SUPPORTING MATERIAL

Support for Aboriginal health services in reducing harms from alcohol: 2-year service provision outcomes in a cluster randomized trial

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Table S1. Detailed description of the eight components of the support model

C1	Implementation agreements included memoranda of understanding outlining the aims of and design of the study, responsibilities of the research team and the services and what each party would provide as part of the study
C2	Two-day workshop with nominated service champions to familiarise them with the aims and methods of the study, to build a champions' network and introduce them to the support model. Training was provided on screening, brief intervention, and treatment of unhealthy alcohol use.
C3	On-site training: The program's core is a half-day face-to-face interactive training workshop. Themes included: harms from alcohol, alcohol use disorders; current evidence-base and guidelines for prevention, and treatment, using AUDIT-C to assess clients' drinking; using data to monitor improvements in screening and treatment; how to deliver brief intervention; use of relapse prevention medicines; community-driven actions to prevent harms from alcohol. Additional modules were available on topics such as Fetal Alcohol Spectrum Disorder (FASD) or more detailed coverage of medical treatments for alcohol dependence. Face-to-face workshops were delivered by an addiction medicine specialist and an Aboriginal health professional (for example, drug and alcohol worker or other health worker). Training content is aligned with Aboriginal and Torres Strait Islander cultural protocols such as gender appropriateness, kinship systems and cultural obligations.
C4	Bi-monthly data feedback report presented as a pdf file and emailed to the service champions and key contacts. Feedback was provided as a graphic representation of proportion of clients drinking at risky levels, as well as screening and treatment rates over time based on the bi-monthly data provided by the services.
C5	Bi-monthly teleconference for service champions to exchange improvement ideas and experiences
C6	Support to modify practice software, where needed, for example to include AUDIT-C in the Adult Health Check and other areas of the interface if requested.
C7	Online platform including a repository of electronic tools and resources, and a private chat platform for the champions.
C8	Services were offered financial support for purchase of resources to help their work on alcohol e.g., standard drink cups, FASD dolls; clinical handbooks, prevention materials.

Table S2 Ethics committees and key Aboriginal community controlled health organisations

Australian state or territory	Ethics committee name	Approval number
New South Wales (NSW)	The Aboriginal Health & Medical Research Council of NSW Ethics Committee	1217/16
Northern Terriory (NT)	Central Australian Human Research Ethics Committee Human Research Ethics Committee of Northern Territory Department of Health and Menzies School of Health Research	CA-17-2842 2017-2737
Queensland (Qld)	Central Queensland Hospital and Health Service Human Research Ethics Committee Far North Queensland Human Research Ethics Committee	17/QCQ/9 17/QCH/45-1143
South Australia (SA)	The Aboriginal Health Research Ethics Committee, South Australia	04-16-694

Victoria (Vic)	St Vincent's Hospital Melbourne Human Research Ethics Committee	LRR 036/17
Western Australia	Western Australian Aboriginal Health Ethics Committee	project 779
	Umbrella Aboriginal community controlled health organisation involved in consultation leading to study design	
South Australia (SA) New South Wales (NSW)	Aboriginal Drug and Alcohol Council SA Incorporated Aboriginal Health Council of South Australia (AHCSA), Aboriginal Drug and Alcohol Network, NSW Aboriginal Health and Medical Research Council, NSW	

SECTION S1 SAMPLE SIZE

The study was powered to detect and increase in both screening (the primary outcome) and in the offer of treatment for unhealthy alcohol use (the secondary outcome). As detecting an increase in treatment provision required a larger sample size than screening, it was the focus of sample size calculation. Treatment provision included any of brief intervention, counselling or pharmacotherapies for alcohol relapse prevention.

In a practice which sees 1000 clients per year, about 60% are likely to be aged 16 years or more (1). Of these clients, approximately 57% are likely to be screened in any 12-month period (2). Of the screened clients, at least 25% are likely to consume alcohol above the levels recommended by the National Health and Medical Research Council (NHMRC) of Australia (3, 4). In the control services 60% of people drinking above recommended levels were considered likely to have any intervention recorded (2). Assuming an intra-cluster correlation coefficient (ICC) of 0.04 (5, 6), a sample of 10 services per arm was found to be sufficient to detect 13% absolute increase in treatment provision in the intervention services (from 60% to 73%, 80% power and 2-sided significance of 0.05). This increase was considered of adequate clinical significance while allowing for a manageable number of services. To allow for possible service attrition, one extra service per arm was recruited. As outcomes in this study are obtained from de-identified, routinely collected electronic patient record data, patient consent is not required, only service consent, so sample size calculations do not incorporate non-consent rates.

SECTION S2. AUDIT-C

A record of Alcohol Use Disorders Identification Test – Consumption (AUDIT-C) (7) was chosen as a screening frequency measure in this study because it is the most frequently used validated screening tool among Aboriginal Community Controlled Health Services. Acceptability studies and comparison studies with the full AUDIT have been conducted in Aboriginal and Torres Strait Islander populations. AUDIT-C was found to be more acceptable than other screening tools and compared favourably with AUDIT (8). The full AUDIT had previously been found to have good internal consistency, and correlation with another measure of alcohol consumption in an Aboriginal or Torres Strait Islander setting (9).

AUDIT-C screening is now used to estimate the proportion of the Aboriginal and Torres Strait Islander consuming alcohol above recommended levels as part of Indigenous primary health care national key performance indicators (10).

SECTION S3. MODEL SELECTION PROCESS

For all models, the fixed effects were condition + implementation + condition*post-implementation. We added a range of random effects including a random intercept for services, a random intercept for clients and a random slope of post-implementation by service, to the fixed effects model:

condition + implementation + condition*post-implementation

Of the models that converged (Tables S3-S5), the model with the lowest Bayesian information criteria (BIC), was considered best fitting (11). This model was compared with simpler, nested models using likelihood ratio testing. If the fit of a more parsimonious model was not significantly worse than the best fitting model, then the simpler model was preferred.

Table S3. Models for predicting odds of screening with AUDIT-C

Model	BIC	LogLik	Number of parameters
(A) Random intercept of service	272336.99	-136136.14	5
(B) Random slope of post-implementation by service and random intercept of service	265195.46	-132552.44	6
(C) Random intercept of service and client	272238.70	-136080.53	6
(D) Random intercept of service and client, random slope of post-implementation by service*	265102.92	-132499.69	7

*indicates best-fit model

Table S4. Models for predicting the odds of any-treatment for unhealthy alcohol use

Model	BIC	LogLik	Number of parameters
(A) Random intercept of service	17926.46	-8930.88	5
(B) Random slope of post-implementation by service and random intercept of service*	17741.41	-8825.41	6

*indicates best-fit model

Table S5. Models for predicting the odds of brief intervention

Model	BIC	LogLik	Number of parameters
(A) Random intercept of service	9706.00	-4820.65	5
(B) Random slope of post-implementation by service and random intercept of service	9610.57	-4759.99	6
(C) Random intercept of service and client	9574.67	-4748.51	6
(D) Random intercept of service and client, random slope of post-implementation by service*	9473.22	-4684.84	7

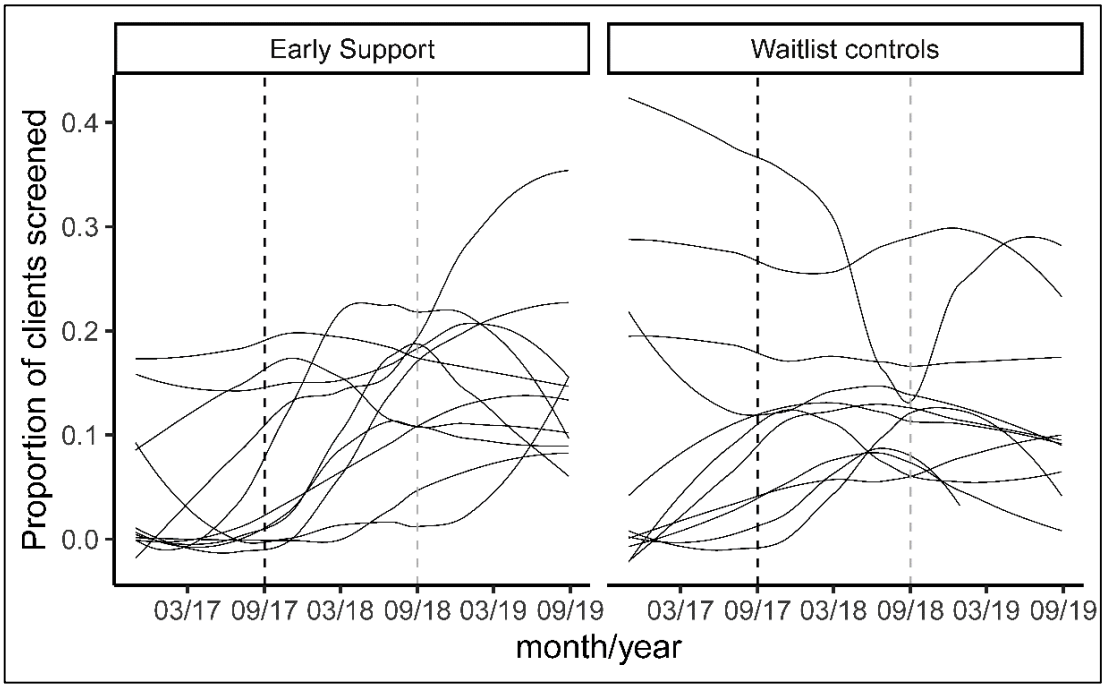
*indicates best-fit model

Table S6. Service characteristics by trial arm, at the over the study period[a] (83,032 clients; 417,228 observations)

Characteristic	Early support	Waitlist controls
Services		
N	11	11[e]
Mean clients per service (SD)	5,068 (3182.7)	2,480 (943.5)
Remoteness		
Urban and inner regional	5	5
Outer regional and remote	2	3
Very remote	4	3
Clients		
N	55,747	27,285
Mean age of clients (years) (SD)	36.9 (16.1)	37.2 (16.5)
Number of female clients (%)	30,658 (55.0)	14,891 (54.6)
Mean observations[b] per client (SD)	5.0 (4.7)	5.1 (4.7)
Clients screened with AUDIT-C (%)	19,077 (34.2)	9,193 (33.7)
Mean AUDIT-C score[c] (SD)	3.7 (3.6)	3.1 (3.5)
Clients with an AUDIT-C > 0[c] (%)	11,567 (60.6)	5,724 (62.3)
Clients recorded as receiving treatment for UAU[d] (%)	831 (1.5)	263 (1.0)
Clients recorded as receiving brief intervention (%)	569 (1.0)	168 (0.6)

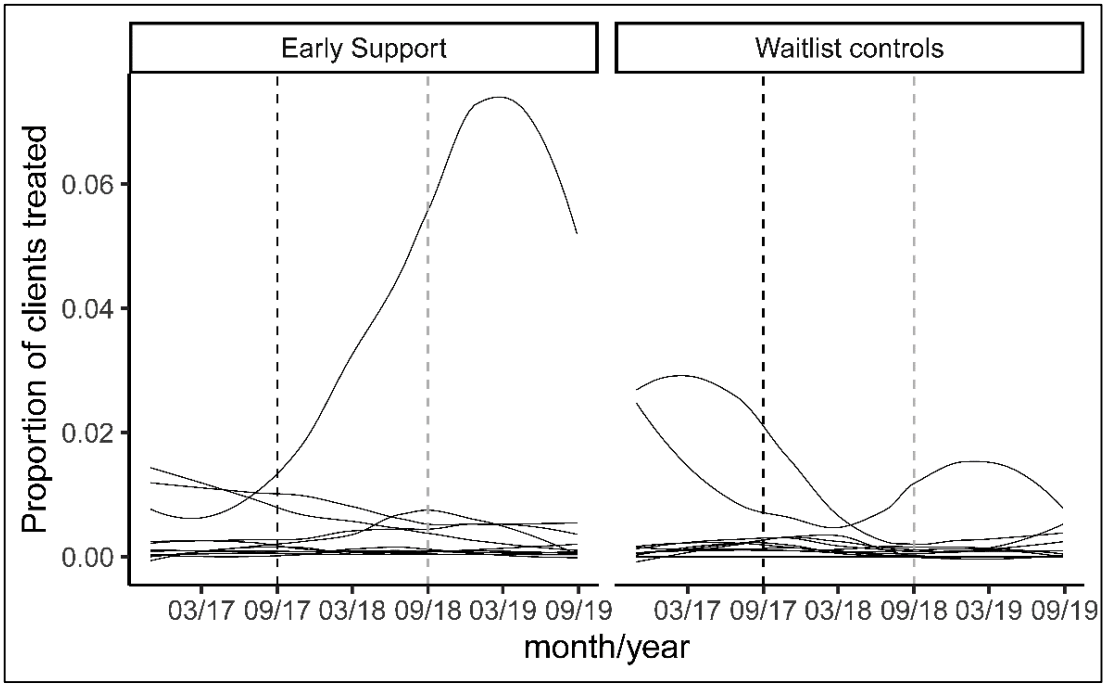
[a]Study period: from 29.08.2016 to 15.08.2019 inclusive. [b]An observation appeared in the dataset for a client if they attended their service for a consultation in the preceding two-month reference period at least once. [c]Mean score among clients who had at least one recorded AUDIT-C score. [d]UAU – unhealthy alcohol use; treatment as recorded in Communicare (i.e. advice recorded using selected clinical items or pharmacotherapies prescribed). [e]One service was unable to provide data from January 2019 onwards as they stopped using Communicare to log AUDIT-C results.

Figure S1. Unadjusted smoothed screening rates by service and trial arm



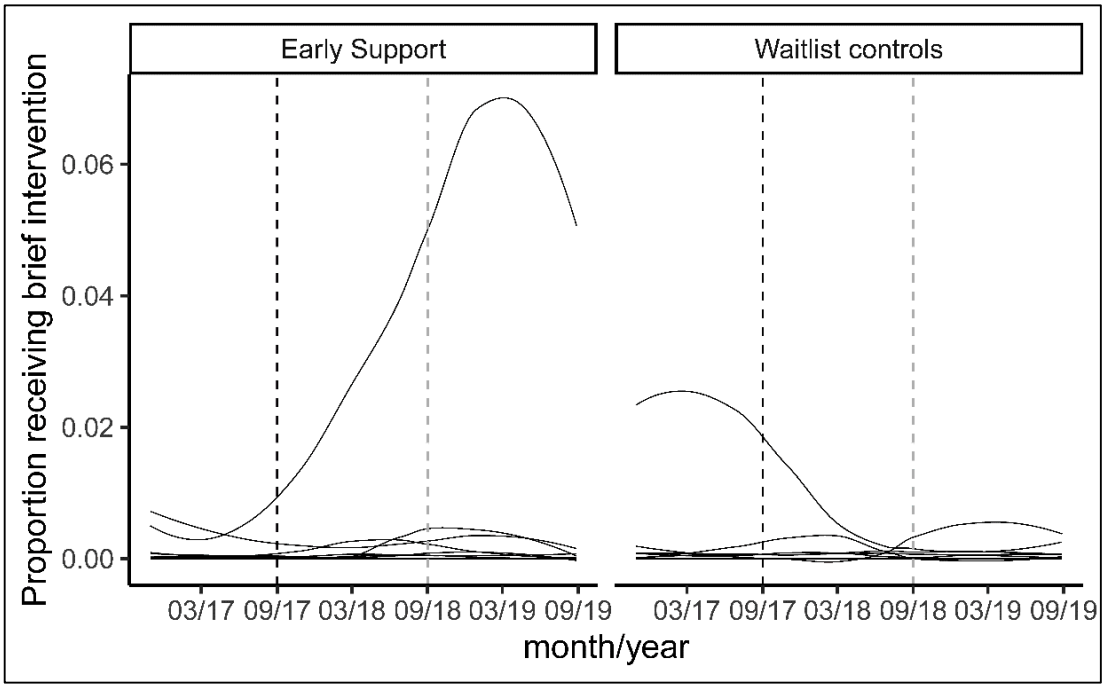
Rates are records of screening for a patient per two-month reference period. Black dashed vertical line denotes start of active implementation phase. Grey dashed vertical line denotes start of maintenance phase.

Figure S2 Unadjusted smoothed rates of any-treatment by service and trial arm



Rates are records of any-treatment for a patient per two-month reference period. Black dashed vertical line denotes start of active implementation phase. Grey dashed vertical line denotes start of maintenance phase.

Figure S3. Unadjusted smoothed rates of brief intervention by service and trial arm



Rates are records of any-treatment for a patient per two-month reference period. Black dashed vertical line denotes start of active implementation phase. Grey dashed vertical line denotes start of maintenance phase.

SECTION S4 ANALYSIS CODE: EXAMPLE OF PROCEDURE

Below is the procedure for analysis in R statistical package. This example is for the outcome of screening with AUDIT-C. The same procedure was followed for the outcomes of any-treatment and brief intervention.

DATA TRANSFORMATION

Load data and packages

```
library(plyr)
library(tidyverse)
library(lubridate)
library(optimx)
library(dfoptim)
library(performance)
library(car)
tx_monthly_data <- readRDS("tx_data.rds")
```

Set Seed

```
set.seed(42)
knitr::opts_chunk$set(cache.extra = knitr::rand_seed)
```

Subset data to consultations occurring before late support implementation

```
tx_monthly_data$last.visit<-as.Date(tx_monthly_data$last.visit, format = "%d/%m/
%Y")
tx_monthly_data<-tx_monthly_data%>%filter(last.visit<dmy("16-08-2019"))
```

Subset baseline data to one year pre-implementation (baseline: 29 August 2016)

```
tx_monthly_data<-tx_monthly_data%>%filter(last.visit>dmy("28-08-2016"))
```

Recode the variable: "condition" to numeric

```
tx_monthly_data$condition<-as.character(tx_monthly_data$condition)%>%
  mapvalues(c("Early","Late"), c(1,0))%>%
  as.numeric()
```

Create a new variable: Implementation date

```
tx_monthly_data$implDate<-dmy("31-08-2017")
```

Create a new variable: Is consult pre or post-implementation?

```
tx_monthly_data$postImpl<-ifelse(tx_monthly_data$last.visit<tx_monthly_data$impl
Date,0,1)
```

ANALYSIS

MODELS WITH RANDOM EFFECTS OF SERVICE

Random intercept of service

```
CIMpostImpl_scr<-glmer(audit~postImpl*condition+(1|service), data=tx_monthly_dat
a, family="binomial")
summary(CIMpostImpl_scr)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: audit ~ postImpl * condition + (1 | service)
##    Data: tx_monthly_data
##
##       AIC       BIC    logLik  deviance  df.resid
##  272282.3  272337.0 -136136.1  272272.3    417223
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.7302 -0.4177 -0.2832 -0.1824  8.1704
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  service (Intercept) 0.6234   0.7895
## Number of obs: 417228, groups:  service, 22
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept)        -2.39571    0.11726 -20.431  < 2e-16 ***
## postImpl            0.20728    0.01823  11.370  < 2e-16 ***
## condition          -0.53495    0.15419  -3.469 0.000521 ***
## postImpl:condition  0.59076    0.02330  25.354  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) pstImp condtn
## postImpl    -0.046
## condition   -0.552  0.026
## pstImpl:cnd  0.036 -0.771 -0.019
```

Random intercept of service and random slope of post-implementation by service

```
AIMpostImpl_scr<-glmer(audit~postImpl*condition+(1+postImpl|service), data=tx_monthly_data, family="binomial")
summary(AIMpostImpl_scr)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: audit ~ postImpl * condition + (1 + postImpl | service)
##    Data: tx_monthly_data
##
##       AIC       BIC    logLik  deviance  df.resid
##  265118.9  265195.5 -132552.4  265104.9    417221
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -0.806 -0.454 -0.301 -0.082 62.802
##
## Random effects:
##  Groups  Name        Variance Std.Dev. Corr
##  service (Intercept) 9.863    3.141
##          postImpl    8.249    2.872    -0.98
## Number of obs: 417228, groups:  service, 22
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -3.70331    0.10096  -36.68   <2e-16 ***
## postImpl            1.62898    0.09232   17.65   <2e-16 ***
## condition          -2.04207    0.12657  -16.13   <2e-16 ***
## postImpl:condition  2.06773    0.09475   21.82   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) pstImp condtn
## postImpl    -0.246
## condition   -0.500  0.081
## pstImpl:cnd  0.062 -0.342 -0.080
```

Comparing nested models

```
anova(CIMpostImpl_scr, AIMpostImpl_scr)
```

```
## Data: tx_monthly_data
## Models:
## CIMpostImpl_scr: audit ~ postImpl * condition + (1 | service)
## AIMpostImpl_scr: audit ~ postImpl * condition + (1 + postImpl | service)
##                 npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## CIMpostImpl_scr    5 272282 272337 -136136   272272
## AIMpostImpl_scr    7 265119 265195 -132552   265105 7167.4  2  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

MODELS WITH RANDOM EFFECTS OF SERVICE AND CLIENT

Random intercept of service and of client

```
CIMpostImplID_scr<-glmer(audit~postImpl*condition+(1|service)+(1|id), data=tx_mo
nthly_data, family="binomial")
summary(CIMpostImplID_scr)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: audit ~ postImpl * condition + (1 | service) + (1 | id)
##    Data: tx_monthly_data
##
##       AIC       BIC    logLik  deviance  df.resid
##  272173.1  272238.7 -136080.5  272161.1    417222
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.8924 -0.4140 -0.2829 -0.1812  8.0431
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  id      (Intercept) 0.06419  0.2534
##  service (Intercept) 0.62480  0.7904
## Number of obs: 417228, groups:  id, 83032; service, 22
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -2.42542    0.17165 -14.130   <2e-16 ***
## postImpl            0.20852    0.01860  11.208   <2e-16 ***
## condition          -0.53485    0.24506  -2.183   0.0291 *
## postImpl:condition  0.59309    0.02382  24.894   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) pstImp condtn
## postImpl    -0.039
## condition   -0.579  0.022
## pstImpl:cnd  0.027 -0.779 -0.035
```

Comparing nested models

```
anova(CIMpostImpl_scr,CIMpostImplID_scr)
```

```
## Data: tx_monthly_data
## Models:
## CIMpostImpl_scr: audit ~ postImpl * condition + (1 | service)
## CIMpostImplID_scr: audit ~ postImpl * condition + (1 | service) + (1 | id)
##                   npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## CIMpostImpl_scr      5 272282 272337 -136136   272272
## CIMpostImplID_scr    6 272173 272239 -136081   272161 111.23  1  < 2.2e-16 **
*
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Random intercept of service and of client and random slope of post-implementation by service

```
AIMALTpostImplID_scr<-glmer(audit~postImpl*condition+(1+postImpl|service)+(1|id)
, data=tx_monthly_data, family="binomial")
summary(AIMALTpostImplID_scr)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: audit ~ postImpl * condition + (1 + postImpl | service) + (1 |
##     id)
##    Data: tx_monthly_data
##
##       AIC       BIC    logLik  deviance  df.resid
##  265015.4  265102.9 -132499.7  264999.4    417220
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -0.982 -0.439 -0.302 -0.081 60.529
##
## Random effects:
##  Groups  Name        Variance Std.Dev. Corr
##  id      (Intercept) 0.06235  0.2497
##  service (Intercept) 9.86869  3.1414
##          postImpl    8.26193  2.8744   -0.98
## Number of obs: 417228, groups:  id, 83032; service, 22
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -3.7305     0.3206 -11.634  < 2e-16 ***
## postImpl             1.6280     0.2691   6.049 1.46e-09 ***
## condition           -2.0438     0.4388  -4.658 3.20e-06 ***
## postImpl:condition   2.0728     0.3451   6.007 1.89e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) pstImp condtn
## postImpl    -0.816
```

```
## condition   -0.256  0.029
## pstImpl:cnd  0.060 -0.087 -0.799
```

Comparing nested models

```
anova(AIMpostImpl_scr,AIMALTpostImplID_scr)
```

```
## Data: tx_monthly_data
## Models:
## AIMpostImpl_scr: audit ~ postImpl * condition + (1 + postImpl | service)
## AIMALTpostImplID_scr: audit ~ postImpl * condition + (1 + postImpl | service)
+ (1 |
## AIMALTpostImplID_scr:     id)
##                       npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## AIMpostImpl_scr          7 265119 265195 -132552   265105
## AIMALTpostImplID_scr     8 265015 265103 -132500   264999 105.48  1  < 2.2e-16
##
## AIMpostImpl_scr
## AIMALTpostImplID_scr ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

INTRACLASS CORRELATION COEFFICIENT

```
performance::icc(AIMALTpostImplID_scr)
```

```
## # Intraclass Correlation Coefficient
##
##      Adjusted ICC: 0.531
##   Conditional ICC: 0.398
```

MEASURES OF EFFECT

Odds Ratios

```
summ<-summary(AIMALTpostImplID_scr)
ORtab_scr<-data.frame(coef(summ))
ORtab_scr$OR<-exp(ORtab_scr$Estimate)
ORtab_scr$OR
```

```
## [1] 0.02398105 5.09361652 0.12953887 7.94709635
```

Confidence Intervals - log(CI)

```
AIMALTpostImplID_scrW<-confint(AIMALTpostImplID_scr,level=0.95 ,method="Wald")
AIMALTpostImplID_scrW
```

```
##                          2.5 %    97.5 %
## .sig01                      NA        NA
## .sig02                      NA        NA
## .sig03                      NA        NA
## .sig04                      NA        NA
## (Intercept)        -4.358944 -3.102039
## postImpl            1.100501  2.155475
## condition          -2.903824 -1.183724
## postImpl:condition  1.396515  2.749099
```

SIMPLE SLOPES ANALYSIS

```
simp_scr<-
  car::deltaMethod(AIMALTpostImplID_scr,
                   g.=c("(b2+b4)"),
                   parameterNames=paste0("b",1:4))%>%
  data.frame()
simp_scr
```

```
##           Estimate       SE   X2.5..  X97.5..
## (b2 + b4) 3.700795 0.418706 2.880146 4.521443
```

Simple slopes OR

```
ORtab_simp_scr<-exp(simp_scr)
ORtab_simp_scr
```

```
##           Estimate       SE   X2.5..  X97.5..
## (b2 + b4) 40.47946 1.519993 17.81688 91.96824
```

Simple slopes table

```
write.csv(ORtab_simp_scr,"ORtab_simp_scr.csv")
```

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