Association Rules & Lift Analysis - Medical Data using R

Loading selected packages into R.

library(tidyverse)

## Warning: package 'tidyverse' was built under R version 4.3.3

## Warning: package 'ggplot2' was built under R version 4.3.3

## Warning: package 'lubridate' was built under R version 4.3.3

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.2 ✔ readr 2.1.4  
## ✔ forcats 1.0.0 ✔ stringr 1.5.0  
## ✔ ggplot2 3.5.0 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.3 ✔ tidyr 1.3.0  
## ✔ purrr 1.0.1   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(dbplyr)

## Warning: package 'dbplyr' was built under R version 4.3.3

##   
## Attaching package: 'dbplyr'  
##   
## The following objects are masked from 'package:dplyr':  
##   
## ident, sql

library(datasets)  
library(tidyr)  
library(arules)

## Warning: package 'arules' was built under R version 4.3.3

## Loading required package: Matrix  
##   
## Attaching package: 'Matrix'  
##   
## The following objects are masked from 'package:tidyr':  
##   
## expand, pack, unpack  
##   
##   
## Attaching package: 'arules'  
##   
## The following object is masked from 'package:dplyr':  
##   
## recode  
##   
## The following objects are masked from 'package:base':  
##   
## abbreviate, write

library(arulesViz)

## Warning: package 'arulesViz' was built under R version 4.3.3

Importing our medical market basket data into R and saving it. We will also be listing all drugs available in data set.

market\_data <- read.csv("C:/Users/Tyler Bier/OneDrive/WGU - MSDA/D212- Data Mining II/Task 3-Market Basket Analysis/medical\_market\_basket.csv", header =TRUE, stringsAsFactors = FALSE)  
str(market\_data)

## 'data.frame': 15002 obs. of 20 variables:  
## $ Presc01: chr "" "amlodipine" "" "citalopram" ...  
## $ Presc02: chr "" "albuterol aerosol" "" "benicar" ...  
## $ Presc03: chr "" "allopurinol" "" "amphetamine salt combo xr" ...  
## $ Presc04: chr "" "pantoprazole" "" "" ...  
## $ Presc05: chr "" "lorazepam" "" "" ...  
## $ Presc06: chr "" "omeprazole" "" "" ...  
## $ Presc07: chr "" "mometasone" "" "" ...  
## $ Presc08: chr "" "fluconozole" "" "" ...  
## $ Presc09: chr "" "gabapentin" "" "" ...  
## $ Presc10: chr "" "pravastatin" "" "" ...  
## $ Presc11: chr "" "cialis" "" "" ...  
## $ Presc12: chr "" "losartan" "" "" ...  
## $ Presc13: chr "" "metoprolol succinate XL" "" "" ...  
## $ Presc14: chr "" "sulfamethoxazole" "" "" ...  
## $ Presc15: chr "" "abilify" "" "" ...  
## $ Presc16: chr "" "spironolactone" "" "" ...  
## $ Presc17: chr "" "albuterol HFA" "" "" ...  
## $ Presc18: chr "" "levofloxacin" "" "" ...  
## $ Presc19: chr "" "promethazine" "" "" ...  
## $ Presc20: chr "" "glipizide" "" "" ...

all\_values <- unlist(market\_data)  
drug\_count <- table(all\_values)  
print(drug\_count)

## all\_values  
## abilify   
## 270677 1788   
## acetaminophen actonel   
## 118 90   
## albuterol aerosol albuterol HFA   
## 153 67   
## alendronate allopurinol   
## 36 250   
## alprazolam amitriptyline   
## 595 34   
## amlodipine amoxicillin   
## 536 65   
## amphetamine amphetamine salt combo   
## 226 513   
## amphetamine salt combo xr atenolol   
## 1348 81   
## atorvastatin azithromycin   
## 972 107   
## benazepril benicar   
## 69 157   
## boniva bupropion sr   
## 46 31   
## carisoprodol carvedilol   
## 86 1306   
## cefdinir celebrex   
## 14 82   
## celecoxib cephalexin   
## 253 65   
## cialis ciprofloxacin   
## 574 44   
## citalopram clavulanate K+   
## 654 73   
## clonazepam clonidine HCI   
## 36 193   
## clopidogrel clotrimazole   
## 450 204   
## codeine crestor   
## 115 33   
## cyclobenzaprine cymbalta   
## 46 71   
## dextroamphetamine XR diazepam   
## 608 1230   
## diclofenac sodium doxycycline hyclate   
## 205 713   
## Duloxetine enalapril   
## 90 31   
## escitalopram esomeprazole   
## 79 63   
## ezetimibe fenofibrate   
## 603 383   
## fexofenadine finasteride   
## 36 5   
## flovent hfa 110mcg inhaler fluconozole   
## 29 239   
## fluoxetine HCI fluticasone   
## 7 33   
## fluticasone nasal spray folic acid   
## 99 203   
## furosemide gabapentin   
## 393 200   
## glimepiride glipizide   
## 68 494   
## glyburide hydrochlorothiazide   
## 1282 221   
## hydrocodone hydrocortisone 2.5% cream   
## 143 3   
## ibuprophen isosorbide mononitrate   
## 169 167   
## lansoprazole lantus   
## 102 323   
## levofloxacin levothyroxine sodium   
## 475 52   
## lisinopril lorazepam   
## 737 68   
## losartan lovastatin   
## 991 101   
## meloxicam metformin   
## 203 379   
## metformin HCI methylprednisone   
## 39 371   
## metoprolol metoprolol succinate XL   
## 715 356   
## metoprolol tartrate mometasone   
## 243 86   
## naproxen omeprazole   
## 439 70   
## oxycodone pantoprazole   
## 124 193   
## paroxetine pioglitazone   
## 469 61   
## potassium Chloride pravastatin   
## 106 228   
## prednisone pregabalin   
## 58 160   
## Premarin promethazine   
## 351 53   
## quetiapine ranitidine   
## 47 47   
## rosuvastatin salmeterol inhaler   
## 37 117   
## sertraline HCI simvastatin   
## 58 69   
## spironolactone sulfamethoxazole   
## 319 37   
## synthroid tamsulosin   
## 65 211   
## temezepam topiramate   
## 139 45   
## tramadol trazodone HCI   
## 49 149   
## triamcinolone Ace topical triamterene   
## 199 173   
## trimethoprim DS valaciclovir   
## 141 33   
## valsartan venlafaxine XR   
## 78 181   
## verapamil SR viagra   
## 42 34   
## Yaz zolpidem   
## 32 131

We will now begin some of the initial data cleaning steps. First, we will be removing blank rows. Then converting

cleaned\_data <- market\_data[!apply(market\_data =="",1, all), ]  
head(cleaned\_data)

## Presc01 Presc02 Presc03 Presc04  
## 2 amlodipine albuterol aerosol allopurinol pantoprazole  
## 4 citalopram benicar amphetamine salt combo xr   
## 6 enalapril   
## 8 paroxetine allopurinol   
## 10 abilify atorvastatin folic acid naproxen  
## 12 cialis   
## Presc05 Presc06 Presc07 Presc08 Presc09 Presc10 Presc11  
## 2 lorazepam omeprazole mometasone fluconozole gabapentin pravastatin cialis  
## 4   
## 6   
## 8   
## 10 losartan   
## 12   
## Presc12 Presc13 Presc14 Presc15 Presc16  
## 2 losartan metoprolol succinate XL sulfamethoxazole abilify spironolactone  
## 4   
## 6   
## 8   
## 10   
## 12   
## Presc17 Presc18 Presc19 Presc20  
## 2 albuterol HFA levofloxacin promethazine glipizide  
## 4   
## 6   
## 8   
## 10   
## 12

cleaned\_data$Id <- factor(seq.int(nrow(cleaned\_data)))  
cleaned\_data <- as.data.frame(unclass(cleaned\_data), stringsAsFactors = TRUE)  
cleaned\_data <- pivot\_longer(cleaned\_data, cols = 1:20, names\_to = "PresciptionCount", values\_to = "Medication")  
cleaned\_data <- cleaned\_data[,c(1,3)]  
cleaned\_data <- cleaned\_data[!(cleaned\_data$Medication==""), ]  
cleaned\_data <- as.data.frame(cleaned\_data)  
cleaned\_data2 <- split(cleaned\_data$Medication, cleaned\_data$Id)  
str(cleaned\_data)

## 'data.frame': 29363 obs. of 2 variables:  
## $ Id : Factor w/ 7501 levels "1","2","3","4",..: 1 1 1 1 1 1 1 1 1 1 ...  
## $ Medication: Factor w/ 120 levels "abilify","acetaminophen",..: 10 4 7 83 69 81 79 50 56 87 ...

dim(cleaned\_data)

## [1] 29363 2

market\_list <- as(cleaned\_data2, "transactions")

## Warning in asMethod(object): removing duplicated items in transactions

market\_data <- as(market\_list, "matrix")

Starting market basket analysis.

rules <- apriori(market\_data, control = list(verbose= FALSE), parameter = list(support=0.006, target = "rules", confidence = 0.4, minlen=2, maxlen=5))  
inspect(rules)

## lhs rhs   
## [1] {potassium Chloride} => {carvedilol}   
## [2] {salmeterol inhaler} => {abilify}   
## [3] {temezepam} => {abilify}   
## [4] {trimethoprim DS} => {abilify}   
## [5] {spironolactone} => {abilify}   
## [6] {metformin} => {abilify}   
## [7] {glipizide} => {abilify}   
## [8] {lisinopril} => {abilify}   
## [9] {carvedilol, spironolactone} => {abilify}   
## [10] {lisinopril, methylprednisone} => {carvedilol}   
## [11] {lisinopril, methylprednisone} => {abilify}   
## [12] {atorvastatin, metformin} => {abilify}   
## [13] {carvedilol, metformin} => {abilify}   
## [14] {amphetamine salt combo xr, fenofibrate} => {abilify}   
## [15] {carvedilol, fenofibrate} => {abilify}   
## [16] {carvedilol, naproxen} => {abilify}   
## [17] {atorvastatin, paroxetine} => {abilify}   
## [18] {atorvastatin, clopidogrel} => {abilify}   
## [19] {clopidogrel, diazepam} => {abilify}   
## [20] {carvedilol, clopidogrel} => {abilify}   
## [21] {atorvastatin, levofloxacin} => {abilify}   
## [22] {carvedilol, levofloxacin} => {abilify}   
## [23] {amphetamine salt combo, metoprolol} => {carvedilol}   
## [24] {amphetamine salt combo, atorvastatin} => {abilify}   
## [25] {amphetamine salt combo, carvedilol} => {abilify}   
## [26] {glipizide, metoprolol} => {abilify}   
## [27] {glipizide, lisinopril} => {carvedilol}   
## [28] {glipizide, lisinopril} => {abilify}   
## [29] {atorvastatin, glipizide} => {carvedilol}   
## [30] {atorvastatin, glipizide} => {abilify}   
## [31] {diazepam, glipizide} => {carvedilol}   
## [32] {diazepam, glipizide} => {abilify}   
## [33] {carvedilol, glipizide} => {abilify}   
## [34] {amlodipine, metoprolol} => {abilify}   
## [35] {amlodipine, atorvastatin} => {abilify}   
## [36] {amlodipine, diazepam} => {abilify}   
## [37] {amlodipine, carvedilol} => {abilify}   
## [38] {atorvastatin, dextroamphetamine XR} => {abilify}   
## [39] {citalopram, glyburide} => {amphetamine salt combo xr}  
## [40] {doxycycline hyclate, metoprolol} => {abilify}   
## [41] {doxycycline hyclate, lisinopril} => {carvedilol}   
## [42] {doxycycline hyclate, lisinopril} => {abilify}   
## [43] {atorvastatin, doxycycline hyclate} => {abilify}   
## [44] {diazepam, doxycycline hyclate} => {abilify}   
## [45] {carvedilol, doxycycline hyclate} => {abilify}   
## [46] {lisinopril, metoprolol} => {carvedilol}   
## [47] {lisinopril, metoprolol} => {abilify}   
## [48] {atorvastatin, metoprolol} => {abilify}   
## [49] {diazepam, metoprolol} => {abilify}   
## [50] {amphetamine salt combo xr, metoprolol} => {abilify}   
## [51] {carvedilol, metoprolol} => {abilify}   
## [52] {lisinopril, losartan} => {carvedilol}   
## [53] {atorvastatin, lisinopril} => {carvedilol}   
## [54] {atorvastatin, lisinopril} => {abilify}   
## [55] {diazepam, lisinopril} => {abilify}   
## [56] {amphetamine salt combo xr, lisinopril} => {carvedilol}   
## [57] {amphetamine salt combo xr, lisinopril} => {abilify}   
## [58] {carvedilol, lisinopril} => {abilify}   
## [59] {abilify, lisinopril} => {carvedilol}   
## [60] {atorvastatin, diazepam} => {abilify}   
## [61] {amphetamine salt combo xr, atorvastatin} => {abilify}   
## [62] {atorvastatin, carvedilol} => {abilify}   
## [63] {amphetamine salt combo xr, diazepam} => {abilify}   
## [64] {carvedilol, diazepam} => {abilify}   
## support confidence coverage lift count  
## [1] 0.006265831 0.4433962 0.01413145 2.546642 47   
## [2] 0.007332356 0.4700855 0.01559792 1.972098 55   
## [3] 0.007732302 0.4172662 0.01853086 1.750511 58   
## [4] 0.007732302 0.4113475 0.01879749 1.725681 58   
## [5] 0.017064391 0.4012539 0.04252766 1.683336 128   
## [6] 0.023063592 0.4564644 0.05052660 1.914955 173   
## [7] 0.027596320 0.4190283 0.06585789 1.757904 207   
## [8] 0.040927876 0.4165536 0.09825357 1.747522 307   
## [9] 0.006799093 0.5049505 0.01346487 2.118363 51   
## [10] 0.006399147 0.4000000 0.01599787 2.297397 48   
## [11] 0.006665778 0.4166667 0.01599787 1.747996 50   
## [12] 0.008532196 0.5614035 0.01519797 2.355194 64   
## [13] 0.007465671 0.5233645 0.01426476 2.195614 56   
## [14] 0.006399147 0.5454545 0.01173177 2.288286 48   
## [15] 0.007598987 0.4789916 0.01586455 2.009461 57   
## [16] 0.006265831 0.4433962 0.01413145 1.860131 47   
## [17] 0.006132516 0.5411765 0.01133182 2.270338 46   
## [18] 0.006665778 0.4504505 0.01479803 1.889725 50   
## [19] 0.007598987 0.5181818 0.01466471 2.173871 57   
## [20] 0.006932409 0.4031008 0.01719771 1.691084 52   
## [21] 0.006132516 0.4299065 0.01426476 1.803540 46   
## [22] 0.006799093 0.4358974 0.01559792 1.828673 51   
## [23] 0.006665778 0.4132231 0.01613118 2.373344 50   
## [24] 0.006532462 0.4666667 0.01399813 1.957755 49   
## [25] 0.009332089 0.4458599 0.02093054 1.870467 70   
## [26] 0.006532462 0.5764706 0.01133182 2.418404 49   
## [27] 0.006132516 0.4339623 0.01413145 2.492459 46   
## [28] 0.006665778 0.4716981 0.01413145 1.978863 50   
## [29] 0.007199040 0.4218750 0.01706439 2.423036 54   
## [30] 0.008532196 0.5000000 0.01706439 2.097595 64   
## [31] 0.007065725 0.4308943 0.01639781 2.474838 53   
## [32] 0.008265565 0.5040650 0.01639781 2.114649 62   
## [33] 0.010265298 0.4476744 0.02293028 1.878079 77   
## [34] 0.007199040 0.4320000 0.01666444 1.812322 54   
## [35] 0.007865618 0.4469697 0.01759765 1.875123 59   
## [36] 0.007598987 0.4222222 0.01799760 1.771303 57   
## [37] 0.008532196 0.4025157 0.02119717 1.688630 64   
## [38] 0.006399147 0.4800000 0.01333156 2.013691 48   
## [39] 0.009065458 0.4121212 0.02199707 2.293265 68   
## [40] 0.006132516 0.4554455 0.01346487 1.910681 46   
## [41] 0.006399147 0.4403670 0.01453140 2.529244 48   
## [42] 0.007465671 0.5137615 0.01453140 2.155327 56   
## [43] 0.007865618 0.4758065 0.01653113 1.996099 59   
## [44] 0.009332089 0.4697987 0.01986402 1.970895 70   
## [45] 0.011465138 0.4550265 0.02519664 1.908923 86   
## [46] 0.008665511 0.5118110 0.01693108 2.939582 65   
## [47] 0.009198773 0.5433071 0.01693108 2.279277 69   
## [48] 0.011065191 0.4689266 0.02359685 1.967236 83   
## [49] 0.009732036 0.4244186 0.02293028 1.780517 73   
## [50] 0.009065458 0.4171779 0.02173044 1.750141 68   
## [51] 0.011998400 0.4306220 0.02786295 1.806541 90   
## [52] 0.006399147 0.4324324 0.01479803 2.483672 48   
## [53] 0.009732036 0.4424242 0.02199707 2.541060 73   
## [54] 0.011065191 0.5030303 0.02199707 2.110308 83   
## [55] 0.010931876 0.4739884 0.02306359 1.988472 82   
## [56] 0.008932142 0.4466667 0.01999733 2.565426 67   
## [57] 0.010131982 0.5066667 0.01999733 2.125563 76   
## [58] 0.017064391 0.4353741 0.03919477 1.826477 128   
## [59] 0.017064391 0.4169381 0.04092788 2.394681 128   
## [60] 0.013998134 0.4356846 0.03212905 1.827780 105   
## [61] 0.013064925 0.4242424 0.03079589 1.779778 98   
## [62] 0.015731236 0.4436090 0.03546194 1.861024 118   
## [63] 0.013464871 0.4056225 0.03319557 1.701663 101   
## [64] 0.015864551 0.4047619 0.03919477 1.698053 119

summary(rules)

## set of 64 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 2 3   
## 8 56   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 2.000 3.000 3.000 2.875 3.000 3.000   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.006133 Min. :0.4000 Min. :0.01133 Min. :1.683   
## 1st Qu.:0.006666 1st Qu.:0.4221 1st Qu.:0.01476 1st Qu.:1.811   
## Median :0.007866 Median :0.4435 Median :0.01706 Median :1.971   
## Mean :0.009934 Mean :0.4559 Mean :0.02226 Mean :2.048   
## 3rd Qu.:0.010432 3rd Qu.:0.4766 3rd Qu.:0.02293 3rd Qu.:2.282   
## Max. :0.040928 Max. :0.5765 Max. :0.09825 Max. :2.940   
## count   
## Min. : 46.00   
## 1st Qu.: 50.00   
## Median : 59.00   
## Mean : 74.52   
## 3rd Qu.: 78.25   
## Max. :307.00   
##   
## mining info:  
## data ntransactions support confidence  
## market\_data 7501 0.006 0.4  
## call  
## apriori(data = market\_data, parameter = list(support = 0.006, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

We will begin targeting the drug used in our research question: Amphetamine and it’s associated forms.

amphetamines <- c("amphetamine", "amphetamine salt combo", "amphetamine salt combo xr")  
rules\_amphetamine <- subset(rules, items %in% amphetamines)  
inspect(rules\_amphetamine)

## lhs rhs   
## [1] {amphetamine salt combo xr, fenofibrate} => {abilify}   
## [2] {amphetamine salt combo, metoprolol} => {carvedilol}   
## [3] {amphetamine salt combo, atorvastatin} => {abilify}   
## [4] {amphetamine salt combo, carvedilol} => {abilify}   
## [5] {citalopram, glyburide} => {amphetamine salt combo xr}  
## [6] {amphetamine salt combo xr, metoprolol} => {abilify}   
## [7] {amphetamine salt combo xr, lisinopril} => {carvedilol}   
## [8] {amphetamine salt combo xr, lisinopril} => {abilify}   
## [9] {amphetamine salt combo xr, atorvastatin} => {abilify}   
## [10] {amphetamine salt combo xr, diazepam} => {abilify}   
## support confidence coverage lift count  
## [1] 0.006399147 0.5454545 0.01173177 2.288286 48   
## [2] 0.006665778 0.4132231 0.01613118 2.373344 50   
## [3] 0.006532462 0.4666667 0.01399813 1.957755 49   
## [4] 0.009332089 0.4458599 0.02093054 1.870467 70   
## [5] 0.009065458 0.4121212 0.02199707 2.293265 68   
## [6] 0.009065458 0.4171779 0.02173044 1.750141 68   
## [7] 0.008932142 0.4466667 0.01999733 2.565426 67   
## [8] 0.010131982 0.5066667 0.01999733 2.125563 76   
## [9] 0.013064925 0.4242424 0.03079589 1.779778 98   
## [10] 0.013464871 0.4056225 0.03319557 1.701663 101

summary(rules\_amphetamine)

## set of 10 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 3   
## 10   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 3 3 3 3 3 3   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.006399 Min. :0.4056 Min. :0.01173 Min. :1.702   
## 1st Qu.:0.007232 1st Qu.:0.4142 1st Qu.:0.01710 1st Qu.:1.802   
## Median :0.009065 Median :0.4351 Median :0.02046 Median :2.042   
## Mean :0.009265 Mean :0.4484 Mean :0.02105 Mean :2.071   
## 3rd Qu.:0.009932 3rd Qu.:0.4617 3rd Qu.:0.02193 3rd Qu.:2.292   
## Max. :0.013465 Max. :0.5455 Max. :0.03320 Max. :2.565   
## count   
## Min. : 48.00   
## 1st Qu.: 54.25   
## Median : 68.00   
## Mean : 69.50   
## 3rd Qu.: 74.50   
## Max. :101.00   
##   
## mining info:  
## data ntransactions support confidence  
## market\_data 7501 0.006 0.4  
## call  
## apriori(data = market\_data, parameter = list(support = 0.006, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

inspect(head(rules\_amphetamine, by="confidence", n=20 ))

## lhs rhs   
## [1] {amphetamine salt combo xr, fenofibrate} => {abilify}   
## [2] {amphetamine salt combo xr, lisinopril} => {abilify}   
## [3] {amphetamine salt combo, atorvastatin} => {abilify}   
## [4] {amphetamine salt combo xr, lisinopril} => {carvedilol}   
## [5] {amphetamine salt combo, carvedilol} => {abilify}   
## [6] {amphetamine salt combo xr, atorvastatin} => {abilify}   
## [7] {amphetamine salt combo xr, metoprolol} => {abilify}   
## [8] {amphetamine salt combo, metoprolol} => {carvedilol}   
## [9] {citalopram, glyburide} => {amphetamine salt combo xr}  
## [10] {amphetamine salt combo xr, diazepam} => {abilify}   
## support confidence coverage lift count  
## [1] 0.006399147 0.5454545 0.01173177 2.288286 48   
## [2] 0.010131982 0.5066667 0.01999733 2.125563 76   
## [3] 0.006532462 0.4666667 0.01399813 1.957755 49   
## [4] 0.008932142 0.4466667 0.01999733 2.565426 67   
## [5] 0.009332089 0.4458599 0.02093054 1.870467 70   
## [6] 0.013064925 0.4242424 0.03079589 1.779778 98   
## [7] 0.009065458 0.4171779 0.02173044 1.750141 68   
## [8] 0.006665778 0.4132231 0.01613118 2.373344 50   
## [9] 0.009065458 0.4121212 0.02199707 2.293265 68   
## [10] 0.013464871 0.4056225 0.03319557 1.701663 101

Now that we have practiced one model. We will combine all amphetamine variants into a single medication, then run market basket analysis on that for comparision to earlier model.

amphetamines\_analysis <- cleaned\_data  
amphetamines\_analysis$Medication <- as.character(amphetamines\_analysis$Medication)  
amphetamines\_analysis[amphetamines\_analysis == "amphetamine" | amphetamines\_analysis == "amphetamine salt combo" | amphetamines\_analysis == "amphetamine salt combo xr"] <- "amphetamines"  
table(amphetamines\_analysis$Medication)

##   
## abilify acetaminophen   
## 1788 118   
## actonel albuterol aerosol   
## 90 153   
## albuterol HFA alendronate   
## 67 36   
## allopurinol alprazolam   
## 250 595   
## amitriptyline amlodipine   
## 34 536   
## amoxicillin amphetamines   
## 65 2087   
## atenolol atorvastatin   
## 81 972   
## azithromycin benazepril   
## 107 69   
## benicar boniva   
## 157 46   
## bupropion sr carisoprodol   
## 31 86   
## carvedilol cefdinir   
## 1306 14   
## celebrex celecoxib   
## 82 253   
## cephalexin cialis   
## 65 574   
## ciprofloxacin citalopram   
## 44 654   
## clavulanate K+ clonazepam   
## 73 36   
## clonidine HCI clopidogrel   
## 193 450   
## clotrimazole codeine   
## 204 115   
## crestor cyclobenzaprine   
## 33 46   
## cymbalta dextroamphetamine XR   
## 71 608   
## diazepam diclofenac sodium   
## 1230 205   
## doxycycline hyclate Duloxetine   
## 713 90   
## enalapril escitalopram   
## 31 79   
## esomeprazole ezetimibe   
## 63 603   
## fenofibrate fexofenadine   
## 383 36   
## finasteride flovent hfa 110mcg inhaler   
## 5 29   
## fluconozole fluoxetine HCI   
## 239 7   
## fluticasone fluticasone nasal spray   
## 33 99   
## folic acid furosemide   
## 203 393   
## gabapentin glimepiride   
## 200 68   
## glipizide glyburide   
## 494 1282   
## hydrochlorothiazide hydrocodone   
## 221 143   
## hydrocortisone 2.5% cream ibuprophen   
## 3 169   
## isosorbide mononitrate lansoprazole   
## 167 102   
## lantus levofloxacin   
## 323 475   
## levothyroxine sodium lisinopril   
## 52 737   
## lorazepam losartan   
## 68 991   
## lovastatin meloxicam   
## 101 203   
## metformin metformin HCI   
## 379 39   
## methylprednisone metoprolol   
## 371 715   
## metoprolol succinate XL metoprolol tartrate   
## 356 243   
## mometasone naproxen   
## 86 439   
## omeprazole oxycodone   
## 70 124   
## pantoprazole paroxetine   
## 193 469   
## pioglitazone potassium Chloride   
## 61 106   
## pravastatin prednisone   
## 228 58   
## pregabalin Premarin   
## 160 351   
## promethazine quetiapine   
## 53 47   
## ranitidine rosuvastatin   
## 47 37   
## salmeterol inhaler sertraline HCI   
## 117 58   
## simvastatin spironolactone   
## 69 319   
## sulfamethoxazole synthroid   
## 37 65   
## tamsulosin temezepam   
## 211 139   
## topiramate tramadol   
## 45 49   
## trazodone HCI triamcinolone Ace topical   
## 149 199   
## triamterene trimethoprim DS   
## 173 141   
## valaciclovir valsartan   
## 33 78   
## venlafaxine XR verapamil SR   
## 181 42   
## viagra Yaz   
## 34 32   
## zolpidem   
## 131

amphetamines\_analysis$Medication <- as.factor(amphetamines\_analysis$Medication)  
analysis\_basket <- split(amphetamines\_analysis$Medication, amphetamines\_analysis$Id)  
analysis\_basket <- as(analysis\_basket, "transactions")

## Warning in asMethod(object): removing duplicated items in transactions

analysis\_basket <- as(analysis\_basket, "matrix")

#Now obtaining association rules for combined amphetamines variables.

amphetamine\_results <- apriori(analysis\_basket, control = list(verbose= FALSE), parameter = list(support=0.01, target = "rules", confidence = 0.4, minlen=2, maxlen=5))  
inspect(amphetamine\_results)

## lhs rhs support confidence  
## [1] {spironolactone} => {abilify} 0.01706439 0.4012539   
## [2] {metformin} => {abilify} 0.02306359 0.4564644   
## [3] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [4] {glipizide} => {abilify} 0.02759632 0.4190283   
## [5] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [6] {lisinopril} => {abilify} 0.04092788 0.4165536   
## [7] {carvedilol, glipizide} => {abilify} 0.01026530 0.4476744   
## [8] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [9] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [10] {carvedilol, doxycycline hyclate} => {abilify} 0.01146514 0.4550265   
## [11] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [12] {atorvastatin, metoprolol} => {abilify} 0.01106519 0.4689266   
## [13] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [14] {carvedilol, metoprolol} => {abilify} 0.01199840 0.4306220   
## [15] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [16] {atorvastatin, lisinopril} => {abilify} 0.01106519 0.5030303   
## [17] {diazepam, lisinopril} => {abilify} 0.01093188 0.4739884   
## [18] {carvedilol, lisinopril} => {abilify} 0.01706439 0.4353741   
## [19] {abilify, lisinopril} => {carvedilol} 0.01706439 0.4169381   
## [20] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [21] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [22] {atorvastatin, diazepam} => {abilify} 0.01399813 0.4356846   
## [23] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [24] {atorvastatin, carvedilol} => {abilify} 0.01573124 0.4436090   
## [25] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [26] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [27] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [28] {carvedilol, diazepam} => {abilify} 0.01586455 0.4047619   
## [29] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## coverage lift count  
## [1] 0.04252766 1.683336 128   
## [2] 0.05052660 1.914955 173   
## [3] 0.06252500 1.657368 200   
## [4] 0.06585789 1.757904 207   
## [5] 0.08718837 1.663957 280   
## [6] 0.09825357 1.747522 307   
## [7] 0.02293028 1.878079 77   
## [8] 0.02199707 1.955042 83   
## [9] 0.02439675 1.699029 80   
## [10] 0.02519664 1.908923 86   
## [11] 0.02519664 1.562837 76   
## [12] 0.02359685 1.967236 83   
## [13] 0.02359685 1.888370 86   
## [14] 0.02786295 1.806541 90   
## [15] 0.02786295 1.710816 92   
## [16] 0.02199707 2.110308 83   
## [17] 0.02306359 1.988472 82   
## [18] 0.03919477 1.826477 128   
## [19] 0.04092788 2.394681 128   
## [20] 0.03172910 2.630423 109   
## [21] 0.03172910 1.974207 112   
## [22] 0.03212905 1.827780 105   
## [23] 0.03212905 1.580414 98   
## [24] 0.03546194 1.861024 118   
## [25] 0.03546194 1.592600 109   
## [26] 0.04519397 1.683026 136   
## [27] 0.02759632 1.614693 86   
## [28] 0.03919477 1.698053 119   
## [29] 0.03919477 1.559899 118

summary(amphetamine\_results)

## set of 29 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 2 3   
## 6 23   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 2.000 3.000 3.000 2.793 3.000 3.000   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.01013 Min. :0.4012 Min. :0.02200 Min. :1.560   
## 1st Qu.:0.01147 1st Qu.:0.4155 1st Qu.:0.02520 1st Qu.:1.683   
## Median :0.01453 Median :0.4354 Median :0.03213 Median :1.807   
## Mean :0.01645 Mean :0.4378 Mean :0.03809 Mean :1.833   
## 3rd Qu.:0.01706 3rd Qu.:0.4565 3rd Qu.:0.04093 3rd Qu.:1.915   
## Max. :0.04093 Max. :0.5030 Max. :0.09825 Max. :2.630   
## count   
## Min. : 76.0   
## 1st Qu.: 86.0   
## Median :109.0   
## Mean :123.4   
## 3rd Qu.:128.0   
## Max. :307.0   
##   
## mining info:  
## data ntransactions support confidence  
## analysis\_basket 7501 0.01 0.4  
## call  
## apriori(data = analysis\_basket, parameter = list(support = 0.01, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

top\_rules <- sort(amphetamine\_results, by = c("lift", "confidence"), decreasing = TRUE)  
inspect(top\_rules)

## lhs rhs support confidence  
## [1] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [2] {abilify, lisinopril} => {carvedilol} 0.01706439 0.4169381   
## [3] {atorvastatin, lisinopril} => {abilify} 0.01106519 0.5030303   
## [4] {diazepam, lisinopril} => {abilify} 0.01093188 0.4739884   
## [5] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [6] {atorvastatin, metoprolol} => {abilify} 0.01106519 0.4689266   
## [7] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [8] {metformin} => {abilify} 0.02306359 0.4564644   
## [9] {carvedilol, doxycycline hyclate} => {abilify} 0.01146514 0.4550265   
## [10] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [11] {carvedilol, glipizide} => {abilify} 0.01026530 0.4476744   
## [12] {atorvastatin, carvedilol} => {abilify} 0.01573124 0.4436090   
## [13] {atorvastatin, diazepam} => {abilify} 0.01399813 0.4356846   
## [14] {carvedilol, lisinopril} => {abilify} 0.01706439 0.4353741   
## [15] {carvedilol, metoprolol} => {abilify} 0.01199840 0.4306220   
## [16] {glipizide} => {abilify} 0.02759632 0.4190283   
## [17] {lisinopril} => {abilify} 0.04092788 0.4165536   
## [18] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [19] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [20] {carvedilol, diazepam} => {abilify} 0.01586455 0.4047619   
## [21] {spironolactone} => {abilify} 0.01706439 0.4012539   
## [22] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [23] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [24] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [25] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [26] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [27] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [28] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [29] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## coverage lift count  
## [1] 0.03172910 2.630423 109   
## [2] 0.04092788 2.394681 128   
## [3] 0.02199707 2.110308 83   
## [4] 0.02306359 1.988472 82   
## [5] 0.03172910 1.974207 112   
## [6] 0.02359685 1.967236 83   
## [7] 0.02199707 1.955042 83   
## [8] 0.05052660 1.914955 173   
## [9] 0.02519664 1.908923 86   
## [10] 0.02359685 1.888370 86   
## [11] 0.02293028 1.878079 77   
## [12] 0.03546194 1.861024 118   
## [13] 0.03212905 1.827780 105   
## [14] 0.03919477 1.826477 128   
## [15] 0.02786295 1.806541 90   
## [16] 0.06585789 1.757904 207   
## [17] 0.09825357 1.747522 307   
## [18] 0.02786295 1.710816 92   
## [19] 0.02439675 1.699029 80   
## [20] 0.03919477 1.698053 119   
## [21] 0.04252766 1.683336 128   
## [22] 0.04519397 1.683026 136   
## [23] 0.08718837 1.663957 280   
## [24] 0.06252500 1.657368 200   
## [25] 0.02759632 1.614693 86   
## [26] 0.03546194 1.592600 109   
## [27] 0.03212905 1.580414 98   
## [28] 0.02519664 1.562837 76   
## [29] 0.03919477 1.559899 118

#Isolating amphetamines data point from market basket analysis.

final\_results <- subset(amphetamine\_results, items %in% "amphetamines")  
inspect(final\_results)

## lhs rhs support confidence  
## [1] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [2] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [3] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [4] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [5] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [6] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [7] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [8] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [9] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [10] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [11] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [12] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [13] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [14] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## coverage lift count  
## [1] 0.06252500 1.657368 200   
## [2] 0.08718837 1.663957 280   
## [3] 0.02199707 1.955042 83   
## [4] 0.02439675 1.699029 80   
## [5] 0.02519664 1.562837 76   
## [6] 0.02359685 1.888370 86   
## [7] 0.02786295 1.710816 92   
## [8] 0.03172910 2.630423 109   
## [9] 0.03172910 1.974207 112   
## [10] 0.03212905 1.580414 98   
## [11] 0.03546194 1.592600 109   
## [12] 0.04519397 1.683026 136   
## [13] 0.02759632 1.614693 86   
## [14] 0.03919477 1.559899 118

summary(final\_results)

## set of 14 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 2 3   
## 2 12   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 2.000 3.000 3.000 2.857 3.000 3.000   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.01013 Min. :0.4012 Min. :0.02200 Min. :1.560   
## 1st Qu.:0.01147 1st Qu.:0.4074 1st Qu.:0.02580 1st Qu.:1.598   
## Median :0.01380 Median :0.4273 Median :0.03173 Median :1.673   
## Mean :0.01586 Mean :0.4347 Mean :0.03684 Mean :1.769   
## 3rd Qu.:0.01553 3rd Qu.:0.4535 3rd Qu.:0.03826 3rd Qu.:1.844   
## Max. :0.03733 Max. :0.5030 Max. :0.08719 Max. :2.630   
## count   
## Min. : 76.0   
## 1st Qu.: 86.0   
## Median :103.5   
## Mean :118.9   
## 3rd Qu.:116.5   
## Max. :280.0   
##   
## mining info:  
## data ntransactions support confidence  
## analysis\_basket 7501 0.01 0.4  
## call  
## apriori(data = analysis\_basket, parameter = list(support = 0.01, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

Inspecting amphetamine associations by confidence

inspect(head(final\_results, by="confidence", n=20 ))

## lhs rhs support confidence  
## [1] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [2] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [3] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [4] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [5] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [6] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [7] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [8] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [9] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [10] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [11] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [12] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [13] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## [14] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## coverage lift count  
## [1] 0.02199707 1.955042 83   
## [2] 0.02359685 1.888370 86   
## [3] 0.03172910 1.974207 112   
## [4] 0.03172910 2.630423 109   
## [5] 0.02786295 1.710816 92   
## [6] 0.02439675 1.699029 80   
## [7] 0.08718837 1.663957 280   
## [8] 0.06252500 1.657368 200   
## [9] 0.02759632 1.614693 86   
## [10] 0.03546194 1.592600 109   
## [11] 0.03212905 1.580414 98   
## [12] 0.02519664 1.562837 76   
## [13] 0.03919477 1.559899 118   
## [14] 0.04519397 1.683026 136

inspect(head(final\_results, by="lift", n=20 ))

## lhs rhs support confidence  
## [1] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [2] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [3] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [4] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [5] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [6] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [7] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [8] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [9] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [10] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [11] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [12] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [13] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [14] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## coverage lift count  
## [1] 0.03172910 2.630423 109   
## [2] 0.03172910 1.974207 112   
## [3] 0.02199707 1.955042 83   
## [4] 0.02359685 1.888370 86   
## [5] 0.02786295 1.710816 92   
## [6] 0.02439675 1.699029 80   
## [7] 0.04519397 1.683026 136   
## [8] 0.08718837 1.663957 280   
## [9] 0.06252500 1.657368 200   
## [10] 0.02759632 1.614693 86   
## [11] 0.03546194 1.592600 109   
## [12] 0.03212905 1.580414 98   
## [13] 0.02519664 1.562837 76   
## [14] 0.03919477 1.559899 118

Inspecting amphetamine associations by confidence and lift

top\_amphetamines <- sort(final\_results, by = c("lift", "confidence"), decreasing = TRUE)  
inspect(top\_amphetamines)

## lhs rhs support confidence  
## [1] {amphetamines, lisinopril} => {carvedilol} 0.01453140 0.4579832   
## [2] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [3] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [4] {atorvastatin, metoprolol} => {amphetamines} 0.01146514 0.4858757   
## [5] {carvedilol, metoprolol} => {amphetamines} 0.01226503 0.4401914   
## [6] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [7] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [8] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [9] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## [10] {carvedilol, glyburide} => {amphetamines} 0.01146514 0.4154589   
## [11] {atorvastatin, carvedilol} => {amphetamines} 0.01453140 0.4097744   
## [12] {atorvastatin, diazepam} => {amphetamines} 0.01306492 0.4066390   
## [13] {carvedilol, doxycycline hyclate} => {amphetamines} 0.01013198 0.4021164   
## [14] {carvedilol, diazepam} => {amphetamines} 0.01573124 0.4013605   
## coverage lift count  
## [1] 0.03172910 2.630423 109   
## [2] 0.03172910 1.974207 112   
## [3] 0.02199707 1.955042 83   
## [4] 0.02359685 1.888370 86   
## [5] 0.02786295 1.710816 92   
## [6] 0.02439675 1.699029 80   
## [7] 0.04519397 1.683026 136   
## [8] 0.08718837 1.663957 280   
## [9] 0.06252500 1.657368 200   
## [10] 0.02759632 1.614693 86   
## [11] 0.03546194 1.592600 109   
## [12] 0.03212905 1.580414 98   
## [13] 0.02519664 1.562837 76   
## [14] 0.03919477 1.559899 118

#Now removing rules with non-psychiatric medications from our top listed groups. Then evaluating the associations between amphetamines and other psych medications.

psych\_rules <- top\_amphetamines[c(2,3,6,7, 8,9)]  
summary(psych\_rules)

## set of 6 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 2 3   
## 2 4   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 2.000 2.250 3.000 2.667 3.000 3.000   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.01067 Min. :0.4012 Min. :0.02200 Min. :1.657   
## 1st Qu.:0.01203 1st Qu.:0.4269 1st Qu.:0.02623 1st Qu.:1.669   
## Median :0.01653 Median :0.4326 Median :0.03846 Median :1.691   
## Mean :0.01980 Mean :0.4444 Mean :0.04551 Mean :1.772   
## 3rd Qu.:0.02453 3rd Qu.:0.4622 3rd Qu.:0.05819 3rd Qu.:1.891   
## Max. :0.03733 Max. :0.5030 Max. :0.08719 Max. :1.974   
## count   
## Min. : 80.00   
## 1st Qu.: 90.25   
## Median :124.00   
## Mean :148.50   
## 3rd Qu.:184.00   
## Max. :280.00   
##   
## mining info:  
## data ntransactions support confidence  
## analysis\_basket 7501 0.01 0.4  
## call  
## apriori(data = analysis\_basket, parameter = list(support = 0.01, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

inspect(psych\_rules)

## lhs rhs support confidence  
## [1] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [2] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [3] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## [4] {amphetamines, atorvastatin} => {abilify} 0.01813092 0.4011799   
## [5] {citalopram} => {amphetamines} 0.03732836 0.4281346   
## [6] {paroxetine} => {amphetamines} 0.02666311 0.4264392   
## coverage lift count  
## [1] 0.03172910 1.974207 112   
## [2] 0.02199707 1.955042 83   
## [3] 0.02439675 1.699029 80   
## [4] 0.04519397 1.683026 136   
## [5] 0.08718837 1.663957 280   
## [6] 0.06252500 1.657368 200

psych\_rules <- psych\_rules[c(-4,-5,-6)]  
summary(psych\_rules)

## set of 3 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 3   
## 3   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 3 3 3 3 3 3   
##   
## summary of quality measures:  
## support confidence coverage lift   
## Min. :0.01067 Min. :0.4372 Min. :0.02200 Min. :1.699   
## 1st Qu.:0.01087 1st Qu.:0.4539 1st Qu.:0.02320 1st Qu.:1.827   
## Median :0.01107 Median :0.4706 Median :0.02440 Median :1.955   
## Mean :0.01222 Mean :0.4703 Mean :0.02604 Mean :1.876   
## 3rd Qu.:0.01300 3rd Qu.:0.4868 3rd Qu.:0.02806 3rd Qu.:1.965   
## Max. :0.01493 Max. :0.5030 Max. :0.03173 Max. :1.974   
## count   
## Min. : 80.00   
## 1st Qu.: 81.50   
## Median : 83.00   
## Mean : 91.67   
## 3rd Qu.: 97.50   
## Max. :112.00   
##   
## mining info:  
## data ntransactions support confidence  
## analysis\_basket 7501 0.01 0.4  
## call  
## apriori(data = analysis\_basket, parameter = list(support = 0.01, target = "rules", confidence = 0.4, minlen = 2, maxlen = 5), control = list(verbose = FALSE))

inspect(psych\_rules)

## lhs rhs support confidence  
## [1] {amphetamines, lisinopril} => {abilify} 0.01493134 0.4705882   
## [2] {citalopram, glyburide} => {amphetamines} 0.01106519 0.5030303   
## [3] {abilify, citalopram} => {amphetamines} 0.01066524 0.4371585   
## coverage lift count  
## [1] 0.03172910 1.974207 112   
## [2] 0.02199707 1.955042 83   
## [3] 0.02439675 1.699029 80