## Supplementary File \#4

## Additional Data on Participation in MEER Sessions and Surveys

## Project participants

1. Participation in the MEER project involved two main activities:

- Attending MEER sessions during the afternoon handover period when these sessions coincided with a rostered morning shift for the participant; and
- Completing online surveys, including a baseline survey at the start of the project (i.e. before MEER sessions commenced) and three post-intervention surveys at the 2.5, 5 and 10 month timepoints.

2. Participation in all activities was voluntary, i.e. individuals who agreed to participate in the project could choose not to attend MEER sessions at any time and for any reason (or for no reason) and similarly could choose not to complete any of the surveys or not to answer questions within the surveys.
3. The Nurse Unit Managers (NUMs) of two units at Epworth Hospital Richmond (i.e. the ED and inpatient ward 4Gray) agreed to invite staff in their units to participate in the project. As Epworth is a private hospital, most medical professionals that work at the hospital are not actually hospital employees and therefore only nursing staff, ED medical staff and clerical staff were invited to participate in the project. ED and 4Gray staff that agreed to participate in the project were assigned a Participant Identification Number (PIN) that was needed to allow individuals to complete the online surveys.
4. ED and 4Gray nursing staff that did not wish to participate in the project, as well as medical practitioners and other clinical and non-clinical staff of the hospital who sometimes work in the participating units (pharmacists, physiotherapists, etc), were encouraged to attend MEER sessions and contribute to the team-based discussions but were not formally invited to participate in the project or allocated a PIN.
5. The following table summarises MEER session attendance records kept by the NUMs combined with data obtained from surveys:

Table SF3. 1 Staff participation and MEER session attendance

| Unit | Total <br> staff on <br> roster | No. of staff <br> assigned a <br> PIN | No. with PIN that <br> attended at least one <br> MEER session | No. with PIN that <br> completed at least <br> one survey | No. with no PIN that <br> attended at least one <br> MEER session |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ED | $81^{*}$ | 50 | 41 | 20 | 24 |
| $4 G r a y$ | $60^{*}$ | 33 | 28 | 21 | 18 |
| TOTAL | $141^{*}$ | 83 | 69 | 41 | 42 |

* These numbers are approximate as staff rosters are continually changing.

Key findings from this summary table:

- The proportion of staff on each roster that agreed to participate (i.e. were assigned a PIN) was $62 \%$ in the ED and $55 \%$ in 4Gray. Some of the staff that were not allocated a PIN would include those on permanent night shift, who knew they would never be able to attend the MEER sessions scheduled for the afternoon handover period.
- More staff attended MEER sessions than requested to formally participate. That is, 83 individuals requested and were assigned a PIN, but a further 42 individuals participated in the MEER sessions without obtaining a PIN. Since they did not receive a PIN, they could not complete the survey. Of these 42 individuals, 27 attended more than a single

MEER session, even though they were not required to attend any sessions at all. It is not clear how to interpret this, other than concluding some people weren't interested in participating in a research project, but were happy to participate in the MEER sessions.

- There were 14 individuals (= $83-69$ ) across the two participating units that were assigned a PIN but never attended a MEER session. This may have simply reflected lack of opportunity, as the MEER sessions were always conducted on a particular day each week and any staff not rostered on the morning shift that day would be unlikely to make a special trip into the hospital to participate.


## Analysis of survey participation

6. While all participants assigned a PIN were able to complete the baseline survey, project participants most likely would not have completed post-intervention surveys (conducted at 2.5 months, 5 months and 10 months) if they had not yet attended at least one MEER session. The following table summarises MEER session attendance records kept by NUMs showing the number of individuals with PINs who had attended at least one MEER session by the closing date of each survey.

Table SF3. 2 Attendance of participants at MEER sessions prior to conduct of post-intervention surveys

|  | Baseline <br> survey <br> (Survey \#1) | 2.5-month <br> survey <br> (Survey \#2) | 5-month <br> survey <br> (Survey \#3) | 10-month <br> survey <br> (Survey \#4) |
| :--- | :---: | :---: | :---: | :---: |
| No. of respondents | 41 | 28 | 39 | 31 |
| Respondents as a percentage of staff with <br> PIN (n = 83) | $49.4 \%$ | $33.7 \%$ | $47.0 \%$ | $37.3 \%$ |
| No. of staff that had attended at least one <br> MEER session by survey closing date | $\mathrm{n} / \mathrm{a}$ | 62 | 66 | 69 |
| Respondents as a percentage of staff <br> with PIN that had attended at least one <br> MEER session by survey closing date | $\mathrm{n} / \mathrm{a}$ | $45.2 \%$ | $59.1 \%$ | $44.9 \%$ |

From this summary table, it can be seen that of the 69 people who received a PIN and attended at least one MEER session, 62 had attended at least one MEER session by the time the 2.5 -month survey was closed for responses and 66 had attended at least one MEER session by the time the 5 -month survey was closed for responses. These figures provide a more realistic denominator for determining response rates in the post-intervention surveys.
7. Analysis of the PIN data collected in the three post-intervention surveys reveals information about which surveys were completed by project participants, as shown in the following Venn diagram.

8. One possible interpretation of this distribution of survey participation is that the seven individuals who completed the first post-intervention survey, but neither of the two remaining surveys, were negatively disposed to - or not engaged by - the MEER sessions and therefore decided not to participate further in the project. A similar interpretation could be applied to the 14 individuals that only completed the second survey. The 10 individuals that only completed the third survey may have only started attending MEER sessions late in the project and so may not have had an opportunity to complete more than one post-intervention survey.

To determine whether there were any differences in the "positivity" of respondents in their opinions of the MEER approach (as presented in Table 2, Rows A - G of the article), depending on which surveys participants answered, or the number of surveys answered, the ratings nominated for each of those seven statements were analysed in further detail.

The seven statements survey respondents were asked to rate were:
Q01: I have enjoyed the team-based discussions
Q02: I like the process of reviewing the standards using the map-based graphical representation in the MEERQAT tool
Q03: I have felt comfortable expressing my views and opinions in the team-based discussions
Q04: I have found hearing the different perspectives amongst my colleagues to be worthwhile
Q05: I have learnt new information about the national quality standards
Q06: I have learnt new information about specific Epworth policies and protocols
Q07: I have enjoyed the opportunity to reflect on my own clinical practice
Initially, the average ratings nominated by the various cohorts of respondents for each of the seven statements were calculated. In the following table, the comparison between those respondents that only completed the first survey at 2.5 months and those that completed multiple surveys is highlighted. Cells in the table highlighted in green are those having the higher average rating in the two-way comparison, while cells highlighted in pink are those having the lower average rating in the two-way comparison.

Table SF3. 3 Average ratings for each statement as nominated by each cohort of survey respondents

| Respondent cohort | Average rating nominated by respondents |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Q01 | Q02 | Q03 | Q04 | Q05 | Q06 | Q07 |
| Overall responses ( $\mathrm{n}=60$ ) | 4.33 | 4.10 | 4.32 | 4.50 | 4.26 | 4.23 | 4.32 |
| 2.5-month responses ( $\mathrm{n}=28$ ) | 4.29 | 4.07 | 4.32 | 4.54 | 4.14 | 3.96 | 4.21 |
| 5-month responses ( $\mathrm{n}=39$ ) | 4.23 | 4.05 | 4.26 | 4.46 | 4.26 | 4.33 | 4.26 |
| 10-month responses ( $\mathrm{n}=31$ ) | 4.48 | 4.19 | 4.39 | 4.52 | 4.37 | 4.35 | 4.48 |
| One survey completed ( $\mathrm{n}=31$ ) | 4.29 | 3.97 | 4.29 | 4.58 | 4.26 | 4.35 | 4.39 |
| Two surveys completed ( $\mathrm{n}=20$ ) | 4.23 | 4.00 | 4.23 | 4.45 | 4.05 | 4.18 | 4.30 |
| Three surveys completed ( $\mathrm{n}=9$ ) | 4.52 | 4.41 | 4.48 | 4.48 | 4.41 | 4.19 | 4.26 |
| Multiple (i.e. 2 or 3 ) surveys completed ( $\mathrm{n}=29$ ) | 4.34 | 4.16 | 4.33 | 4.46 | 4.26 | 4.18 | 4.28 |
| Only completed 2.5 -month survey ( $n=7$ ) | 4.00 | 4.00 | 4.57 | 4.71 | 4.00 | 4.00 | 4.29 |
| Only completed 5-month survey ( $\mathrm{n}=14$ ) | 4.14 | 3.86 | 4.21 | 4.64 | 4.36 | 4.50 | 4.36 |
| Only completed 10-month survey ( $\mathrm{n}=10$ ) | 4.70 | 4.10 | 4.20 | 4.40 | 4.30 | 4.40 | 4.50 |

Charts comparing these average ratings are presented on the following pages.

## Respondent Views on MEER Session - Average ratings based on respondent profile

For each of the seven statements survey respondents were asked to rate, the following charts show the average rating for various cohorts of respondents, based on:

- All respondents for a particular post-intervention survey (All surveys, 2.5-month survey; 5-month survey; 10-month survey)
- Number of post-intervention surveys the respondent completed (1,2,3 or multiple i.e. 2 or 3 surveys)
- Respondents that only answered the 2.5 -month survey, or only answered the 5 -month survey or only answered the $10-$ month survey.
- The red rectangle highlights the comparison between respondents that only answered the first post-intervention survey at 2.5 months and those who answered multiple (i.e. 2 or 3 ) post-intervention surveys.
Key:

|  | Signifies the average rating <br> for that cohort was equal to <br> the overall average for that <br> statement | Signifies the average rating <br> for that cohort was below <br> the overall average for that <br> statement | Signifies the average rating <br> for that cohort was above <br> the overall average for that <br> statement | Signifies the highest <br> average rating for that <br> statement across all the <br> various cohorts |
| :--- | :--- | :--- | :--- | :--- | :--- |



I have felt comfortable expressing my views and opinions in the team-based discussions


I have found hearing the different perspectives amongst my colleagues to be worthwhile



From this analysis, it is apparent there were differences, but no consistent patterns across the seven statements as to which cohorts - on average - rated their perceptions of the MEER intervention more or less positively. Most certainly, these results would suggest that the individuals that only completed the first post-intervention survey at 2.5 months were not, as a group, less positive about all aspects of their experiences than other participants that continued to answer surveys at the 5-and 10-month timepoints. It should also be noted the least positive averages in the table, which were in relation to the statement I like the process of reviewing the standards using the map-based graphical representation in the MEERQAT tool, were nevertheless approaching an average of 4 , which is a positive response. Therefore, this analysis is effectively about the degree of positiveness, as opposed to positive versus negative.
9. To determine whether there were any statistically significant differences between the ratings nominated for these seven statements by the various cohorts of survey participants, differences in survey question responses were analysed by ordinal regression with Cumulative Link Models (CLM) or Cumulative Link Mixed Models (CLMM). This analysis is presented in the R notebook on the following pages.
10. In summary, the analyses revealed the following:

- There were differences observed between respondents when the responses for the 2.5-month, 5 -month and 10-month surveys were compared ( p 0.01 ).
- There was no significant difference overall between the 2.5 -month and 5 -month surveys ( $p>0.1$ ). However, when the comparison was done question by question, a significant difference was seen for Q06 (I have learnt new information about specific Epworth policies and protocols).
- There was a significant difference overall between the 2.5 -month and 10 -month surveys ( $p<0.01$ ). When the comparison was done question by question, the only significant difference was seen for Q06 (I have learnt new information about specific Epworth policies and protocols).
- There was a significant difference overall between the 5-month and 10-month surveys ( $p<0.01$ ). However, when the comparison was done question by question, no significant differences were found.
- No significant difference was found between the responses of participants that only answered the 2.5-month survey and participants that responded to multiple (i.e. two or three) of the post-intervention surveys ( $p>0.1$ ). When the comparison was done question by question, no significant differences were found.
- No significant difference was found between the responses of participants that only answered the 5-month survey and participants that responded to multiple (i.e. two or three) of the post-intervention surveys ( $p>0.1$ ). When the comparison was done question by question, no significant differences were found.


# MEER intervention survey - analysis of differences between survey responses 

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## Introduction

This R notebook checks for differences between survey responses which were conducted after the initial baseline survey, i.e. at 2.5 months (survey 2), 5 months (survey 3 ) and 10 months (survey 4 ) after the start of the MEER trial at the Epworth hospital.
The analysis focusses on the first seven questions reported in Table 2 of the paper ("Staff opinions on the MEER approach and its impact") as listed below:

- Q1: I have enjoyed the team-based discussions
- Q2: I like the process of reviewing the standards using the map-based graphical representations in the MEERQAT tool
- Q3: I have felt comfortable expressing my views and opinions in the team-based discussions
- Q4: I have found hearing the different perspectives amongst my colleagues to be worthwhile
- Q5: I have learnt new information about the national quality standards
- Q6: I have learnt new information about specific Epworth policies and protocols
- Q7: I have enjoyed the opportunity to reflect on my own clinical practice

The responses for each survey question were based on a 5 point Likert scale, ranging from a least favourable (1) to a most favourable (5) response. The Likert scales are not assumed to necessarily represent equally spaced responses.
Each particpant was identified by a unique pin for each survey.
Not all trial participants responded to each survey. A Venn diagram showing the numbers of survey respondents across the three surveys $(2,3,4)$ is shown below:


Figure 1: Venn diagram of survey respondents
The specific aim of the analyses is to address the following questions:

1. Do the ratings nominated by respondents differ between Survey 2, Survey 3 and Survey 4?
2. Do the ratings nominated by respondents who only completed Survey 2 differ from respondents who answered two or three of the post-intervention surveys?
3. Do the ratings nominated by respondents who only completed Survey 3 differ from respondents who answered two or three of the post-intervention surveys?

Differences in survey question responses were analysed by ordinal regression with Culumlative Link Models (CLM) or Cumulative Link Mixed Models (CLMM), using the R clm or clmm functions respectively.

## Reference

Mangiafico (2016) "SUMMARY AND ANALYSIS OF EXTENSION EDUCATION PROGRAM EVALUATION IN R" see section on Two-sample Paired Ordinal Test with CLMM http://rcompanion.org/handbook/ G_12.html

## Load libraries

```
library("readxl")
library(psych)
library(ggplot2)
library(dplyr)
library(FSA)
library(lemon)
knit_print.data.frame <- lemon_print
```


## Read in and process the Likert data file

```
# Read in the data for 5 scale Likert scores
Data <- read.csv("Survey data BMJOQ reshaped.csv")
# Create labelled variables for survey names (for plot axis labels)
survey_names = c("2.5 month survey","5 month survey","10 month survey")
Data$survey_names <- mapvalues(Data$survey, from=c(2,3,4), to=survey_names)
Data$survey_names <- factor(Data$survey_names, ordered=TRUE, levels=survey_names)
# factorize variables
Data$qn <- factor(Data$qn)
Data$num_surveys <- factor(Data$num_surveys)
Data$survey <- factor(Data$survey)
Data$Likert.f <- factor(Data$Likert, ordered = TRUE)
```


## Display head and tail of the data

|  | pin | qn | num_surveys | survey | Likert | survey_names | Likert.f |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 7 | Q01 | 1 | 2 | 4 | 2.5 month survey | 4 |
| 2 | 1011 | Q01 | 2 | 2 | 3 | 2.5 month survey | 3 |
| 3 | 1062 | Q01 | 2 | 2 | 4 | 2.5 month survey | 4 |
| 4 | 1012 | Q01 | 2 | 2 | 4 | 2.5 month survey | 4 |
| $\ldots$ | $\ldots$ | NA | NA | NA | $\ldots$ | NA | NA |
| 681 | 1037 | Q07 | 2 | 4 | 5 | 10 month survey | 5 |
| 682 | 2068 | Q07 | 1 | 4 | 5 | 10 month survey | 5 |
| 683 | 1059 | Q07 | 2 | 4 | 5 | 10 month survey | 5 |
| 684 | 1070 | Q07 | 3 | 4 | 5 | 10 month survey | 5 |

## Check the data



## Get Likert data counts

```
xtabs( ~ survey + Likert.f + num_surveys, data = Data)
## , , num_surveys = 1
## Likert.f
# survey 2 
## 
### 
##
, , num_surveys = 2
Likert.f
survey 2 
        2
        3}0
        4 0
    , num_surveys = 3
        Likert.f
survey 2 3 4 4
        2 0 4 31128
        3
        4 0 1 31 31
```


## Summarize data treating Likert ratings as numeric

```
Summarize(Likert ~ num_surveys + survey, data=Data, digits=3)
```

| \#\# | num_surveys | survey | n | mean | sd | min | Q1 | median | Q3 max |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| \#\# | 1 | 1 | 2 | 49 | 4.224 | 0.848 | 2 | 4 | 4 | 5.0 |
| \#\# | 2 | 2 | 2 | 84 | 4.095 | 0.705 | 2 | 4 | 4 | 5.0 |
| \#\# | 3 | 3 | 2 | 63 | 4.381 | 0.607 | 3 | 4 | 4 | 5.0 |
| \#\# 4 | 1 | 3 | 98 | 4.296 | 0.677 | 2 | 4 | 4 | 5.0 | 5 |
| \#\# | 5 | 2 | 3 | 111 | 4.207 | 0.507 | 3 | 4 | 4 | 4.5 |
| \#\# 6 | 3 | 3 | 63 | 4.317 | 0.563 | 3 | 4 | 4 | 5.0 | 5 |
| \#\# | 7 | 1 | 4 | 70 | 4.371 | 0.783 | 2 | 4 | 5 | 5.0 |
| \#\# | 8 | 2 | 4 | 83 | 4.361 | 0.636 | 3 | 4 | 4 | 5.0 |
| \#\# 9 | 3 | 4 | 63 | 4.476 | 0.535 | 3 | 4 | 4 | 5.0 | 5 |

Summarize(Likert ~ num_surveys, data=Data, digits=3)

| \#\# | num_surveys | n | mean | sd | min | Q1 | median | Q3 | max |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| \#\# | 1 | 1 | 217 | 4.304 | 0.751 | 2 | 4 | 4 | 5 | 55

Summarize(Likert ~ survey, data=Data, digits=3)

| \#\# | survey | n | mean | sd min | Q1 | median | Q3 | max |  |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| \#\# | 1 | 2 | 196 | 4.219 | 0.722 | 2 | 4 | 4 | 5 |
| \#\# 2 | 3 | 272 | 4.265 | 0.586 | 2 | 4 | 4 | 5 | 5 |
| \#\# | 3 | 4 | 216 | 4.398 | 0.660 | 2 | 4 | 4 | 5 | 5

## ANALYSIS OF QUESTIONS

## Load libraries for CLM and CLMM analysis

library (car)
library (RVAideMemoire)

Question 1: Do the ratings nominated by respondents differ between Survey 2 ( 2.5 months), Survey 3 ( 5 months) and Survey 4 ( 10 months)?

Plot histograms of normalised counts of the Likert responses by survey number
NORMALISED Likert counts by survey number


NORMALISED Likert counts by survey number for each question


Likert

Test for differences in Likert ratings between all surveys (2,3,4) for all questions
Using the clmm function, Likert.f is the dependent variable, and survey is the independent variable. Question number, qn, is used as a blocking variable.

```
modelSN <- clmm(Likert.f ~ survey + (1|qn),
    data=Data, threshold = "flexible")
anov <- Anova(modelSN, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## survey 10.22 2 0.006034 **
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Test for differences in Likert ratings between survey 2 and survey 3 for all questions

```
DataS2S3 <- Data[Data$survey != 4,] # exclude data from survey 4
modelSN <- clmm(Likert.f ~ survey + (1|qn),
        data=DataS2S3, threshold = "flexible")
anov <- Anova(modelSN, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## survey 0.030416 1 0.8616
```

Test for differences in Likert ratings between survey 2 and survey 4 for all questions

```
DataS2S4 <- Data[Data$survey != 3,] # exclude data from survey 3
modelSN <- clmm(Likert.f ~ survey + (1|qn),
    data=DataS2S4, threshold = "flexible")
anov <- Anova(modelSN, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## survey 6.9005 1 0.008617 **
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*'0.05 '.' 0.1 ' ' 1
sum(anov["Pr(>Chisq)"])
## [1] 0.008616933
```

Test for differences in Likert ratings between survey 3 and survey 4 for all questions

```
DataS3S4 <- Data[Data$survey != 2,] # exclude data from survey 2
modelSN <- clmm(Likert.f ~ survey + (1|qn),
                        data=DataS3S4, threshold = "flexible")
anov <- Anova(modelSN, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## survey 8.2366 1 0.004105 **
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Test for differences between surveys by question
Using the clm function, Likert.f is the dependent variable, and survey is the independent variable.
$\operatorname{Pr}(>$ Chisq $)$ is provided for each question for none, survey2, survey3, or survey4 data excluded.

```
for (excluded_survey in c('none',2,3,4)) {
    questions = unique(DataSS$qn)
    # Test for each question
    for (question in questions) {
        modelSN <- clm(Likert.f ~ survey,
        anov <- Anova(modelSN, type = "II")
        p <- round(sum(anov["Pr(>Chisq)"]),4)
        cat(paste(question, p,"\n"))
    }
}
##
## *** EXCLUDED SURVEY: none ***
## Q01 0.1455
## Q02 0.6389
## Q03 0.4139
## Q04 0.7385
## Q05 0.5284
## Q06 0.0653
## Q07 0.1208
##
## *** EXCLUDED SURVEY: 2 ***
## Q01 0.0528
## Q02 0.3438
## Q03 0.1927
## Q04 0.5652
## Q05 0.4424
## Q06 0.8455
## Q07 0.0717
##
## *** EXCLUDED SURVEY: 3 ***
## Q01 0.1989
## Q02 0.5344
## Q03 0.5528
## Q04 0.8742
## Q05 0.285
## Q06 0.0451
## Q07 0.085
##
## *** EXCLUDED SURVEY: 4 ***
## Q01 0.6455
## Q02 0.8376
## Q03 0.4803
## Q04 0.465
## Q05 0.6394
## Q06 0.0456
## Q07 0.834
```

    cat (paste("\n*** EXCLUDED SURVEY:",excluded_survey,"***\n"))
    DataSS <- Data \%>\% filter(survey != excluded_survey) \#Data subsample with excluded survey
        DataQN <- DataSS \%>\% filter(qn == question) \#Data subsample for question number
                            data=DataQN, threshold = "flexible")
    Question 2: Do the ratings nominated by respondents who only completed Survey 2 differ from respondents who answered two or three of the post-intervention surveys?


Figure 2: Venn diagram of test samples

Set up the data with testcol as the independent variable

```
Data2 <- Data
Data2$testcol <- 2
Data2 <- Data2 %>%
    mutate(testcol = replace(testcol, survey==2 & num surveys==1, 0)) %>%
    mutate(testcol = replace(testcol, num_surveys != 1, 1)) %>%
    filter(testcol != 2)
Data2$testcol <- factor(Data2$testcol)
testcol_names = c("red group","blue group")
Data2$testcol_names <- mapvalues(Data2$testcol, from=c(0,1), to=testcol_names)
```

Plot the histograms
NORMALISED Likert counts by test column


NORMALISED Likert counts by test column per question


Likert

## Conduct test for all questions combined

Using the clmm function, Likert.f is the dependent variable, and testcol is the independent variable. testcol delineates between single responses for survey 2 (red group) and multiple survey (blue group) responses. Question number, qn, is used as a blocking variable.

```
modeltest <- clmm(Likert.f ~ testcol + (1|qn),
    data=Data2, threshold = "flexible")
anov <- Anova(modeltest, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## testcol 0.0012733 1 0.9715
```


## Test for each question

Using the clm function, Likert.f is the dependent variable, and testcol is the independent variable. testcol delineates between single responses for survey 2 (red group) and multiple survey (blue group) responses. Analayses are conducted for each question seperately.

```
questions = unique(DataSS$qn)
for (question in questions) {
    DataQN <- Data2 %>% filter(qn == question) #survey subsample for question number
    modelSN <- clm(Likert.f ~ testcol,
                                    data=DataQN, threshold = "flexible")
    anov <- Anova(modelSN, type = "II")
    p <- round(sum(anov["Pr(>Chisq)"]),4) # return the p value from the anova test
    cat(paste("Pr(>Chisq) for",question,":",p,"\n"))
}
## Pr(>Chisq) for Q01 : 0.193
## Pr(>Chisq) for Q02 : 0.5414
## Pr(>Chisq) for Q03 : 0.3687
## Pr(>Chisq) for Q04 : 0.2208
## Pr(>Chisq) for Q05 : 0.5983
## Pr(>Chisq) for Q06 : 0.9416
## Pr(>Chisq) for Q07 : 0.6663
```

Question 3: Do the ratings nominated by respondents who only completed Survey 3 differ from respondents who answered two or three of the post-intervention surveys?


Figure 3: Venn diagram of test samples

Set up the data with testcol as the independent variable

```
Data3 <- Data
Data3$testcol <- 2
Data3 <- Data3 %>%
    mutate(testcol = replace(testcol, survey==3 & num_surveys==1, 0)) %>%
    mutate(testcol = replace(testcol, num_surveys != 1, 1)) %>%
    filter(testcol != 2)
Data3$testcol <- factor(Data3$testcol)
testcol_names = c("red group","blue group")
Data3$testcol_names <- mapvalues(Data3$testcol, from=c(0,1), to=testcol_names)
```

Plot the histograms
NORMALISED Likert counts by test column


NORMALISED Likert counts by test column per question


## Likert

## Conduct test for all questions combined

Using the clmm function, Likert.f is the dependent variable, and testcol is the independent variable. testcol delineates between single responses for survey 3 (red group) and multiple survey (blue group) responses. Question number, qn, is used as a blocking variable.

```
modeltest <- clmm(Likert.f ~ testcol + (1|qn),
    data=Data3, threshold = "flexible")
anov <- Anova(modeltest, type = "II")
print(anov)
## Analysis of Deviance Table (Type II tests)
##
## Response: Likert.f
## LR Chisq Df Pr(>Chisq)
## testcol 0.12806 1 0.7205
```


## Test for each question

Using the clm function, Likert.f is the dependent variable, and testcol is the independent variable. testcol delineates between single responses for survey 3 (red group) and multiple survey (blue group) responses. Analayses are conducted for each question seperately.

```
questions = unique(DataSS$qn)
for (question in questions) {
    DataQN <- Data3 %>% filter(qn == question) #survey subsample for question number
    modelSN <- clm(Likert.f ~ testcol,
                        data=DataQN, threshold = "flexible")
    anov <- Anova(modelSN, type = "II")
    p <- round(sum(anov["Pr(>Chisq)"]),4) # return the p value from the anova test
    cat(paste("Pr(>Chisq) for",question,":",p,"\n"))
}
## Pr(>Chisq) for Q01 : 0.2768
## Pr(>Chisq) for Q02 : 0.1964
## Pr(>Chisq) for Q03 : 0.5317
## Pr(>Chisq) for Q04 : 0.2458
## Pr(>Chisq) for Q05 : 0.528
## Pr(>Chisq) for Q06 : 0.067
## Pr(>Chisq) for Q07 : 0.5572
```

