.03899480 0.03899480 0.00000000 0.03899480 63.8  
## 7 0.16071429 0.16071429 0.00000000 0.00000000 47.5  
## 8 0.15950377 0.47851130 0.07975188 0.03987594 38.5  
## 9 0.64719101 0.36404494 0.16179775 0.00000000 38.2  
## 11 0.44253227 0.27658267 0.16594960 0.11063307 47.8  
## 12 0.00000000 0.18776078 0.12517385 0.00000000 65.2  
## 13 0.49225160 0.41020966 0.08204193 0.08204193 36.8  
## 15 0.35363458 0.08840864 0.17681729 0.17681729 33.3  
## 16 0.00000000 0.00000000 0.13513514 0.00000000 68.4  
## 17 0.00000000 0.00000000 0.00000000 0.00000000 68.8  
## 18 0.67542214 0.00000000 0.16885553 0.00000000 50.0  
## TklW\_Tackles Def 3rd\_Tackles Mid 3rd\_Tackles Att 3rd\_Tackles Tkl\_Challenges  
## 1 0.5000000 0.5000000 0.4705882 0.05882353 0.3235294  
## 2 0.3287944 0.2092328 0.1494520 0.23912321 0.2092328  
## 3 1.0475864 0.7702841 0.8935296 0.33892503 0.9243410  
## 4 2.0446533 0.9870740 1.7978848 0.56404230 1.9388954  
## 5 0.9698276 0.9310345 0.4267241 0.03879310 0.9310345  
## 6 0.8578856 0.9358752 0.3899480 0.15597920 1.1698440  
## 7 1.9687500 1.7276786 0.7232143 0.36160714 1.9285714  
## 8 0.7975188 0.3987594 0.6380151 0.19937971 0.5981391  
## 9 0.8494382 0.4044944 0.6876404 0.24269663 0.5258427  
## 11 0.7744315 0.2765827 0.6637984 0.49784880 0.6084819  
## 12 1.1265647 0.3755216 1.3143255 0.43810848 0.9388039  
## 13 0.6563355 0.1640839 0.6563355 0.32816773 0.5742935  
## 15 1.3261297 0.8840864 0.2652259 0.44204322 0.4420432  
## 16 2.2972973 1.7567568 1.4864865 0.40540541 1.7567568  
## 17 1.7341040 0.8670520 1.2138728 0.17341040 1.9075145  
## 18 1.3508443 0.8442777 0.6754221 0.33771107 1.3508443  
## Att\_Challenges Sh\_Blocks Pass\_Blocks Int Clr Err  
## 1 0.5882353 0.3823529 0.3235294 1.5294118 5.1470588 0.11764706  
## 2 0.4782464 0.0000000 0.3287944 0.2092328 0.1494520 0.00000000  
## 3 1.5713797 0.3081137 0.7394728 1.7562479 1.7254365 0.03081137  
## 4 3.5605170 0.2115159 1.9036428 0.7755582 1.0223267 0.03525264  
## 5 1.3189655 0.5818966 0.4655172 0.4655172 4.8103448 0.07758621  
## 6 1.8327556 0.1559792 0.1949740 0.7798960 1.9887348 0.07798960  
## 7 4.0580357 0.3214286 0.6830357 1.2053571 2.1696429 0.16071429  
## 8 1.5551617 0.1595038 1.2361542 0.3588835 0.6778910 0.07975188  
## 9 1.3752809 0.0000000 0.7280899 0.2831461 0.2831461 0.04044944  
## 11 1.2722803 0.1106331 0.9403811 0.6084819 0.8850645 0.05531653  
## 12 1.4394993 0.4381085 0.5006954 0.3129346 0.5006954 0.12517385  
## 13 1.5587967 0.0000000 0.7383774 0.5742935 0.4922516 0.00000000  
## 15 1.3261297 0.0000000 0.5304519 0.2652259 1.0609037 0.00000000  
## 16 2.5675676 0.2702703 0.4054054 1.3513514 2.1621622 0.00000000  
## 17 2.7745665 1.0404624 0.5202312 1.2138728 3.4682081 0.34682081  
## 18 2.7016886 0.0000000 0.6754221 0.5065666 3.5459662 0.00000000  
## possession\_cols\_unadj Def Pen\_Touches Def 3rd\_Touches Mid 3rd\_Touches  
## 1 60.0 11.7647059 35.382353 48.94118  
## 2 44.7 0.2989040 2.630355 13.86915  
## 3 48.0 3.2043821 13.741869 39.25368  
## 4 38.1 1.9388954 9.835488 33.27850  
## 5 50.0 8.1853448 33.129310 40.61638  
## 6 38.9 3.3535529 19.497400 34.39341  
## 7 45.2 3.4151786 22.700893 37.84821  
## 8 54.3 0.9171467 7.297297 27.75366  
## 9 45.9 0.6067416 3.155056 15.45169  
## 11 58.3 1.1063307 3.982790 12.00369  
## 12 62.5 1.6898470 10.013908 34.73574  
## 13 36.7 0.4102097 2.461258 15.17776  
## 15 38.1 0.8840864 3.801572 9.81336  
## 16 50.0 3.2432432 18.378378 37.83784  
## 17 0.0 9.3641618 31.734104 45.78035  
## 18 37.5 2.8705441 23.977486 40.18762  
## Att 3rd\_Touches Att Pen\_Touches Att\_Take\_Ons Succ\_Take\_Ons Carries\_Carries  
## 1 4.441176 1.2941176 0.1470588 0.08823529 49.47059  
## 2 29.681169 9.5649286 3.6765194 1.64397210 31.26536  
## 3 14.943512 0.7086614 2.3108524 1.10920917 39.62342  
## 4 21.997650 2.1151586 1.4806110 0.56404230 31.48061  
## 5 4.267241 0.8534483 0.1551724 0.07758621 45.93103  
## 6 22.538995 1.9497400 0.7019064 0.27296360 40.08666  
## 7 24.830357 1.6875000 1.2455357 0.56250000 44.55804  
## 8 22.888790 3.8280904 1.3956580 0.75764289 29.18919  
## 9 27.020225 6.2696629 4.4898876 2.06292135 29.64944  
## 11 26.883835 4.8125384 2.6551936 1.54886294 28.21143  
## 12 20.716273 3.1293463 1.0013908 0.62586926 39.55494  
## 13 19.690064 7.3837739 2.4612580 0.90246126 20.26436  
## 15 16.444008 5.4813360 1.8565815 0.70726916 15.73674  
## 16 26.351351 1.4864865 1.0810811 0.54054054 40.27027  
## 17 6.416185 0.8670520 0.0000000 0.00000000 52.54335  
## 18 23.639775 5.5722326 2.7016886 1.01313321 47.61726  
## TotDist\_Carries PrgDist\_Carries PrgC\_Carries Final\_Third\_Carries CPA\_Carries  
## 1 236.97059 129.35294 0.5294118 0.5882353 0.08823529  
## 2 188.54865 98.72800 4.2444371 1.6140817 3.37761541  
## 3 207.97672 105.00514 2.0027388 2.1876070 0.27730229  
## 4 128.53114 67.82609 1.1985899 1.4453584 0.17626322  
## 5 212.19828 122.58621 0.8146552 0.5043103 0.00000000  
## 6 175.90555 100.91854 2.2616984 1.8717504 0.23396880  
## 7 205.79464 109.76786 1.9687500 1.4062500 0.32142857  
## 8 149.13602 83.77935 2.5919362 1.8342933 0.67789101  
## 9 217.01124 113.37978 4.1662921 2.1438202 2.22471910  
## 11 197.59066 100.67609 2.6551936 1.6594960 0.99569760  
## 12 189.26287 86.55772 1.4394993 0.9388039 0.31293463  
## 13 118.14038 61.77758 2.9535096 1.7228806 1.64083865  
## 15 86.55206 46.67976 1.9449902 1.5029470 1.06090373  
## 16 170.54054 90.67568 2.0270270 0.6756757 0.27027027  
## 17 284.04624 164.21965 0.8670520 0.3468208 0.17341040  
## 18 292.12008 170.88180 4.3902439 2.8705441 1.18198874  
## Mis\_Carries Rec\_Receiving PrgR\_Receiving misc\_cols\_unadj Fls Fld  
## 1 0.2647059 60.67647 0.1764706 71.0 0.4411765 0.3529412  
## 2 3.1384922 38.14015 12.7034208 42.9 0.6575888 0.9863833  
## 3 1.4789456 47.69599 1.6638138 65.0 1.2940774 1.4173228  
## 4 1.0928320 42.40893 2.7497062 35.8 2.1151586 1.3748531  
## 5 0.3103448 56.40517 0.1163793 72.0 1.0086207 0.6982759  
## 6 0.9748700 50.77123 3.7045061 33.3 0.4289428 0.3119584  
## 7 0.7633929 53.91964 3.4955357 18.8 0.4419643 0.2812500  
## 8 1.3557820 39.07842 4.7851130 45.0 1.4754098 0.9171467  
## 9 2.0629213 35.51461 10.8808989 26.7 1.9415730 1.2134831  
## 11 2.1020283 31.53042 13.2759680 40.5 0.9403811 1.2722803  
## 12 1.3769124 48.88039 4.1933241 52.0 0.9388039 1.4394993  
## 13 2.9535096 25.51504 7.0556062 41.2 1.4767548 0.9845032  
## 15 1.8565815 19.44990 5.9233792 35.6 2.3870334 1.2377210  
## 16 0.5405405 51.62162 5.1351351 45.5 1.2162162 0.8108108  
## 17 0.1734104 58.09249 0.3468208 69.2 0.3468208 0.5202312  
## 18 1.3508443 54.37148 4.5590994 53.8 1.3508443 1.6885553  
## Off Recov Won\_Aerial\_Duels Lost\_Aerial\_Duels  
## 1 0.00000000 3.176471 3.2352941 1.3235294  
## 2 0.47824643 2.779807 0.2690136 0.3586848  
## 3 0.00000000 5.607669 0.8010955 0.4313591  
## 4 0.07050529 5.111633 0.6698002 1.1985899  
## 5 0.00000000 3.336207 2.7931034 1.0862069  
## 6 0.07798960 3.548527 0.2339688 0.4679376  
## 7 0.04017857 5.062500 0.1205357 0.5223214  
## 8 0.15950377 4.785113 0.7177669 0.8772707  
## 9 0.40449438 3.964045 0.4853933 1.3348315  
## 11 0.27658267 3.429625 0.8297480 1.2169637  
## 12 0.06258693 4.881780 0.8136300 0.7510431  
## 13 0.08204193 3.281677 1.7228806 2.4612580  
## 15 0.97249509 3.359528 1.4145383 2.5638507  
## 16 0.13513514 3.513514 0.6756757 0.8108108  
## 17 0.00000000 5.895954 1.5606936 0.6936416  
## 18 0.00000000 5.741088 1.1819887 1.0131332

# Perform PCA  
pca\_result <- prcomp(liverpool\_2425\_logs[ , 5:76], scale. = TRUE)  
pca\_data <- as.data.frame(pca\_result$x[, 1:2]) # Use the first 2 principal components  
pca\_data$cluster <- as.factor(liverpool\_2425\_logs$Pos)  
pca\_data$label <- as.factor(liverpool\_2425\_logs$Player)  
  
  
loadings\_pc1\_pc2 <- pca\_result$rotation[, 1:2]  
# Sort for PC1 by absolute value  
sorted\_pc1 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,1]), decreasing = TRUE), 1]  
# Sort for PC2 by absolute value  
sorted\_pc2 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,2]), decreasing = TRUE), 2]  
cat("Top variables for PC1:\n")

## Top variables for PC1:

sorted\_pc1

## TotDist\_Total Mid 3rd\_Touches Cmp\_Medium   
## -0.169407988 -0.168668325 -0.168535987   
## Att\_Medium Def 3rd\_Touches Mis\_Carries   
## -0.168515852 -0.163909040 0.163866230   
## SoT\_per\_90\_Standard PrgDist\_Total Sh\_per\_90\_Standard   
## 0.161521807 -0.160840069 0.160163443   
## npxG\_Expected Rec\_Receiving Carries\_Carries   
## 0.159336753 -0.159099634 -0.155151734   
## Att Pen\_Touches Final\_Third PrgR\_Progression   
## 0.154979903 -0.153871839 0.152551100   
## PrgR\_Receiving Def Pen\_Touches Att\_Take\_Ons   
## 0.152551100 -0.149062745 0.144858950   
## Clr Succ\_Take\_Ons CPA\_Carries   
## -0.144220647 0.142387239 0.140935624   
## defense\_cols\_unadj Sh\_Blocks Cmp\_Short   
## -0.140501027 -0.137447669 -0.135728206   
## Cmp\_percent\_Short TO\_SCA\_Types Cmp\_percent\_Medium   
## -0.134086791 0.133835867 -0.133363076   
## Att\_Short Cmp\_Long npxG\_per\_Sh\_Expected   
## -0.132832181 -0.127576182 0.126135321   
## Sh\_SCA\_Types PrgC\_Progression PrgC\_Carries   
## 0.124855175 0.123024609 0.123024609   
## Fld\_SCA\_Types Att\_Long gca\_cols\_unadj   
## 0.122727248 -0.122127529 0.121032074   
## Off Int Att 3rd\_Touches   
## 0.120942422 -0.118821441 0.114436788   
## PrgP Err PassLive\_SCA\_Types   
## -0.110873702 -0.107398405 0.106447939   
## Tkl\_Challenges KP misc\_cols\_unadj   
## -0.102566707 0.102329629 -0.098594532   
## PrgDist\_Carries xAG\_Expected Def 3rd\_Tackles   
## -0.098534119 0.098050956 -0.096914494   
## Fls Final\_Third\_Carries TotDist\_Carries   
## 0.095577525 0.094932766 -0.093169838   
## Fld Def\_SCA\_Types Lost\_Aerial\_Duels   
## 0.089653275 0.085532349 0.075388111   
## Att 3rd\_Tackles TklW\_Tackles Won\_Aerial\_Duels   
## 0.072715281 -0.072327384 -0.070333103   
## Recov Att\_Challenges Sw\_Pass\_Types   
## -0.067956634 -0.065559847 -0.065346880   
## PPA Mid 3rd\_Tackles TI\_Pass\_Types   
## 0.062257389 -0.056307481 -0.055198209   
## Cmp\_percent\_Long Pass\_Blocks possession\_cols\_unadj   
## 0.051158721 0.037980558 0.034579731   
## CrdY TB\_Pass\_Types CrsPA   
## 0.029347547 0.026796860 0.015708861   
## Crs\_Pass\_Types SoT\_percent\_Standard Dist\_Standard   
## -0.013341008 0.012191823 -0.008708371

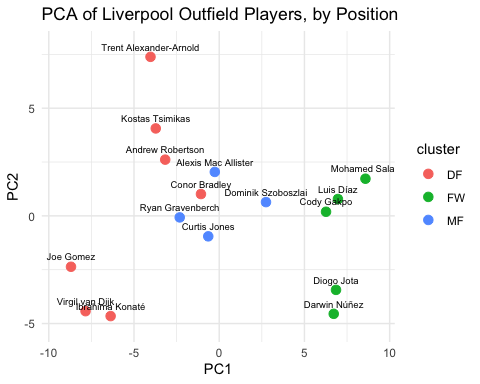
cat("\nTop variables for PC2:\n")

##   
## Top variables for PC2:

sorted\_pc2

## CrsPA Crs\_Pass\_Types Won\_Aerial\_Duels   
## 0.2464278046 0.2441686899 -0.2434474791   
## PPA Att 3rd\_Touches KP   
## 0.2403731498 0.2144335685 0.2114615629   
## PrgP TI\_Pass\_Types xAG\_Expected   
## 0.2044166613 0.2032027514 0.2020495872   
## PassLive\_SCA\_Types misc\_cols\_unadj gca\_cols\_unadj   
## 0.1962865918 -0.1871514299 0.1859698938   
## Att\_Challenges Dist\_Standard Lost\_Aerial\_Duels   
## 0.1808737347 0.1781201044 -0.1767459796   
## TB\_Pass\_Types Att\_Long Def 3rd\_Tackles   
## 0.1746412897 0.1608794802 0.1572765870   
## Tkl\_Challenges npxG\_per\_Sh\_Expected TklW\_Tackles   
## 0.1572289364 -0.1392461152 0.1372121240   
## Def\_SCA\_Types Cmp\_Long Cmp\_percent\_Long   
## -0.1235475022 0.1197190268 -0.1195370603   
## Def Pen\_Touches Att 3rd\_Tackles PrgC\_Progression   
## -0.1106490729 0.1026805113 0.0969011678   
## PrgC\_Carries Att\_Short Clr   
## 0.0969011678 0.0944253981 -0.0891038460   
## Final\_Third\_Carries Cmp\_Short Mid 3rd\_Tackles   
## 0.0882405400 0.0853256475 0.0833377576   
## Recov npxG\_Expected Final\_Third   
## 0.0778424129 -0.0748156864 0.0747978113   
## Succ\_Take\_Ons PrgR\_Receiving PrgR\_Progression   
## 0.0684215933 0.0651841552 0.0651841552   
## Cmp\_percent\_Medium Sh\_Blocks Att\_Take\_Ons   
## -0.0625333363 -0.0618994309 0.0610265951   
## Cmp\_percent\_Short Rec\_Receiving Sw\_Pass\_Types   
## 0.0556739159 0.0553755257 0.0546181330   
## CrdY Fls Off   
## -0.0543024334 -0.0534139112 -0.0525247697   
## Pass\_Blocks Int Carries\_Carries   
## 0.0515309908 0.0487733434 0.0411013980   
## Def 3rd\_Touches SoT\_per\_90\_Standard Fld   
## -0.0372266538 -0.0336923256 -0.0317383967   
## TotDist\_Total PrgDist\_Total Sh\_per\_90\_Standard   
## 0.0314212385 0.0282579066 -0.0278438115   
## Cmp\_Medium SoT\_percent\_Standard possession\_cols\_unadj   
## -0.0259918736 -0.0233651071 0.0217649563   
## Mid 3rd\_Touches Err TotDist\_Carries   
## 0.0190582380 -0.0179317755 0.0170182574   
## Att Pen\_Touches CPA\_Carries TO\_SCA\_Types   
## -0.0150413460 0.0144945350 0.0094304206   
## defense\_cols\_unadj PrgDist\_Carries Att\_Medium   
## 0.0084443059 0.0072754418 0.0051019925   
## Mis\_Carries Fld\_SCA\_Types Sh\_SCA\_Types   
## -0.0050775656 -0.0048101876 -0.0007955226

# Plot PCA with clusters  
ggplot(pca\_data, aes(x = PC1, y = PC2, color = cluster)) +  
 geom\_point(size = 3) +  
 scale\_x\_continuous(expand = expansion(mult = 0.1)) +  
 scale\_y\_continuous(expand = expansion(mult = 0.1)) +  
 theme\_minimal() +  
 labs(title = "PCA of Liverpool Outfield Players, by Position", x = "PC1", y = "PC2") +   
 geom\_text(aes(label = label), vjust = -1, hjust = 0.5, color = "black", size = 2.5) # Add labels



chelsea\_2425\_url <- "https://fbref.com/en/squads/cff3d9bb/Chelsea-Stats"  
chelsea\_2425\_logs <- pull\_team\_data(chelsea\_2425\_url)  
  
chelsea\_2425\_logs

## Player Pos Age Min\_Playing\_Time CrdY npxG\_Expected  
## 1 Moisés Caicedo MF 23-177 2991 0.30090271 0.02407222  
## 2 Cole Palmer MF 22-357 2831 0.19074532 0.40374426  
## 3 Levi Colwill DF 22-061 2789 0.25815705 0.04195052  
## 4 Marc Cucurella DF 26-280 2628 0.34246575 0.08904110  
## 5 Enzo Fernández MF 24-101 2590 0.24324324 0.18764479  
## 7 Nicolas Jackson FW 23-312 2114 0.29801325 0.51939451  
## 8 Noni Madueke FW 23-049 1723 0.15670342 0.42832269  
## 9 Pedro Neto FW 25-050 1923 0.37441498 0.13104524  
## 10 Malo Gusto DF 21-344 1819 0.19791094 0.08411215  
## 11 Jadon Sancho FW 25-034 1668 0.05395683 0.10791367  
## 12 Wesley Fofana DF 24-132 1172 0.53754266 0.03071672  
## 13 Tosin Adarabioyo DF 27-216 1229 0.21969081 0.06590724  
## 14 Reece James DF 25-141 835 0.10778443 0.03233533  
## 15 Christopher Nkunku FW 27-165 921 0.19543974 0.46905537  
## 16 Trevoh Chalobah DF 25-297 746 0.12064343 0.08445040  
## 17 Roméo Lavia MF 21-112 607 0.59308072 0.02965404  
## xAG\_Expected PrgC\_Progression PrgR\_Progression SoT\_percent\_Standard  
## 1 0.08726179 1.1434303 0.99297894 16.7  
## 2 0.29565525 3.2744613 5.24549629 36.0  
## 3 0.03549659 0.4195052 0.35496594 18.8  
## 4 0.06506849 1.0273973 3.69863014 40.9  
## 5 0.21891892 1.9806950 3.99613900 36.7  
## 7 0.18306528 1.9583728 5.32166509 43.2  
## 8 0.20371445 6.9471851 10.86477075 41.1  
## 9 0.25273011 5.1482059 10.29641186 31.4  
## 10 0.05937328 2.3749313 4.15612974 18.2  
## 11 0.18345324 5.1798561 11.54676259 30.4  
## 12 0.03071672 1.4590444 0.30716724 0.0  
## 13 0.01464605 0.3661513 0.07323027 16.7  
## 14 0.05389222 0.6467066 0.97005988 37.5  
## 15 0.20521173 1.6612378 6.64495114 44.0  
## 16 0.14477212 0.4825737 0.24128686 33.3  
## 17 0.10378913 0.4448105 0.88962109 0.0  
## Sh\_per\_90\_Standard SoT\_per\_90\_Standard Dist\_Standard npxG\_per\_Sh\_Expected  
## 1 0.54 0.09 25.1 0.04  
## 2 3.53 1.27 20.3 0.11  
## 3 0.52 0.10 9.9 0.08  
## 4 0.75 0.31 16.5 0.12  
## 5 1.70 0.63 18.6 0.11  
## 7 3.15 1.36 12.7 0.17  
## 8 3.81 1.57 14.6 0.11  
## 9 2.39 0.75 18.9 0.05  
## 10 1.09 0.20 21.3 0.08  
## 11 1.24 0.38 15.3 0.09  
## 12 0.23 0.00 10.6 0.13  
## 13 0.88 0.15 12.5 0.08  
## 14 0.86 0.32 23.2 0.03  
## 15 2.44 1.07 12.6 0.19  
## 16 0.72 0.24 10.8 0.12  
## 17 0.15 0.00 16.0 0.18  
## Cmp\_percent\_Short Cmp\_percent\_Medium Cmp\_percent\_Long TotDist\_Total  
## 1 92.2 92.5 77.8 932.9188  
## 2 85.9 84.8 59.6 614.7722  
## 3 92.7 95.3 57.7 1274.2309  
## 4 93.9 90.0 57.4 825.9247  
## 5 88.8 84.9 58.4 860.8031  
## 7 81.9 78.0 64.3 166.4191  
## 8 86.5 76.1 56.4 350.2844  
## 9 92.8 81.3 47.8 471.3885  
## 10 93.1 88.2 61.3 944.4805  
## 11 89.2 84.0 50.0 455.0180  
## 12 93.9 92.5 61.9 941.6212  
## 13 95.7 94.9 61.1 1325.8340  
## 14 94.3 88.9 51.5 1110.0719  
## 15 91.6 92.2 100.0 383.8436  
## 16 94.8 94.8 56.7 1108.2306  
## 17 90.4 94.6 80.0 754.1021  
## PrgDist\_Total Cmp\_Short Att\_Short Cmp\_Medium Att\_Medium Cmp\_Long Att\_Long  
## 1 247.07121 24.132397 26.178536 24.222668 26.178536 4.5436309 5.8375125  
## 2 159.65383 13.574709 15.800071 13.161427 15.513953 4.9275874 8.2656305  
## 3 449.70957 24.202223 26.106131 40.788813 42.821800 4.2273216 7.3252062  
## 4 231.36986 26.198630 27.910959 23.013699 25.582192 2.1232877 3.6986301  
## 5 241.85328 22.308880 25.123552 19.876448 23.420849 5.2123552 8.9305019  
## 7 36.18732 7.535478 9.195837 3.618732 4.640492 0.3831599 0.5960265  
## 8 87.59721 14.364481 16.610563 7.312826 9.611143 1.1491584 2.0371445  
## 9 99.26677 14.461778 15.585023 10.764431 13.244930 2.5741030 5.3822153  
## 10 237.49313 28.251787 30.329852 24.837823 28.152831 3.3644860 5.4920286  
## 11 105.21583 20.935252 23.471223 10.791367 12.841727 0.7014388 1.4028777  
## 12 262.24403 23.498294 25.034130 29.564846 31.945392 1.9965870 3.2252560  
## 13 474.45891 27.388120 28.633035 40.569569 42.766477 4.2473556 6.9568755  
## 14 380.69461 28.347305 30.071856 26.838323 30.179641 5.4970060 10.6706587  
## 15 74.26710 18.078176 19.739414 9.283388 10.065147 0.5863192 0.5863192  
## 16 348.53887 28.833780 30.402145 30.884718 32.573727 4.1018767 7.2386059  
## 17 203.87150 20.906096 23.130148 20.906096 22.092257 2.3723229 2.9654036  
## KP Final\_Third PPA CrsPA PrgP TB\_Pass\_Types  
## 1 0.84252758 6.4694082 0.93279840 0.06018054 5.837513 0.36108325  
## 2 2.47968916 4.6096786 1.93924408 0.54044507 6.167432 0.60402685  
## 3 0.45177483 4.6468268 0.22588741 0.09680889 4.001434 0.09680889  
## 4 0.61643836 3.6986301 0.41095890 0.10273973 3.561644 0.06849315  
## 5 2.46718147 5.3861004 1.35521236 0.24324324 6.810811 0.45173745  
## 7 1.19205298 0.9366131 0.42573321 0.04257332 1.575213 0.04257332  
## 8 1.46256529 0.6268137 1.72373767 0.41787580 3.290772 0.05223447  
## 9 1.96567863 1.3104524 1.54446178 0.98283931 2.620905 0.00000000  
## 10 0.98955470 5.2941176 0.89059923 0.29686641 5.838373 0.09895547  
## 11 1.88848921 1.3489209 2.48201439 0.00000000 4.640288 0.37769784  
## 12 0.46075085 4.1467577 0.07679181 0.00000000 2.457338 0.00000000  
## 13 0.07323027 3.8812042 0.07323027 0.00000000 2.709520 0.14646054  
## 14 1.07784431 7.7604790 0.53892216 0.10778443 5.497006 0.43113772  
## 15 1.36807818 2.5407166 0.68403909 0.00000000 2.442997 0.19543974  
## 16 0.36193029 4.4638070 0.36193029 0.00000000 4.101877 0.12064343  
## 17 1.03789127 5.7825371 0.44481054 0.00000000 3.410214 0.44481054  
## Sw\_Pass\_Types Crs\_Pass\_Types TI\_Pass\_Types gca\_cols\_unadj PassLive\_SCA\_Types  
## 1 0.39117352 0.24072217 0.6920762 2.71 2.4072217  
## 2 0.41328153 4.22818792 0.4768633 5.72 3.8149064  
## 3 0.22588741 0.41950520 0.1613482 1.19 1.0648978  
## 4 0.03424658 0.99315068 7.4657534 1.58 1.3698630  
## 5 0.83397683 3.57915058 0.1389961 4.76 3.7181467  
## 7 0.00000000 0.12771996 0.1702933 2.90 1.7455061  
## 8 0.20893790 3.02959954 0.8879861 3.76 2.6639582  
## 9 0.23400936 6.13104524 0.5616225 3.88 2.8549142  
## 10 0.14843321 2.52336449 5.6899395 2.77 2.7212754  
## 11 0.05395683 1.24100719 0.4856115 3.51 3.1294964  
## 12 0.00000000 0.07679181 1.5358362 1.15 0.9215017  
## 13 0.21969081 0.00000000 0.2929211 0.88 0.5126119  
## 14 0.21556886 4.09580838 5.3892216 1.62 0.9700599  
## 15 0.09771987 0.39087948 0.0000000 3.32 2.0521173  
## 16 0.24128686 0.36193029 1.0857909 1.45 1.0857909  
## 17 0.29654036 0.00000000 0.0000000 1.93 1.7792422  
## TO\_SCA\_Types Sh\_SCA\_Types Fld\_SCA\_Types Def\_SCA\_Types defense\_cols\_unadj  
## 1 0.06018054 0.00000000 0.06018054 0.18054162 62.5  
## 2 0.38149064 0.57223596 0.22253621 0.06358177 38.1  
## 3 0.00000000 0.03226963 0.00000000 0.03226963 64.0  
## 4 0.00000000 0.06849315 0.03424658 0.00000000 50.0  
## 5 0.06949807 0.13899614 0.13899614 0.17374517 37.2  
## 7 0.38315989 0.29801325 0.38315989 0.08514664 37.5  
## 8 0.52234475 0.31340685 0.20893790 0.05223447 39.4  
## 9 0.23400936 0.23400936 0.18720749 0.00000000 38.9  
## 10 0.00000000 0.04947774 0.00000000 0.00000000 51.1  
## 11 0.16187050 0.05395683 0.16187050 0.00000000 41.7  
## 12 0.07679181 0.07679181 0.00000000 0.00000000 42.9  
## 13 0.00000000 0.36615134 0.00000000 0.00000000 66.7  
## 14 0.00000000 0.10778443 0.00000000 0.00000000 33.3  
## 15 0.48859935 0.48859935 0.09771987 0.19543974 75.0  
## 16 0.00000000 0.24128686 0.00000000 0.12064343 83.3  
## 17 0.00000000 0.00000000 0.00000000 0.14827018 50.0  
## TklW\_Tackles Def 3rd\_Tackles Mid 3rd\_Tackles Att 3rd\_Tackles Tkl\_Challenges  
## 1 1.8956871 1.0832497 1.5045135 0.42126379 1.5045135  
## 2 0.5086542 0.3496998 0.2225362 0.22253621 0.2543271  
## 3 0.9035497 0.6453926 0.5485837 0.09680889 0.5163141  
## 4 1.3013699 0.9931507 0.8219178 0.17123288 0.8561644  
## 5 1.0424710 0.5559846 0.9729730 0.59073359 1.0077220  
## 7 0.4683065 0.1702933 0.2554399 0.38315989 0.1277200  
## 8 0.7835171 0.3656413 0.6268137 0.15670342 0.6790482  
## 9 0.4212168 0.4212168 0.3744150 0.18720749 0.3276131  
## 10 1.3853766 1.2864211 0.7421660 0.09895547 1.1874656  
## 11 0.3237410 0.1618705 0.1079137 0.26978417 0.2697842  
## 12 0.9215017 0.4607509 0.5375427 0.00000000 0.4607509  
## 13 0.7323027 0.7323027 0.2929211 0.00000000 0.5858421  
## 14 0.9700599 0.5389222 0.3233533 0.10778443 0.3233533  
## 15 0.7817590 0.2931596 0.3908795 0.48859935 0.5863192  
## 16 0.4825737 0.3619303 0.4825737 0.00000000 0.6032172  
## 17 1.6309720 0.7413509 1.4827018 0.59308072 1.1861614  
## Att\_Challenges Sh\_Blocks Pass\_Blocks Int Clr Err  
## 1 2.4072217 0.27081244 1.0531595 1.4142427 1.4142427 0.03009027  
## 2 0.6676086 0.03179089 0.4132815 0.2543271 0.5404451 0.03179089  
## 3 0.8067408 0.77447114 0.3226963 1.0003586 3.1946934 0.12907852  
## 4 1.7123288 0.44520548 0.9246575 0.7876712 2.6027397 0.10273973  
## 5 2.7104247 0.17374517 0.9382239 0.3822394 0.7644788 0.13899614  
## 7 0.3405866 0.08514664 0.4683065 0.1277200 0.6385998 0.00000000  
## 8 1.7237377 0.00000000 0.7312826 0.4178758 0.5223447 0.00000000  
## 9 0.8424337 0.09360374 0.4680187 0.3744150 0.2340094 0.00000000  
## 10 2.3254535 0.39582188 1.0390324 1.1379879 2.2759758 0.24738868  
## 11 0.6474820 0.00000000 0.4856115 0.1079137 0.3237410 0.10791367  
## 12 1.0750853 0.69112628 0.3839590 1.0750853 4.2235495 0.15358362  
## 13 0.8787632 0.51261188 0.1464605 0.7323027 4.5402766 0.00000000  
## 14 0.9700599 0.43113772 0.8622754 1.2934132 1.9401198 0.43113772  
## 15 0.7817590 0.19543974 0.6840391 0.6840391 0.9771987 0.00000000  
## 16 0.7238606 0.24128686 0.2412869 0.8445040 4.7050938 0.12064343  
## 17 2.3723229 0.00000000 0.8896211 1.9275124 0.8896211 0.00000000  
## possession\_cols\_unadj Def Pen\_Touches Def 3rd\_Touches Mid 3rd\_Touches  
## 1 42.6 2.5576730 15.105316 43.39017  
## 2 45.6 0.6358177 4.228188 23.36630  
## 3 60.0 10.6489781 40.046612 42.27322  
## 4 30.8 3.4246575 20.650685 31.95205  
## 5 45.7 1.1119691 10.737452 35.68726  
## 7 30.5 0.8088931 1.958373 11.57994  
## 8 42.9 0.9402205 4.335461 12.37957  
## 9 31.9 0.5148206 4.071763 13.80655  
## 10 26.7 2.8202309 18.554151 37.20726  
## 11 47.4 0.5935252 6.151079 14.40647  
## 12 53.3 6.2201365 28.412969 40.16212  
## 13 80.0 11.7168430 41.741253 44.15785  
## 14 37.5 3.4491018 22.958084 45.59281  
## 15 37.0 0.9771987 5.081433 17.88274  
## 16 33.3 6.6353887 33.659517 41.01877  
## 17 61.5 1.9275124 13.492586 35.88138  
## Att 3rd\_Touches Att Pen\_Touches Att\_Take\_Ons Succ\_Take\_Ons Carries\_Carries  
## 1 12.668004 0.3610832 1.6248746 0.6920762 39.35807  
## 2 25.559873 4.0056517 3.2744613 1.4941717 33.25327  
## 3 4.130513 1.1294371 0.3226963 0.1936178 49.24346  
## 4 16.643836 2.4657534 0.4452055 0.1369863 29.58904  
## 5 24.254826 2.5366795 1.5984556 0.7297297 38.74517  
## 7 14.858089 5.8325449 2.5118259 0.7663198 17.07190  
## 8 27.736506 8.5142194 4.3876959 1.8804411 29.35577  
## 9 30.046802 4.7737910 4.2589704 1.3572543 30.65523  
## 10 21.671248 2.0780649 0.7421660 0.1979109 42.60033  
## 11 29.352518 6.2589928 5.1258993 2.4280576 33.39928  
## 12 4.223549 0.7679181 1.1518771 0.6143345 42.77304  
## 13 1.903987 0.9519935 0.3661513 0.2929211 52.21318  
## 14 13.796407 0.4311377 1.7245509 0.6467066 42.79042  
## 15 21.205212 5.0814332 2.6384365 0.9771987 27.36156  
## 16 6.514745 1.3270777 0.3619303 0.1206434 45.12064  
## 17 8.599671 0.1482702 1.9275124 1.1861614 34.10214  
## TotDist\_Carries PrgDist\_Carries PrgC\_Carries Final\_Third\_Carries CPA\_Carries  
## 1 185.3862 87.83350 1.1434303 0.8425276 0.06018054  
## 2 221.2964 105.10067 3.2744613 2.0981985 1.11268103  
## 3 224.5644 124.46397 0.4195052 0.3549659 0.03226963  
## 4 123.7329 72.08904 1.0273973 0.5821918 0.06849315  
## 5 179.7568 87.88031 1.9806950 1.8416988 0.27799228  
## 7 103.8363 55.04730 1.9583728 1.0217597 1.27719962  
## 8 243.0992 155.13639 6.9471851 2.2460824 4.17875798  
## 9 253.8066 132.96412 5.1482059 2.3868955 1.77847114  
## 10 214.2881 107.36668 2.3749313 1.7317207 0.39582188  
## 11 229.1547 126.09712 5.1798561 1.7266187 2.96762590  
## 12 241.8174 123.94198 1.4590444 0.9215017 0.07679181  
## 13 216.0293 123.75915 0.3661513 0.1464605 0.00000000  
## 14 169.5449 78.46707 0.6467066 0.4311377 0.00000000  
## 15 133.6808 61.36808 1.6612378 1.5635179 1.27035831  
## 16 180.1206 83.96783 0.4825737 0.2412869 0.00000000  
## 17 155.5354 69.09390 0.4448105 1.1861614 0.00000000  
## Mis\_Carries Rec\_Receiving PrgR\_Receiving misc\_cols\_unadj Fls Fld  
## 1 1.0531595 49.40822 0.99297894 66.7 1.8355065 1.6248746  
## 2 1.9392441 38.75309 5.24549629 12.5 0.3814906 1.7484988  
## 3 0.4195052 63.37755 0.35496594 59.8 1.3553245 0.5808534  
## 4 0.8904110 43.11644 3.69863014 36.3 1.1301370 1.0958904  
## 5 0.9382239 51.67181 3.99613900 32.5 1.5637066 1.6332046  
## 7 2.7672658 20.86093 5.32166509 34.0 1.3623463 1.2346263  
## 8 2.1416135 33.74347 10.86477075 40.0 1.0446895 1.2536274  
## 9 1.8252730 34.35257 10.29641186 27.8 0.8424337 1.3572543  
## 10 0.7916438 51.80319 4.15612974 34.8 0.9895547 0.8905992  
## 11 1.5647482 38.57914 11.54676259 33.3 0.3237410 0.5935252  
## 12 1.2286689 51.06655 0.30716724 69.2 1.8430034 1.2286689  
## 13 0.2196908 67.07893 0.07323027 58.1 0.5858421 0.4393816  
## 14 0.6467066 51.73653 0.97005988 77.8 0.6467066 1.0778443  
## 15 1.7589577 34.78827 6.64495114 42.1 1.5635179 1.0749186  
## 16 0.3619303 60.44236 0.24128686 68.8 0.7238606 0.6032172  
## 17 0.1482702 41.07084 0.88962109 83.3 1.7792422 0.4448105  
## Off Recov Won\_Aerial\_Duels Lost\_Aerial\_Duels  
## 1 0.00000000 5.927783 0.90270812 0.4513541  
## 2 0.19074532 2.956552 0.03179089 0.2225362  
## 3 0.12907852 3.485120 2.45249193 1.6457512  
## 4 0.10273973 3.767123 0.99315068 1.7465753  
## 5 0.03474903 4.899614 0.45173745 0.9382239  
## 7 0.80889309 1.873226 0.76631977 1.4900662  
## 8 0.20893790 3.499710 0.52234475 0.7835171  
## 9 0.14040562 3.276131 0.46801872 1.2168487  
## 10 0.09895547 5.640462 0.39582188 0.7421660  
## 11 0.26978417 5.233813 0.26978417 0.5395683  
## 12 0.00000000 4.146758 2.07337884 0.9215017  
## 13 0.07323027 2.489829 2.63628967 1.9039870  
## 14 0.00000000 5.712575 2.26347305 0.6467066  
## 15 0.29315961 2.833876 1.56351792 2.1498371  
## 16 0.00000000 3.016086 2.65415550 1.2064343  
## 17 0.00000000 4.448105 1.48270181 0.2965404

# Perform PCA  
pca\_result <- prcomp(chelsea\_2425\_logs[ , 5:76], scale. = TRUE)  
pca\_data <- as.data.frame(pca\_result$x[, 1:2]) # Use the first 2 principal components  
pca\_data$cluster <- as.factor(chelsea\_2425\_logs$Pos)  
pca\_data$label <- as.factor(chelsea\_2425\_logs$Player)  
  
  
loadings\_pc1\_pc2 <- pca\_result$rotation[, 1:2]  
# Sort for PC1 by absolute value  
sorted\_pc1 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,1]), decreasing = TRUE), 1]  
# Sort for PC2 by absolute value  
sorted\_pc2 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,2]), decreasing = TRUE), 2]  
cat("Top variables for PC1:\n")

## Top variables for PC1:

sorted\_pc1

## Mid 3rd\_Touches Cmp\_Medium Att\_Medium   
## -0.167113820 -0.165824898 -0.164554182   
## TotDist\_Total Att Pen\_Touches Def 3rd\_Touches   
## -0.163688499 0.160571331 -0.159066920   
## Mis\_Carries PrgDist\_Total Fld\_SCA\_Types   
## 0.157807324 -0.157678949 0.156705432   
## PrgR\_Progression PrgR\_Receiving Sh\_per\_90\_Standard   
## 0.156639127 0.156639127 0.154578137   
## Cmp\_percent\_Medium Att\_Take\_Ons SoT\_per\_90\_Standard   
## -0.153565450 0.153069803 0.152734106   
## Rec\_Receiving xAG\_Expected Cmp\_Short   
## -0.152499413 0.152224003 -0.151475309   
## TO\_SCA\_Types Att\_Short Att 3rd\_Touches   
## 0.151082959 -0.148563188 0.147723412   
## CPA\_Carries Final\_Third\_Carries PrgC\_Carries   
## 0.144616797 0.143957432 0.143737772   
## PrgC\_Progression Clr Carries\_Carries   
## 0.143737772 -0.143569108 -0.143521668   
## gca\_cols\_unadj Def Pen\_Touches npxG\_Expected   
## 0.141912615 -0.139066065 0.138468859   
## Cmp\_percent\_Short Won\_Aerial\_Duels KP   
## -0.137274899 -0.135673279 0.135519292   
## Sh\_Blocks Succ\_Take\_Ons misc\_cols\_unadj   
## -0.135286974 0.133526855 -0.130850990   
## PPA Int Final\_Third   
## 0.130616494 -0.127571960 -0.126233612   
## PassLive\_SCA\_Types Off SoT\_percent\_Standard   
## 0.123772956 0.112994697 0.104046592   
## Def 3rd\_Tackles Cmp\_Long CrsPA   
## -0.101436768 -0.093952869 0.091303880   
## Sh\_SCA\_Types defense\_cols\_unadj TklW\_Tackles   
## 0.086562375 -0.086461131 -0.086217661   
## Fld Att\_Long Crs\_Pass\_Types   
## 0.083001106 -0.082803047 0.080188347   
## Err possession\_cols\_unadj Tkl\_Challenges   
## -0.074294777 -0.072178129 -0.068885287   
## Att 3rd\_Tackles Mid 3rd\_Tackles TI\_Pass\_Types   
## 0.062172653 -0.059066631 -0.050681545   
## Recov npxG\_per\_Sh\_Expected CrdY   
## -0.047916709 0.042975372 -0.037742041   
## Att\_Challenges Fls Lost\_Aerial\_Duels   
## -0.037351223 -0.036992333 -0.024853131   
## PrgP PrgDist\_Carries Dist\_Standard   
## -0.022175993 0.021055001 0.016249589   
## Def\_SCA\_Types TB\_Pass\_Types Cmp\_percent\_Long   
## 0.014907919 0.009370596 -0.007808515   
## TotDist\_Carries Pass\_Blocks Sw\_Pass\_Types   
## 0.006244458 0.004276351 -0.004018848

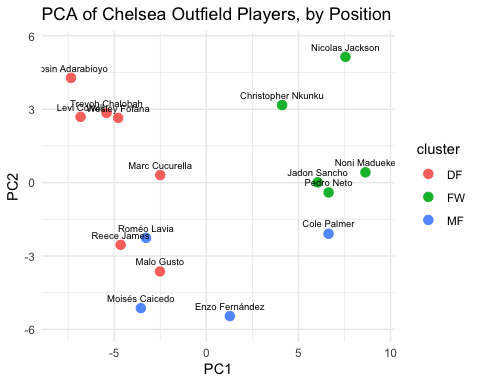
cat("\nTop variables for PC2:\n")

##   
## Top variables for PC2:

sorted\_pc2

## Dist\_Standard PrgP Recov   
## -0.259670179 -0.253527133 -0.241302678   
## Pass\_Blocks Att\_Challenges Lost\_Aerial\_Duels   
## -0.231267708 -0.229841242 0.211750978   
## Sw\_Pass\_Types TB\_Pass\_Types Tkl\_Challenges   
## -0.198918346 -0.187337925 -0.184004677   
## PassLive\_SCA\_Types Mid 3rd\_Tackles TklW\_Tackles   
## -0.181372624 -0.175964402 -0.174046519   
## Final\_Third Cmp\_Long Won\_Aerial\_Duels   
## -0.169949047 -0.152462036 0.150699575   
## Off Def 3rd\_Tackles KP   
## 0.148136691 -0.147670640 -0.145942364   
## Crs\_Pass\_Types Def Pen\_Touches Fld   
## -0.144833493 0.135571612 -0.134607445   
## gca\_cols\_unadj Att\_Long PPA   
## -0.132464272 -0.131937168 -0.128180663   
## npxG\_per\_Sh\_Expected Clr Att 3rd\_Tackles   
## 0.127335359 0.126549324 -0.121873868   
## Att 3rd\_Touches Sh\_SCA\_Types Final\_Third\_Carries   
## -0.119836230 0.113715414 -0.112899374   
## defense\_cols\_unadj Err Int   
## 0.108964525 -0.096698013 -0.090474448   
## npxG\_Expected Def 3rd\_Touches CrsPA   
## 0.090036119 0.087614326 -0.087040793   
## Att\_Short TO\_SCA\_Types Sh\_Blocks   
## -0.076711195 0.076134858 0.074709857   
## TI\_Pass\_Types Mid 3rd\_Touches Att Pen\_Touches   
## -0.071516947 -0.070366552 0.069117806   
## Def\_SCA\_Types Cmp\_Short possession\_cols\_unadj   
## -0.068564936 -0.063225889 0.058668634   
## Mis\_Carries SoT\_per\_90\_Standard Succ\_Take\_Ons   
## 0.057748108 0.051280212 -0.042325245   
## xAG\_Expected Fld\_SCA\_Types TotDist\_Carries   
## -0.041635091 0.041574278 -0.037108433   
## Sh\_per\_90\_Standard CPA\_Carries PrgC\_Progression   
## 0.034603137 0.031840582 -0.031758850   
## PrgC\_Carries SoT\_percent\_Standard Fls   
## -0.031758850 0.031328077 -0.030044067   
## TotDist\_Total Att\_Take\_Ons Carries\_Carries   
## -0.029996756 -0.028604771 -0.028384480   
## Cmp\_percent\_Medium Cmp\_Medium misc\_cols\_unadj   
## 0.023027856 0.020460671 0.016723389   
## Cmp\_percent\_Long Rec\_Receiving PrgDist\_Carries   
## 0.016617207 -0.016252514 0.010230376   
## PrgDist\_Total Att\_Medium PrgR\_Receiving   
## 0.009447744 0.007757209 -0.007033693   
## PrgR\_Progression Cmp\_percent\_Short CrdY   
## -0.007033693 -0.002606785 -0.001192644

# Plot PCA with clusters  
ggplot(pca\_data, aes(x = PC1, y = PC2, color = cluster)) +  
 geom\_point(size = 3) +  
 scale\_x\_continuous(expand = expansion(mult = 0.1)) +  
 scale\_y\_continuous(expand = expansion(mult = 0.1)) +  
 theme\_minimal() +  
 labs(title = "PCA of Chelsea Outfield Players, by Position", x = "PC1", y = "PC2") +   
 geom\_text(aes(label = label), vjust = -1, hjust = 0.5, color = "black", size = 2.5) # Add labels



#bmouth\_2425\_url <- "https://fbref.com/en/squads/4ba7cbea/Bournemouth-Stats"  
#bmouth\_2425\_logs <- pull\_team\_data(bmouth\_2425\_url)  
  
#bmouth\_2425\_logs  
  
# Perform PCA  
#pca\_result <- prcomp(bmouth\_2425\_logs[ , 5:76], scale. = TRUE)  
#pca\_data <- as.data.frame(pca\_result$x[, 1:2]) # Use the first 2 principal components  
#pca\_data$cluster <- as.factor(bmouth\_2425\_logs$Pos)  
#pca\_data$label <- as.factor(bmouth\_2425\_logs$Player)  
  
  
loadings\_pc1\_pc2 <- pca\_result$rotation[, 1:2]  
# Sort for PC1 by absolute value  
sorted\_pc1 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,1]), decreasing = TRUE), 1]  
# Sort for PC2 by absolute value  
sorted\_pc2 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,2]), decreasing = TRUE), 2]  
cat("Top variables for PC1:\n")

## Top variables for PC1:

sorted\_pc1

## Mid 3rd\_Touches Cmp\_Medium Att\_Medium   
## -0.167113820 -0.165824898 -0.164554182   
## TotDist\_Total Att Pen\_Touches Def 3rd\_Touches   
## -0.163688499 0.160571331 -0.159066920   
## Mis\_Carries PrgDist\_Total Fld\_SCA\_Types   
## 0.157807324 -0.157678949 0.156705432   
## PrgR\_Progression PrgR\_Receiving Sh\_per\_90\_Standard   
## 0.156639127 0.156639127 0.154578137   
## Cmp\_percent\_Medium Att\_Take\_Ons SoT\_per\_90\_Standard   
## -0.153565450 0.153069803 0.152734106   
## Rec\_Receiving xAG\_Expected Cmp\_Short   
## -0.152499413 0.152224003 -0.151475309   
## TO\_SCA\_Types Att\_Short Att 3rd\_Touches   
## 0.151082959 -0.148563188 0.147723412   
## CPA\_Carries Final\_Third\_Carries PrgC\_Carries   
## 0.144616797 0.143957432 0.143737772   
## PrgC\_Progression Clr Carries\_Carries   
## 0.143737772 -0.143569108 -0.143521668   
## gca\_cols\_unadj Def Pen\_Touches npxG\_Expected   
## 0.141912615 -0.139066065 0.138468859   
## Cmp\_percent\_Short Won\_Aerial\_Duels KP   
## -0.137274899 -0.135673279 0.135519292   
## Sh\_Blocks Succ\_Take\_Ons misc\_cols\_unadj   
## -0.135286974 0.133526855 -0.130850990   
## PPA Int Final\_Third   
## 0.130616494 -0.127571960 -0.126233612   
## PassLive\_SCA\_Types Off SoT\_percent\_Standard   
## 0.123772956 0.112994697 0.104046592   
## Def 3rd\_Tackles Cmp\_Long CrsPA   
## -0.101436768 -0.093952869 0.091303880   
## Sh\_SCA\_Types defense\_cols\_unadj TklW\_Tackles   
## 0.086562375 -0.086461131 -0.086217661   
## Fld Att\_Long Crs\_Pass\_Types   
## 0.083001106 -0.082803047 0.080188347   
## Err possession\_cols\_unadj Tkl\_Challenges   
## -0.074294777 -0.072178129 -0.068885287   
## Att 3rd\_Tackles Mid 3rd\_Tackles TI\_Pass\_Types   
## 0.062172653 -0.059066631 -0.050681545   
## Recov npxG\_per\_Sh\_Expected CrdY   
## -0.047916709 0.042975372 -0.037742041   
## Att\_Challenges Fls Lost\_Aerial\_Duels   
## -0.037351223 -0.036992333 -0.024853131   
## PrgP PrgDist\_Carries Dist\_Standard   
## -0.022175993 0.021055001 0.016249589   
## Def\_SCA\_Types TB\_Pass\_Types Cmp\_percent\_Long   
## 0.014907919 0.009370596 -0.007808515   
## TotDist\_Carries Pass\_Blocks Sw\_Pass\_Types   
## 0.006244458 0.004276351 -0.004018848

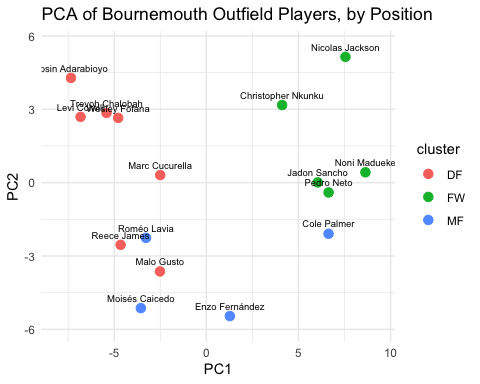
cat("\nTop variables for PC2:\n")

##   
## Top variables for PC2:

sorted\_pc2

## Dist\_Standard PrgP Recov   
## -0.259670179 -0.253527133 -0.241302678   
## Pass\_Blocks Att\_Challenges Lost\_Aerial\_Duels   
## -0.231267708 -0.229841242 0.211750978   
## Sw\_Pass\_Types TB\_Pass\_Types Tkl\_Challenges   
## -0.198918346 -0.187337925 -0.184004677   
## PassLive\_SCA\_Types Mid 3rd\_Tackles TklW\_Tackles   
## -0.181372624 -0.175964402 -0.174046519   
## Final\_Third Cmp\_Long Won\_Aerial\_Duels   
## -0.169949047 -0.152462036 0.150699575   
## Off Def 3rd\_Tackles KP   
## 0.148136691 -0.147670640 -0.145942364   
## Crs\_Pass\_Types Def Pen\_Touches Fld   
## -0.144833493 0.135571612 -0.134607445   
## gca\_cols\_unadj Att\_Long PPA   
## -0.132464272 -0.131937168 -0.128180663   
## npxG\_per\_Sh\_Expected Clr Att 3rd\_Tackles   
## 0.127335359 0.126549324 -0.121873868   
## Att 3rd\_Touches Sh\_SCA\_Types Final\_Third\_Carries   
## -0.119836230 0.113715414 -0.112899374   
## defense\_cols\_unadj Err Int   
## 0.108964525 -0.096698013 -0.090474448   
## npxG\_Expected Def 3rd\_Touches CrsPA   
## 0.090036119 0.087614326 -0.087040793   
## Att\_Short TO\_SCA\_Types Sh\_Blocks   
## -0.076711195 0.076134858 0.074709857   
## TI\_Pass\_Types Mid 3rd\_Touches Att Pen\_Touches   
## -0.071516947 -0.070366552 0.069117806   
## Def\_SCA\_Types Cmp\_Short possession\_cols\_unadj   
## -0.068564936 -0.063225889 0.058668634   
## Mis\_Carries SoT\_per\_90\_Standard Succ\_Take\_Ons   
## 0.057748108 0.051280212 -0.042325245   
## xAG\_Expected Fld\_SCA\_Types TotDist\_Carries   
## -0.041635091 0.041574278 -0.037108433   
## Sh\_per\_90\_Standard CPA\_Carries PrgC\_Progression   
## 0.034603137 0.031840582 -0.031758850   
## PrgC\_Carries SoT\_percent\_Standard Fls   
## -0.031758850 0.031328077 -0.030044067   
## TotDist\_Total Att\_Take\_Ons Carries\_Carries   
## -0.029996756 -0.028604771 -0.028384480   
## Cmp\_percent\_Medium Cmp\_Medium misc\_cols\_unadj   
## 0.023027856 0.020460671 0.016723389   
## Cmp\_percent\_Long Rec\_Receiving PrgDist\_Carries   
## 0.016617207 -0.016252514 0.010230376   
## PrgDist\_Total Att\_Medium PrgR\_Receiving   
## 0.009447744 0.007757209 -0.007033693   
## PrgR\_Progression Cmp\_percent\_Short CrdY   
## -0.007033693 -0.002606785 -0.001192644

# Plot PCA with clusters  
ggplot(pca\_data, aes(x = PC1, y = PC2, color = cluster)) +  
 geom\_point(size = 3) +  
 scale\_x\_continuous(expand = expansion(mult = 0.1)) +  
 scale\_y\_continuous(expand = expansion(mult = 0.1)) +  
 theme\_minimal() +  
 labs(title = "PCA of Bournemouth Outfield Players, by Position", x = "PC1", y = "PC2") +   
 geom\_text(aes(label = label), vjust = -1, hjust = 0.5, color = "black", size = 2.5) # Add labels



#manu\_2425\_url <- "https://fbref.com/en/squads/19538871/Manchester-United-Stats"  
#manu\_2425\_logs <- pull\_team\_data(manu\_2425\_url)  
  
#manu\_2425\_logs  
  
# Perform PCA  
#pca\_result <- prcomp(manu\_2425\_logs[ , 5:76], scale. = TRUE)  
#pca\_data <- as.data.frame(pca\_result$x[, 1:2]) # Use the first 2 principal components  
#pca\_data$cluster <- as.factor(manu\_2425\_logs$Pos)  
#pca\_data$label <- as.factor(manu\_2425\_logs$Player)  
  
  
loadings\_pc1\_pc2 <- pca\_result$rotation[, 1:2]  
# Sort for PC1 by absolute value  
sorted\_pc1 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,1]), decreasing = TRUE), 1]  
# Sort for PC2 by absolute value  
sorted\_pc2 <- loadings\_pc1\_pc2[order(abs(loadings\_pc1\_pc2[,2]), decreasing = TRUE), 2]  
cat("Top variables for PC1:\n")

## Top variables for PC1:

sorted\_pc1

## Mid 3rd\_Touches Cmp\_Medium Att\_Medium   
## -0.167113820 -0.165824898 -0.164554182   
## TotDist\_Total Att Pen\_Touches Def 3rd\_Touches   
## -0.163688499 0.160571331 -0.159066920   
## Mis\_Carries PrgDist\_Total Fld\_SCA\_Types   
## 0.157807324 -0.157678949 0.156705432   
## PrgR\_Progression PrgR\_Receiving Sh\_per\_90\_Standard   
## 0.156639127 0.156639127 0.154578137   
## Cmp\_percent\_Medium Att\_Take\_Ons SoT\_per\_90\_Standard   
## -0.153565450 0.153069803 0.152734106   
## Rec\_Receiving xAG\_Expected Cmp\_Short   
## -0.152499413 0.152224003 -0.151475309   
## TO\_SCA\_Types Att\_Short Att 3rd\_Touches   
## 0.151082959 -0.148563188 0.147723412   
## CPA\_Carries Final\_Third\_Carries PrgC\_Carries   
## 0.144616797 0.143957432 0.143737772   
## PrgC\_Progression Clr Carries\_Carries   
## 0.143737772 -0.143569108 -0.143521668   
## gca\_cols\_unadj Def Pen\_Touches npxG\_Expected   
## 0.141912615 -0.139066065 0.138468859   
## Cmp\_percent\_Short Won\_Aerial\_Duels KP   
## -0.137274899 -0.135673279 0.135519292   
## Sh\_Blocks Succ\_Take\_Ons misc\_cols\_unadj   
## -0.135286974 0.133526855 -0.130850990   
## PPA Int Final\_Third   
## 0.130616494 -0.127571960 -0.126233612   
## PassLive\_SCA\_Types Off SoT\_percent\_Standard   
## 0.123772956 0.112994697 0.104046592   
## Def 3rd\_Tackles Cmp\_Long CrsPA   
## -0.101436768 -0.093952869 0.091303880   
## Sh\_SCA\_Types defense\_cols\_unadj TklW\_Tackles   
## 0.086562375 -0.086461131 -0.086217661   
## Fld Att\_Long Crs\_Pass\_Types   
## 0.083001106 -0.082803047 0.080188347   
## Err possession\_cols\_unadj Tkl\_Challenges   
## -0.074294777 -0.072178129 -0.068885287   
## Att 3rd\_Tackles Mid 3rd\_Tackles TI\_Pass\_Types   
## 0.062172653 -0.059066631 -0.050681545   
## Recov npxG\_per\_Sh\_Expected CrdY   
## -0.047916709 0.042975372 -0.037742041   
## Att\_Challenges Fls Lost\_Aerial\_Duels   
## -0.037351223 -0.036992333 -0.024853131   
## PrgP PrgDist\_Carries Dist\_Standard   
## -0.022175993 0.021055001 0.016249589   
## Def\_SCA\_Types TB\_Pass\_Types Cmp\_percent\_Long   
## 0.014907919 0.009370596 -0.007808515   
## TotDist\_Carries Pass\_Blocks Sw\_Pass\_Types   
## 0.006244458 0.004276351 -0.004018848

cat("\nTop variables for PC2:\n")

##   
## Top variables for PC2:

sorted\_pc2

## Dist\_Standard PrgP Recov   
## -0.259670179 -0.253527133 -0.241302678   
## Pass\_Blocks Att\_Challenges Lost\_Aerial\_Duels   
## -0.231267708 -0.229841242 0.211750978   
## Sw\_Pass\_Types TB\_Pass\_Types Tkl\_Challenges   
## -0.198918346 -0.187337925 -0.184004677   
## PassLive\_SCA\_Types Mid 3rd\_Tackles TklW\_Tackles   
## -0.181372624 -0.175964402 -0.174046519   
## Final\_Third Cmp\_Long Won\_Aerial\_Duels   
## -0.169949047 -0.152462036 0.150699575   
## Off Def 3rd\_Tackles KP   
## 0.148136691 -0.147670640 -0.145942364   
## Crs\_Pass\_Types Def Pen\_Touches Fld   
## -0.144833493 0.135571612 -0.134607445   
## gca\_cols\_unadj Att\_Long PPA   
## -0.132464272 -0.131937168 -0.128180663   
## npxG\_per\_Sh\_Expected Clr Att 3rd\_Tackles   
## 0.127335359 0.126549324 -0.121873868   
## Att 3rd\_Touches Sh\_SCA\_Types Final\_Third\_Carries   
## -0.119836230 0.113715414 -0.112899374   
## defense\_cols\_unadj Err Int   
## 0.108964525 -0.096698013 -0.090474448   
## npxG\_Expected Def 3rd\_Touches CrsPA   
## 0.090036119 0.087614326 -0.087040793   
## Att\_Short TO\_SCA\_Types Sh\_Blocks   
## -0.076711195 0.076134858 0.074709857   
## TI\_Pass\_Types Mid 3rd\_Touches Att Pen\_Touches   
## -0.071516947 -0.070366552 0.069117806   
## Def\_SCA\_Types Cmp\_Short possession\_cols\_unadj   
## -0.068564936 -0.063225889 0.058668634   
## Mis\_Carries SoT\_per\_90\_Standard Succ\_Take\_Ons   
## 0.057748108 0.051280212 -0.042325245   
## xAG\_Expected Fld\_SCA\_Types TotDist\_Carries   
## -0.041635091 0.041574278 -0.037108433   
## Sh\_per\_90\_Standard CPA\_Carries PrgC\_Progression   
## 0.034603137 0.031840582 -0.031758850   
## PrgC\_Carries SoT\_percent\_Standard Fls   
## -0.031758850 0.031328077 -0.030044067   
## TotDist\_Total Att\_Take\_Ons Carries\_Carries   
## -0.029996756 -0.028604771 -0.028384480   
## Cmp\_percent\_Medium Cmp\_Medium misc\_cols\_unadj   
## 0.023027856 0.020460671 0.016723389   
## Cmp\_percent\_Long Rec\_Receiving PrgDist\_Carries   
## 0.016617207 -0.016252514 0.010230376   
## PrgDist\_Total Att\_Medium PrgR\_Receiving   
## 0.009447744 0.007757209 -0.007033693   
## PrgR\_Progression Cmp\_percent\_Short CrdY   
## -0.007033693 -0.002606785 -0.001192644

# Plot PCA with clusters  
ggplot(pca\_data, aes(x = PC1, y = PC2, color = cluster)) +  
 geom\_point(size = 3) +  
 scale\_x\_continuous(expand = expansion(mult = 0.1)) +  
 scale\_y\_continuous(expand = expansion(mult = 0.1)) +  
 theme\_minimal() +  
 labs(title = "PCA of Man. United Outfield Players, by Position", x = "PC1", y = "PC2") +   
 geom\_text(aes(label = label), vjust = -1, hjust = 0.5, color = "black", size = 2.5) # Add labels

