Network Meta-Analysis Workshop Instructions

1 Introduction

Welcome to the Network Meta-Analysis (NMA) workshop! In this session, you will learn how to conduct NMA using the `netmeta` package in R. The workshop consists of two hands-on coding sessions:

1. Session 1: Basic Network Meta-Analysis (30 minutes)

2. Session 2: Advanced Topics in Frequentist NMA (20 minutes)

2 Session 1: Basic Network Meta-Analysis (30 min)

2.1 Step 1: Load Data and Explore the Structure (10 min)

Dataset Assignment: Each group will work with one of five different datasets from `netmeta` (`Baker2009, Dogliotti2014, Dong2013, Franchini2012, Gurusamy2011`). Please visit `https://www.rdocumentation.org/packages/netmeta/versions/3.1-1/topics/<your_dataset>` for a description of the data.

```r
library(netmeta)

# Load your assigned dataset
# Example: data("Baker2009")
data(your_dataset)

# Explore dataset
# Example: str(Baker2009)
str(your_dataset)
summary(your_dataset)
head(your_dataset)

# Count unique treatments and studies
# Variables describing study and treatment may be different in your dataset
length(unique(c(your_dataset$treat1, your_dataset$treat2)))
length(unique(your_dataset$studlab))
```

Discussion Questions:

- How many studies and how many treatments/interventions are in your network?

- What do the key variables represent?

- Draw a graph that represents the available direct evidence in your network. I.e. one node for each treatment and an edge between treatments that are **directly** compared in any study.

2.2 Step 2: Transform data to contrast-based format for input into *netmeta()* (5 min)

```
# Transform data from long arm−based format to contrast−based
# format. Argument 'sm' has to be used for odds ratio as summary
# measure; by default the risk ratio is used in the metabin
# function called internally.

# Note: arguments will be different for other datasets
pw <- pairwise(treatment, exac, total, studlab = paste(study, year),
               data = Baker2009, sm = "OR")
```

Discussion Questions:

- What is the format of the dataset before call to *pairwise()* and after?

- Were there any issues or warnings when running *pairwise()*?

2.3 Step 3: Conduct Network Meta-Analysis (5 min)

```
nma <- netmeta(pw)
summary(nma)
```

Discussion Questions:

- How do treatment effects appear in your dataset?

- How are direct and indirect comparisons combined?

- How can heterogeneity affect results?

2.4 Step 4: Network Visualization (5 min)

```
# Plot network for your dataset
netgraph(nma,
         number.of.studies = TRUE)
```

Tasks: Modify color settings, point sizes, node orientation, etc. See netgraph.netmeta at `https://cran.r-project.org/web/packages/netmeta/netmeta.pdf` for arguments.

2.5 Step 5: Treatment Ranking and Forest Plot (5 min)

```
# Rank treatments and generate forest plot
netrank(nma)
forest(nma)
```

```
# Create netleague plot
netleague(nma)
```

Discussion Questions:

- How does your dataset rank treatments?

- How do league tables help in interpreting results?

3 Session 2: Advanced Topics in Frequentist NMA (20 min)

3.1 Step 1: Checking for Inconsistency (10 min)

```
# Check inconsistency in your dataset
library(dplyr)

# Forest plot showing direct vs indirect evidence and pooled estimate
netsplit(nma) %>% forest()

# Plot showing which comparisons have inconsistency and to what degree
netheat(nma)
```

Discussion Questions:

- Recall: What does inconsistency mean in network meta-analysis?

- How do we interpret the node-splitting results?

- What are possible sources of inconsistency in your dataset?

3.2 Step 2: Sensitivity Analysis (10 min)

```
# Remove studies one-by-one and observe the impact
# Study variable and values may be different in your dataset
filtered_data <- your_dataset[your_dataset$studlab != "1", ]
nma_sens <- netmeta(
  TE = filtered_data$TE, seTE = filtered_data$seTE,
  treat1 = filtered_data$treat1, treat2 = filtered_data$treat2,
  studlab = filtered_data$studlab, data = filtered_data, sm = ''SMD"
)
summary(nma_sens)
```

Discussion Questions:

- How does removing a study impact treatment rankings?

- Are certain studies driving the results?

- How do we decide which studies to exclude in sensitivity analysis?

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Final Note: Experiment with modifying parameters, run additional analyses, and compare results across datasets to develop a deeper understanding of network meta-analysis. Please feel free to reach out with any questions!