

Illustrative examples

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Set-up

```
# load functions
source("functions.R")

## -- Attaching packages ----- tidyverse
## v ggplot2 3.2.1      v purrr  0.3.2
## v tibble  2.1.3      v dplyr  0.8.3
## v tidyr   1.0.0      v stringr 1.4.0
## v readr   1.3.1      v forcats 0.4.0

## -- Conflicts ----- tidyverse_confli
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

## Loading required package: Matrix

##
## Attaching package: 'Matrix'

## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack

## Loading 'metafor' package (version 2.1-0). For an overview
## and introduction to the package please type: help(metafor).

##
## Attaching package: 'extraDistr'

## The following object is masked from 'package:purrr':
##
##     rdunif
```

Read in data

```
# read in data

file1 <- "CD005158StatsDataOnly.rm5"
dat1 <- xmlParse(file1)
dat1 <- xmlToList(dat1)

file2 <- "CD011047StatsDataOnly.rm5"
dat2 <- xmlParse(file2)
dat2 <- xmlToList(dat2)

# extract data from file 1
```

```

# extract subsets of data in which at least one zero occurred

## cardiovascular mortality
dat1_cardio_mort <- extract_data(
  data = dat1, no_outcome = 2,
  subgroup_from = 6, subgroup_to = 9
)

# extract data from file 2

## adverse event (serious)
dat2_adv_event_ser <- extract_data(
  data = dat2, no_outcome = 6,
  subgroup_from = 6, subgroup_to = 7
) %>%
  filter(!is.na(study_id))

## mortality (cardiovascular)
dat2_mort_cardio <- extract_data(
  data = dat2, no_outcome = 9,
  subgroup_from = 6, subgroup_to = 7
) %>%
  filter(!is.na(study_id))

## stroke fatal
dat2_stroke_fatal <- extract_data(
  data = dat2, no_outcome = 11,
  subgroup_from = 6, subgroup_to = 7
)

```

Prep data for analysis

```

# dat1_cardio_mort

## for standard models
dat1_cardio_mort <- dat1_cardio_mort %>%
  mutate(
    events_1 = as.numeric(events_1),
    events_2 = as.numeric(events_2),
    total_1 = as.numeric(total_1),
    total_2 = as.numeric(total_2),
    no_events_1 = total_1 - events_1,
    no_events_2 = total_2 - events_2
  )

dat1_cardio_mort_stand <- prep_data_standard(
  data = dat1_cardio_mort,
  treat_event = "events_1",
  treat_no_event = "no_events_1",
  control_event = "events_2",
  control_no_event = "no_events_2",

```

```

k = 0.5)

## in long format
dat1_cardio_mort_long <- dat1_cardio_mort %>%
  select(-c(no_events_1, no_events_2)) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

## in long format without double zero studies
dat1_cardio_mort_long_negbin <- dat1_cardio_mort_stand %>%
  select(study_id:total_2) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

# dat2_adv_event_ser

## for standard models
dat2_adv_event_ser <- dat2_adv_event_ser %>%
  mutate(
    events_1 = as.numeric(events_1),
    events_2 = as.numeric(events_2),
    total_1 = as.numeric(total_1),
    total_2 = as.numeric(total_2),
    no_events_1 = total_1 - events_1,
    no_events_2 = total_2 - events_2
  )

dat2_adv_event_ser_stand <- prep_data_standard(
  data = dat2_adv_event_ser,
  treat_event = "events_1",
  treat_no_event = "no_events_1",
  control_event = "events_2",
  control_no_event = "no_events_2",
  k = 0.5)

## in long format
dat2_adv_event_ser_long <- dat2_adv_event_ser %>%
  select(-c(no_events_1, no_events_2)) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

## in long format without double zero studies
dat2_adv_event_ser_long_negbin <- dat2_adv_event_ser_stand %>%
  select(study_id:total_2) %>%

```

```

gather(events_1:events_2, key = "group", value = "count") %>%
mutate(n = ifelse(group == "events_1", total_1, total_2),
       group = as.factor(group),
       group = factor(group, levels(group)[c(2,1)])) %>%
select(-c(total_1, total_2))

# dat2_mort_cardio

## for standard models
dat2_mort_cardio <- dat2_mort_cardio %>%
  mutate(
    events_1 = as.numeric(events_1),
    events_2 = as.numeric(events_2),
    total_1 = as.numeric(total_1),
    total_2 = as.numeric(total_2),
    no_events_1 = total_1 - events_1,
    no_events_2 = total_2 - events_2
  )

dat2_mort_cardio_stand <- prep_data_standard(
  data = dat2_mort_cardio,
  treat_event = "events_1",
  treat_no_event = "no_events_1",
  control_event = "events_2",
  control_no_event = "no_events_2",
  k = 0.5)

## in long format
dat2_mort_cardio_long <- dat2_mort_cardio %>%
  select(-c(no_events_1, no_events_2)) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

## in long format without double zero studies
dat2_mort_cardio_long_negbin <- dat2_mort_cardio_stand %>%
  select(study_id:total_2) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

# dat2_stroke_fatal

## for standard models
dat2_stroke_fatal <- dat2_stroke_fatal %>%
  mutate(
    events_1 = as.numeric(events_1),
    events_2 = as.numeric(events_2),
    total_1 = as.numeric(total_1),

```

```

    total_2 = as.numeric(total_2),
    no_events_1 = total_1 - events_1,
    no_events_2 = total_2 - events_2
  )

dat2_stroke_fatal_stand <- prep_data_standard(
  data = dat2_stroke_fatal,
  treat_event = "events_1",
  treat_no_event = "no_events_1",
  control_event = "events_2",
  control_no_event = "no_events_2",
  k = 0.5)

## in long format
dat2_stroke_fatal_long <- dat2_stroke_fatal %>%
  select(-c(no_events_1, no_events_2)) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

## in long format without double zero studies
dat2_stroke_fatal_long_negbin <- dat2_stroke_fatal_stand %>%
  select(study_id:total_2) %>%
  gather(events_1:events_2, key = "group", value = "count") %>%
  mutate(n = ifelse(group == "events_1", total_1, total_2),
         group = as.factor(group),
         group = factor(group, levels(group)[c(2,1)])) %>%
  select(-c(total_1, total_2))

```

Describe data

```

# dat1_cardio_mort
describe_data(
  data = dat1_cardio_mort,
  data_long = dat1_cardio_mort_long,
  data2 = dat1_cardio_mort_stand,
  data2_long = dat1_cardio_mort_long_negbin
)

## [1] "For dataset dat1_cardio_mort:"
## [1] "No. of studies: 7"
## [1] "Out of those, no. of single-zero studies: 1"
## [1] "Out of those, no. of double-zero studies: 0"
## [1] "Average sample size was 4557.57 with SD 6647.5"
## [1] "Minimal sample size is 86, maximal sample size is 15603"

# dat2_adv_event_ser
## that was the data set where only double-zero studies were included
describe_data(
  data = dat2_adv_event_ser,

```

```

data_long = dat2_adv_event_ser_long,
data2 = dat2_adv_event_ser_stand,
data2_long = dat2_adv_event_ser_long_negbin
)

## [1] "For dataset dat2_adv_event_ser:"
## [1] "No. of studies: 4"
## [1] "Out of those, no. of single-zero studies: 0"
## [1] "Out of those, no. of double-zero studies: 4"
## [1] "Average sample size was 118 with SD 89.71"
## [1] "Minimal sample size is 28, maximal sample size is 240"

# dat2_mort_cardio
describe_data(
  data = dat2_mort_cardio,
  data_long = dat2_mort_cardio_long,
  data2 = dat2_mort_cardio_stand,
  data2_long = dat2_mort_cardio_long_negbin
)

## [1] "For dataset dat2_mort_cardio:"
## [1] "No. of studies: 7"
## [1] "Out of those, no. of single-zero studies: 3"
## [1] "Out of those, no. of double-zero studies: 2"
## [1] "Average sample size was 161.71 with SD 174.25"
## [1] "Minimal sample size is 41, maximal sample size is 532"

# dat2_stroke_fatal
describe_data(
  data = dat2_stroke_fatal,
  data_long = dat2_stroke_fatal_long,
  data2 = dat2_stroke_fatal_stand,
  data2_long = dat2_stroke_fatal_long_negbin
)

## [1] "For dataset dat2_stroke_fatal:"
## [1] "No. of studies: 4"
## [1] "Out of those, no. of single-zero studies: 1"
## [1] "Out of those, no. of double-zero studies: 3"
## [1] "Average sample size was 228.75 with SD 215.32"
## [1] "Minimal sample size is 41, maximal sample size is 532"

```

Analysis

```

# dat1_cardio_mort

results_dat1_cardio_mort <- run_analyses(
  data = dat1_cardio_mort,
  data_long = dat1_cardio_mort_long,
  data2 = dat1_cardio_mort_stand,
  data2_long = dat1_cardio_mort_long_negbin
)

## boundary (singular) fit: see ?isSingular

```

```
## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## boundary (singular) fit: see ?isSingular

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Error in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1, :
## non-finite finite-difference value [1]
```

```
show_results(
  results = results_dat1_cardio_mort,
  data2 = dat1_cardio_mort_stand
)
```

```
## [1] "Results for m_REML:"
##
## Random-Effects Model (k = 7; tau^2 estimator: REML)
##
##      logLik  deviance      AIC      BIC      AICc
##    -4.1480    8.2960   12.2960   11.8795   16.2960
##
## tau^2 (estimated amount of total heterogeneity): 0 (SE = 0.0098)
## tau (square root of estimated tau^2 value):      0
## I^2 (total heterogeneity / total variability):    0.00%
## H^2 (total variability / sampling variability):   1.00
##
## Test for Heterogeneity:
## Q(df = 6) = 3.1450, p-val = 0.7904
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   -0.0176   0.0569   -0.3085   0.7577   -0.1292    0.0940
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```

## [1] "RR for m_REML:"
##      RR  CI_lower  CI_upper
## 0.9825880 0.8788184 1.0986106
## [1] "Results for m_REML_tcc:"
##
## Random-Effects Model (k = 7; tau^2 estimator: REML)
##
##      logLik  deviance      AIC      BIC      AICc
## -5.9093   11.8186   15.8186   15.4021   19.8186
##
## tau^2 (estimated amount of total heterogeneity): 0.0001 (SE = 0.0100)
## tau (square root of estimated tau^2 value):      0.0090
## I^2 (total heterogeneity / total variability):   0.22%
## H^2 (total variability / sampling variability):   1.00
##
## Test for Heterogeneity:
## Q(df = 6) = 2.9096, p-val = 0.8201
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
## -0.0161  0.0573  -0.2816  0.7782  -0.1285  0.0962
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_REML_tcc:"
##      RR  CI_lower  CI_upper
## 0.9839861 0.8794277 1.1009759
## [1] "Results for m_DL:"
##
## Random-Effects Model (k = 7; tau^2 estimator: DL)
##
##      logLik  deviance      AIC      BIC      AICc
## -3.1742    3.1450   10.3484   10.2403   13.3484
##
## tau^2 (estimated amount of total heterogeneity): 0 (SE = 0.0214)
## tau (square root of estimated tau^2 value):      0
## I^2 (total heterogeneity / total variability):   0.00%
## H^2 (total variability / sampling variability):   1.00
##
## Test for Heterogeneity:
## Q(df = 6) = 3.1450, p-val = 0.7904
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
## -0.0176  0.0569  -0.3085  0.7577  -0.1292  0.0940
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL:"
##      RR  CI_lower  CI_upper

```



```

## 0.9825880 0.8788184 1.0986106
## [1] "Results for m_DL_tcc:"
##
## Random-Effects Model (k = 7; tau^2 estimator: DL)
##
##      logLik  deviance      AIC      BIC      AICc
##    -4.9362    2.9096   13.8723   13.7642   16.8723
##
## tau^2 (estimated amount of total heterogeneity): 0 (SE = 0.0214)
## tau (square root of estimated tau^2 value):      0
## I^2 (total heterogeneity / total variability):   0.00%
## H^2 (total variability / sampling variability):   1.00
##
## Test for Heterogeneity:
## Q(df = 6) = 2.9096, p-val = 0.8201
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   -0.0164    0.0570   -0.2876    0.7736   -0.1281    0.0953
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL_tcc:"
##      RR  CI_lower  CI_upper
## 0.9837455 0.8797945 1.0999786
## [1] "Results for m_SJ:"
##
## Random-Effects Model (k = 7; tau^2 estimator: SJ)
##
##      logLik  deviance      AIC      BIC      AICc
##    -4.6221    6.0408   13.2443   13.1361   16.2443
##
## tau^2 (estimated amount of total heterogeneity): 0.0387 (SE = 0.0905)
## tau (square root of estimated tau^2 value):      0.1968
## I^2 (total heterogeneity / total variability):   51.14%
## H^2 (total variability / sampling variability):   2.05
##
## Test for Heterogeneity:
## Q(df = 6) = 3.1450, p-val = 0.7904
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##    0.0177    0.1366    0.1299    0.8966   -0.2499    0.2854
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ:"
##      RR  CI_lower  CI_upper
## 1.0179023 0.7788843 1.3302683
## [1] "Results for m_SJ_tcc:"

```

```

##
## Random-Effects Model (k = 7; tau^2 estimator: SJ)
##
##   logLik  deviance      AIC      BIC      AICc
##   -7.7712    8.5797   19.5425   19.4343   22.5425
##
## tau^2 (estimated amount of total heterogeneity): 0.1559 (SE = 0.7635)
## tau (square root of estimated tau^2 value):      0.3948
## I^2 (total heterogeneity / total variability):   80.76%
## H^2 (total variability / sampling variability):   5.20
##
## Test for Heterogeneity:
## Q(df = 6) = 2.9096, p-val = 0.8201
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   0.0384  0.2361  0.1627  0.8708  -0.4244  0.5013
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ_tcc:"
##      RR CI_lower CI_upper
## 1.0391665 0.6541533 1.6507857
## [1] "Results for m_poisson:"
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: poisson ( log )
## Formula: count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      88.4      91.6     -39.2     78.4        9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.99304 -0.41669  0.03942  0.08437  0.30520
##
## Random effects:
##   Groups   Name                Variance Std.Dev. Corr
##   study_id (Intercept)    0.3887    0.6234
##   groupevents_1 0.0138    0.1175   -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -3.9576    0.3072 -12.883  <2e-16 ***
## groupevents_1  0.1224    0.1367  0.895    0.371
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)

```

```

## groupvnts_1 -0.565
## convergence code: 0
## boundary (singular) fit: see ?isSingular
##
## [1] "RR for m_poiss:"
##      RR CI_lower CI_upper
## 1.130208 0.864517 1.477553
## [1] "Results for m_zip_rifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      6
##
## Random effects:
##
## Conditional model:
## Groups   Name              Variance Std.Dev. Corr
## study_id (Intercept)    0.38899  0.6237
## groupevents_1 0.01381  0.1175  -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Zero-inflation model:
## Groups   Name              Variance Std.Dev.
## study_id (Intercept) 2.678e+144 1.636e+72
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -3.9580      NA      NA      NA
## groupevents_1  0.1225      NA      NA      NA
##
## Zero-inflation model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -549.4      NA      NA      NA
## groupevents_1 -197.5      NA      NA      NA
## [1] "m_zip_rifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      7
##
## Random effects:
##
## Conditional model:
## Groups   Name              Variance Std.Dev. Corr

```

```

## study_id (Intercept) 0.38899 0.6237
## groupevents_1 0.01381 0.1175 -1.00
## Number of obs: 14, groups: study_id, 7
##
## Conditional model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -3.9580 NA NA NA
## groupevents_1 0.1225 NA NA NA
##
## Zero-inflation model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -1156.7 NA NA NA
## groupevents_1 131.5 NA NA NA
## [1] "m_zip_fifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_ri:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation: ~1 + (1 | study_id)
## Data: data_long
##
## AIC BIC logLik deviance df.resid
## NA NA NA NA 7
##
## Random effects:
##
## Conditional model:
## Groups Name Variance Std.Dev. Corr
## study_id (Intercept) 0.38898 0.6237
## groupevents_1 0.01381 0.1175 -1.00
## Number of obs: 14, groups: study_id, 7
##
## Zero-inflation model:
## Groups Name Variance Std.Dev.
## study_id (Intercept) 2.525e-260 1.589e-130
## Number of obs: 14, groups: study_id, 7
##
## Conditional model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -3.9580 NA NA NA
## groupevents_1 0.1225 NA NA NA
##
## Zero-inflation model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -836.3 NA NA NA
## [1] "m_zip_ri did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fi:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation: ~1
## Data: data_long
##
## AIC BIC logLik deviance df.resid

```

```

##      NA      NA      NA      NA      8
##
## Random effects:
##
## Conditional model:
##   Groups   Name          Variance Std.Dev. Corr
##   study_id (Intercept)  0.38898  0.6237
##           groupevents_1 0.01381  0.1175  -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -3.9580          NA      NA      NA
## groupevents_1  0.1225          NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -2772          NA      NA      NA
## [1] "m_zip_fi did not converge properly (no standard errors were computed)."
## [1] "Results for m_cond_binom:"
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##   Family: binomial ( logit )
## Formula:
## cbind(events_1, events_2) ~ 1 + (1 | study_id) + offset(log(group_ratio))
##   Data: data2
##
##      AIC      BIC    logLik deviance df.resid
##    30.2    30.1    -13.1    26.2         5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.9829 -0.6524 -0.0204  0.3044  1.2051
##
## Random effects:
##   Groups   Name          Variance Std.Dev.
##   study_id (Intercept)  0          0
## Number of obs: 7, groups:  study_id, 7
##
## Fixed effects:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.01682    0.05813  -0.289    0.772
## convergence code: 0
## boundary (singular) fit: see ?isSingular
##
## [1] "RR for m_cond_binom:"
##           RR CI_lower CI_upper
## 0.9833194 0.8774370 1.1019789
## [1] "Results for m_beta_binom:"
##   Family: betabinomial ( logit )
## Formula:
##           cbind(events_1, events_2) ~ 1 + offset(log(group_ratio))
##   Data: data2
##
##      AIC      BIC    logLik deviance df.resid

```

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##      30.2      30.1      -13.1      26.2      5
##
##
## Overdispersion parameter for betabinomial family (): 6.92e+07
##
## Conditional model:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.01682    0.05813  -0.289   0.772
## [1] "RR for m_beta_binom:"
##           RR CI_lower CI_upper
## 0.9833159 0.8774334 1.1019755
## [1] "Results for m_kuss_binom:"
## $par
##           b0           b1           prec
## -3.64014725 -0.06766926 122.37098462
##
## $value
## [1] 45.73919
##
## $counts
## function gradient
##      196      NA
##
## $convergence
## [1] 0
##
## $message
## NULL
##
## $hessian
##           b0           b1           prec
## b0  29.353859102 13.639897485 0.0041356625
## b1  13.639897485 13.639897482 -0.0024671571
## prec 0.004135662 -0.002467157 0.0002431761
##
## [1] "RR for m_kuss_binom:"
##           RR CI_lower CI_upper
## 0.9345695 0.4506866 1.9379771
## [1] "Results for m_cai_binom:"
## [1] "Error in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1, : \n non-finite fi
## attr("class")
## [1] "try-error"
## attr("condition")
## <simpleError in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1, Y2 = data2$ever
## [1] "Trying to compute m_cai_binom failed."
## [1] "RR for cai_binom:"
## [1] "There was an error in computing the model. No RR available."
# dat2_adv_event_ser

## that was the data set where only double-zero studies were included
results_dat2_adv_event_ser <- run_analyses(
  data = dat2_adv_event_ser,
  data_long = dat2_adv_event_ser_long,

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data2 = dat2_adv_event_ser_stand,
data2_long = dat2_adv_event_ser_long_negbin
)

## Error in rma(yi = yi, vi = vi, data = data2, method = "REML") :
##   Processing terminated since k = 0.
## Error in rma(yi = log_RR_tcc, vi = log_RR_tcc_var, data = data2, method = "REML") :
##   Processing terminated since k = 0.
## Error in rma(yi = yi, vi = vi, data = data2, method = "DL") :
##   Processing terminated since k = 0.
## Error in rma(yi = log_RR_tcc, vi = log_RR_tcc_var, data = data2, method = "DL") :
##   Processing terminated since k = 0.
## Error in rma(yi = yi, vi = vi, data = data2, method = "SJ") :
##   Processing terminated since k = 0.
## Error in rma(yi = log_RR_tcc, vi = log_RR_tcc_var, data = data2, method = "SJ") :
##   Processing terminated since k = 0.
## Error : Response is constant

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Error : Invalid grouping factor specification, study_id

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

show_results(
  results = results_dat2_adv_event_ser,
  data2 = dat2_adv_event_ser_stand
)

## [1] "Results for m_REML:"
##   Length      Class      Mode
##      1 try-error character
## [1] "RR for m_REML:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_REML_tcc:"
##   Length      Class      Mode
##      1 try-error character

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## [1] "RR for m_REML_tcc:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_DL:"
##      Length      Class      Mode
##      1 try-error character
## [1] "RR for m_DL:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_DL_tcc:"
##      Length      Class      Mode
##      1 try-error character
## [1] "RR for m_DL_tcc:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_SJ:"
##      Length      Class      Mode
##      1 try-error character
## [1] "RR for m_SJ:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_SJ_tcc:"
##      Length      Class      Mode
##      1 try-error character
## [1] "RR for m_SJ_tcc:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_poisson:"
##      Length      Class      Mode
##      1 try-error character
## [1] "RR for m_poisson:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_zip_rifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      0
##
## Random effects:
##
## Conditional model:
##      Groups   Name              Variance Std.Dev. Corr
##      study_id (Intercept)    1.002    1.001
##      groupevents_1 1.000    1.000    0.00
## Number of obs: 8, groups:  study_id, 4
##
## Zero-inflation model:
##      Groups   Name              Variance Std.Dev.
##      study_id (Intercept) 2.608e-13 5.107e-07
## Number of obs: 8, groups:  study_id, 4
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -0.0046567      NA      NA      NA
## groupevents_1  0.0001805      NA      NA      NA

```



```
##
## Zero-inflation model:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)      32.44         NA      NA      NA
## groupevents_1      6.44         NA      NA      NA
## [1] "m_zip_rifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fifs:"

## Warning in sqrt(diag(vcov)): NaNs produced

## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      1
##
## Random effects:
##
## Conditional model:
## Groups   Name              Variance Std.Dev. Corr
## study_id (Intercept)    0.9977   0.9988
##      groupevents_1 0.9972   0.9986   0.00
## Number of obs: 8, groups: study_id, 4
##
## Conditional model:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)    0.01532         NA      NA      NA
## groupevents_1  0.01657         NA      NA      NA
##
## Zero-inflation model:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)    3.550e+01  2.560e+07      0      1
## groupevents_1  2.364e+00  8.731e+07      0      1
##
## Warning in sqrt(diag(vcov)): NaNs produced
##
## Warning in sqrt(diag(vcov)): NaNs produced
##
## [1] "m_zip_fifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_ri:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      1
##
## Random effects:
##
## Conditional model:
## Groups   Name              Variance Std.Dev. Corr
```

```

## study_id (Intercept) 1.002 1.001
## groupevents_1 1.001 1.000 0.00
## Number of obs: 8, groups: study_id, 4
##
## Zero-inflation model:
## Groups Name Variance Std.Dev.
## study_id (Intercept) 1.369e-12 1.17e-06
## Number of obs: 8, groups: study_id, 4
##
## Conditional model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.007728 NA NA NA
## groupevents_1 -0.005163 NA NA NA
##
## Zero-inflation model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) 33.91 NA NA NA
## [1] "m_zip_ri did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fi:"
##
## Warning in sqrt(diag(vcov)): NaNs produced
##
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation: ~1
## Data: data_long
##
## AIC BIC logLik deviance df.resid
## NA NA NA NA 2
##
## Random effects:
##
## Conditional model:
## Groups Name Variance Std.Dev. Corr
## study_id (Intercept) 1.003 1.001
## groupevents_1 1.001 1.001 0.00
## Number of obs: 8, groups: study_id, 4
##
## Conditional model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.013065 NA NA NA
## groupevents_1 -0.008809 NA NA NA
##
## Zero-inflation model:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) 3.449e+01 1.092e+07 0 1
##
## Warning in sqrt(diag(vcov)): NaNs produced
##
## Warning in sqrt(diag(vcov)): NaNs produced
##
## [1] "m_zip_fi did not converge properly (no standard errors were computed)."
## [1] "Results for m_cond_binom:"
## Length Class Mode
## 1 try-error character

```

```

## [1] "RR for m_cond_binom:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_beta_binom:"
## Family: betabinomial ( logit )
## Formula:          cbind(events_1, events_2) ~ 1 + offset(log(group_ratio))
## Data: data2
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      -2
##
##
## Overdispersion parameter for betabinomial family (): 1
##
## Conditional model:
##      Estimate Std. Error z value Pr(>|z|)
## (Intercept)      0      NA      NA      NA
## [1] "RR for m_beta_binom:"
##      RR CI_lower CI_upper
##      1      NaN      NaN
## [1] "Results for m_kuss_binom:"
## $par
##      b0      b1      prec
## -47.866667  6.366667 15.233333
##
## $value
## [1] 0
##
## $counts
## function gradient
##      36      NA
##
## $convergence
## [1] 0
##
## $message
## NULL
##
## $hessian
##      b0 b1 prec
## b0    0  0  0
## b1    0  0  0
## prec  0  0  0
##
## [1] "RR for m_kuss_binom:"
## [[1]]
##      RR CI_lower CI_upper
## 582.1142      NA      NA
##
## [[2]]
## [1] "Hessian matrix included only zeroes."
##
## [1] "Results for m_cai_binom:"
## $par
## gamma  psi

```

```
## 0.1 0.1
##
## $value
## [1] 0
##
## $counts
## function gradient
##      3      NA
##
## $convergence
## [1] 0
##
## $message
## NULL
##
## $hessian
##      gamma psi
## gamma      0  0
## psi        0  0
##
## [1] "RR for cai_binom:"
## [1] "All studies were double-zero studies and excluded for the computation\n
```

of this mode

```
# dat2_mort_cardio
```

```
results_dat2_mort_cardio <- run_analyses(
  data = dat2_mort_cardio,
  data_long = dat2_mort_cardio_long,
  data2 = dat2_mort_cardio_stand,
  data2_long = dat2_mort_cardio_long_negbin
)
```

```
## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## boundary (singular) fit: see ?isSingular

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
```

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## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Error in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1, :
##   non-finite finite-difference value [1]

show_results(
  results = results_dat2_mort_cardio,
  data2 = dat2_mort_cardio_stand
)

## [1] "Results for m_REML:"
##
## Random-Effects Model (k = 5; tau^2 estimator: REML)
##
##   logLik deviance      AIC      BIC      AICc
##   -7.2292  14.4584  18.4584  17.2310  30.4584
##
## tau^2 (estimated amount of total heterogeneity): 0.3683 (SE = 1.6385)
## tau (square root of estimated tau^2 value):      0.6069
## I^2 (total heterogeneity / total variability):    15.64%
## H^2 (total variability / sampling variability):   1.19
##
## Test for Heterogeneity:
## Q(df = 4) = 4.2992, p-val = 0.3670
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   -1.0605   0.6820  -1.5550   0.1199   -2.3971    0.2762
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_REML:"
##           RR   CI_lower   CI_upper
## 0.34628895 0.09097987 1.31805027
## [1] "Results for m_REML_tcc:"
##
## Random-Effects Model (k = 5; tau^2 estimator: REML)
##
##   logLik deviance      AIC      BIC      AICc
##  -11.1083  22.2166  26.2166  24.9892  38.2166
##
## tau^2 (estimated amount of total heterogeneity): 1.0324 (SE = 3.6088)
## tau (square root of estimated tau^2 value):      1.0160
## I^2 (total heterogeneity / total variability):    15.60%
## H^2 (total variability / sampling variability):   1.18
##
## Test for Heterogeneity:
## Q(df = 4) = 2.6757, p-val = 0.6135
##
## Model Results:
##

```

```

## estimate      se      zval    pval    ci.lb    ci.ub
## -1.4147  1.0879 -1.3003  0.1935 -3.5470  0.7177
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_REML_tcc:"
##      RR  CI_lower  CI_upper
## 0.2430087 0.0288116 2.0496333
## [1] "Results for m_DL:"
##
## Random-Effects Model (k = 5; tau^2 estimator: DL)
##
##      logLik  deviance      AIC      BIC      AICc
## -8.5284    4.3246   21.0568   20.2757   27.0568
##
## tau^2 (estimated amount of total heterogeneity): 0.1486 (SE = 1.5108)
## tau (square root of estimated tau^2 value):      0.3855
## I^2 (total heterogeneity / total variability):   6.96%
## H^2 (total variability / sampling variability):   1.07
##
## Test for Heterogeneity:
## Q(df = 4) = 4.2992, p-val = 0.3670
##
## Model Results:
##
## estimate      se      zval    pval    ci.lb    ci.ub
## -1.0947  0.6453 -1.6963  0.0898 -2.3596  0.1701 .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL:"
##      RR  CI_lower  CI_upper
## 0.33463111 0.09445995 1.18545460
## [1] "Results for m_DL_tcc:"
##
## Random-Effects Model (k = 5; tau^2 estimator: DL)
##
##      logLik  deviance      AIC      BIC      AICc
## -12.7381    2.6757   29.4762   28.6951   35.4762
##
## tau^2 (estimated amount of total heterogeneity): 0 (SE = 3.9506)
## tau (square root of estimated tau^2 value):      0
## I^2 (total heterogeneity / total variability):   0.00%
## H^2 (total variability / sampling variability):   1.00
##
## Test for Heterogeneity:
## Q(df = 4) = 2.6757, p-val = 0.6135
##
## Model Results:
##
## estimate      se      zval    pval    ci.lb    ci.ub
## -1.5559  0.8267 -1.8820  0.0598 -3.1763  0.0645 .

```

```

##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL_tcc:"
##      RR      CI_lower      CI_upper
## 0.21100223 0.04174173 1.06660512
## [1] "Results for m_SJ:"
##
## Random-Effects Model (k = 5; tau^2 estimator: SJ)
##
##      logLik  deviance      AIC      BIC      AICc
## -8.7275    4.7229   21.4551   20.6740   27.4551
##
## tau^2 (estimated amount of total heterogeneity): 0.8985 (SE = 0.9127)
## tau (square root of estimated tau^2 value):      0.9479
## I^2 (total heterogeneity / total variability):   31.13%
## H^2 (total variability / sampling variability):   1.45
##
## Test for Heterogeneity:
## Q(df = 4) = 4.2992, p-val = 0.3670
##
## Model Results:
##
##      estimate      se      zval      pval      ci.lb      ci.ub
## -1.0052    0.7607   -1.3214    0.1864   -2.4963    0.4858
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ:"
##      RR      CI_lower      CI_upper
## 0.36595592 0.08239092 1.62546728
## [1] "Results for m_SJ_tcc:"
##
## Random-Effects Model (k = 5; tau^2 estimator: SJ)
##
##      logLik  deviance      AIC      BIC      AICc
## -13.2038    3.6072   30.4076   29.6265   36.4076
##
## tau^2 (estimated amount of total heterogeneity): 2.5542 (SE = 6.1310)
## tau (square root of estimated tau^2 value):      1.5982
## I^2 (total heterogeneity / total variability):   31.37%
## H^2 (total variability / sampling variability):   1.46
##
## Test for Heterogeneity:
## Q(df = 4) = 2.6757, p-val = 0.6135
##
## Model Results:
##
##      estimate      se      zval      pval      ci.lb      ci.ub
## -1.3365    1.3656   -0.9787    0.3277   -4.0131    1.3401
##
## ---

```

```

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ_tcc:"
##      RR      CI_lower  CI_upper
## 0.26276522 0.01807796 3.81932166
## [1] "Results for m_poisson:"
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: poisson ( log )
## Formula: count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##    39.8    43.0    -14.9    29.8        9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0094 -0.5999 -0.3636  0.3669  1.9059
##
## Random effects:
## Groups Name Variance Std.Dev. Corr
## study_id (Intercept) 0.2279 0.4774
## groupevents_1 0.7172 0.8469 -1.00
## Number of obs: 14, groups: study_id, 7
##
## Fixed effects:
## Estimate Std. Error z value Pr(>|z|)
## (Intercept) -3.9086 0.5038 -7.758 8.65e-15 ***
## groupevents_1 -1.3107 0.8438 -1.553 0.12
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr)
## groupvnts_1 -0.709
## [1] "RR for m_poisson:"
##      RR      CI_lower  CI_upper
## 0.26963338 0.05158541 1.40935515
## [1] "Results for m_zip_rifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation: ~1 + group + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA        6
##
## Random effects:
##
## Conditional model:
## Groups Name Variance Std.Dev. Corr
## study_id (Intercept) 0.2279 0.4774
## groupevents_1 0.7172 0.8469 -1.00

```



```

## Number of obs: 14, groups:  study_id, 7
##
## Zero-inflation model:
##   Groups   Name                Variance   Std.Dev.
##   study_id (Intercept) 3.556e-308 1.886e-154
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -3.909         NA      NA      NA
## groupevents_1  -1.311         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -890.6         NA      NA      NA
## groupevents_1  -743.3         NA      NA      NA
## [1] "m_zip_rifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      7
##
## Random effects:
##
## Conditional model:
##   Groups   Name                Variance Std.Dev. Corr
##   study_id (Intercept)  0.2279  0.4774
##   groupevents_1 0.7172  0.8469  -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -3.909         NA      NA      NA
## groupevents_1  -1.311         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -491.2         NA      NA      NA
## groupevents_1  -613.0         NA      NA      NA
## [1] "m_zip_fifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_ri:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      7

```

```

##
## Random effects:
##
## Conditional model:
##   Groups   Name                Variance Std.Dev. Corr
##   study_id (Intercept)    0.2279   0.4774
##           groupevents_1 0.7172   0.8469  -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Zero-inflation model:
##   Groups   Name                Variance Std.Dev.
##   study_id (Intercept) 4.592e-158 2.143e-79
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)      -3.909         NA      NA      NA
## groupevents_1    -1.311         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)     -1779         NA      NA      NA
## [1] "m_zip_ri did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fi:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      8
##
## Random effects:
##
## Conditional model:
##   Groups   Name                Variance Std.Dev. Corr
##   study_id (Intercept)    0.2279   0.4774
##           groupevents_1 0.7172   0.8469  -1.00
## Number of obs: 14, groups:  study_id, 7
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)      -3.909         NA      NA      NA
## groupevents_1    -1.311         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)     -1224         NA      NA      NA
## [1] "m_zip_fi did not converge properly (no standard errors were computed)."
## [1] "Results for m_cond_binom:"
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )

```

```

## Formula:
## cbind(events_1, events_2) ~ 1 + (1 | study_id) + offset(log(group_ratio))
##   Data: data2
##
##      AIC      BIC   logLik deviance df.resid
##    14.0    13.2    -5.0    10.0      3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.7712 -0.6766 -0.4271  1.2718  2.3046
##
## Random effects:
##   Groups   Name      Variance Std.Dev.
## study_id (Intercept) 0          0
## Number of obs: 5, groups: study_id, 5
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -1.6347      0.6364  -2.569   0.0102 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## convergence code: 0
## boundary (singular) fit: see ?isSingular
##
## [1] "RR for m_cond_binom:"
##      RR   CI_lower   CI_upper
## 0.19500884 0.05602066 0.67882898
## [1] "Results for m_beta_binom:"
## Family: betabinomial ( logit )
## Formula:      cbind(events_1, events_2) ~ 1 + offset(log(group_ratio))
## Data: data2
##
##      AIC      BIC   logLik deviance df.resid
##      NA      NA      NA      NA      3
##
##
## Overdispersion parameter for betabinomial family (): 7.46e+06
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -1.6347      0.6364  -2.569   0.0102 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## [1] "RR for m_beta_binom:"
##      RR   CI_lower   CI_upper
## 0.1950089 0.0560207 0.6788292
## [1] "Results for m_kuss_binom:"
## $par
##      b0      b1      prec
## -3.663631e+00 -1.611172e+00 1.967018e+07
##
## $value
## [1] 15.22815
##

```

```

## $counts
## function gradient
##      496      NA
##
## $convergence
## [1] 0
##
## $message
## NULL
##
## $hessian
##           b0           b1           prec
## b0  1.738177e+01  3.015186e+00  2.764864e-04
## b1  3.015186e+00  3.015186e+00 -4.365575e-05
## prec 2.764864e-04 -4.365575e-05 -1.571607e-03
##
## [1] "RR for m_kuss_binom:"
##      RR      CI_lower      CI_upper
## 0.19965353 0.05768634 0.69100469
## [1] "Results for m_cai_binom:"
## [1] "Error in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1, : \n non-finite fi
## attr("class")
## [1] "try-error"
## attr("condition")
## <simpleError in optim(par = theta_init, fn = likelihood_cai, Y1 = data2$events_1,      Y2 = data2$sever
## [1] "Trying to compute m_cai_binom failed."
## [1] "RR for cai_binom:"
## [1] "There was an error in computing the model. No RR available."
# dat2_stroke_fatal

results_dat2_stroke_fatal <- run_analyses(
  data = dat2_stroke_fatal,
  data_long = dat2_stroke_fatal_long,
  data2 = dat2_stroke_fatal_stand,
  data2_long = dat2_stroke_fatal_long_negbin
)

## boundary (singular) fit: see ?isSingular

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =

```

```

## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in nlminb(start = par, objective = fn, gradient = gr, control =
## control$optCtrl): NA/NaN function evaluation

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; singular
## convergence (7). See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; non-positive-
## definite Hessian matrix. See vignette('troubleshooting')

## Error : grouping factors must have > 1 sampled level

## Warning in fitTMB(TMBStruc): Model convergence problem; extreme or very
## small eigen values detected. See vignette('troubleshooting')

## Warning in fitTMB(TMBStruc): Model convergence problem; false convergence
## (8). See vignette('troubleshooting')

## Error in optim(par = theta_init_beta, fn = likelihood_kuss, treat_event = data$events_1, :
## non-finite finite-difference value [1]

## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced

## Warning in beta((psi * gamma), (psi * W)): NaNs produced

## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced

## Warning in beta((psi * gamma), (psi * W)): NaNs produced

## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced

## Warning in beta((psi * gamma), (psi * W)): NaNs produced

## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced

## Warning in beta((psi * gamma), (psi * W)): NaNs produced

```

```
## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced
## Warning in beta((psi * gamma), (psi * W)): NaNs produced
## Warning in beta((psi * gamma + Y1), (psi * W + Y2)): NaNs produced
## Warning in beta((psi * gamma), (psi * W)): NaNs produced
```

```
show_results(
  results = results_dat2_stroke_fatal,
  data2 = dat2_stroke_fatal_stand
)
```

```
## [1] "Results for m_REML:"
##
## Fixed-Effects Model (k = 1)
##
##   logLik  deviance      AIC      BIC      AICc
##   -1.4060    0.0000    4.8120    2.8120    8.8120
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb    ci.ub
##    1.0808    1.6275  0.6641  0.5067  -2.1091  4.2706
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_REML:"
##           RR  CI_lower  CI_upper
##    2.946903  0.121345 71.566514
## [1] "Results for m_REML_tcc:"
##
## Fixed-Effects Model (k = 1)
##
##   logLik  deviance      AIC      BIC      AICc
##   -3.6180    0.0000    9.2359    7.2359   13.2359
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb    ci.ub
##    5.3801   14.8653  0.3619  0.7174  -23.7554  34.5155
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_REML_tcc:"
##           RR      CI_lower      CI_upper
##    2.170367e+02 4.821204e-11 9.770363e+14
## [1] "Results for m_DL:"
```

```

##
## Fixed-Effects Model (k = 1)
##
##   logLik  deviance      AIC      BIC      AICc
## -1.4060    0.0000    4.8120    2.8120    8.8120
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   1.0808   1.6275   0.6641   0.5067   -2.1091   4.2706
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL:"
##      RR  CI_lower  CI_upper
## 2.946903 0.121345 71.566514
## [1] "Results for m_DL_tcc:"
##
## Fixed-Effects Model (k = 1)
##
##   logLik  deviance      AIC      BIC      AICc
## -3.6180    0.0000    9.2359    7.2359   13.2359
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub
##   5.3801  14.8653   0.3619   0.7174  -23.7554   34.5155
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_DL_tcc:"
##      RR      CI_lower      CI_upper
## 2.170367e+02 4.821204e-11 9.770363e+14
## [1] "Results for m_SJ:"
##
## Fixed-Effects Model (k = 1)
##
##   logLik  deviance      AIC      BIC      AICc
## -1.4060    0.0000    4.8120    2.8120    8.8120
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se      zval      pval      ci.lb      ci.ub

```

```

##    1.0808  1.6275  0.6641  0.5067  -2.1091  4.2706
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ:"
##      RR  CI_lower  CI_upper
## 2.946903  0.121345 71.566514
## [1] "Results for m_SJ_tcc:"
##
## Fixed-Effects Model (k = 1)
##
##    logLik  deviance      AIC      BIC      AICc
## -3.6180    0.0000    9.2359    7.2359   13.2359
##
## Test for Heterogeneity:
## Q(df = 0) = 0.0000, p-val = 1.0000
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb    ci.ub
## 5.3801  14.8653  0.3619  0.7174  -23.7554  34.5155
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## [1] "RR for m_SJ_tcc:"
##      RR      CI_lower      CI_upper
## 2.170367e+02 4.821204e-11 9.770363e+14
## [1] "Results for m_pois:"
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: poisson ( log )
## Formula: count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##    14.9    15.3     -2.4      4.9        3
##
## Scaled residuals:
##      Min      1Q  Median      3Q      Max
## -0.7705 -0.2465  0.0000  0.0000  1.5738
##
## Random effects:
## Groups   Name              Variance Std.Dev. Corr
## study_id (Intercept)    0.001414  0.03761
## groupevents_1 0.001414  0.03761  -1.00
## Number of obs: 8, groups:  study_id, 4
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -36.10    1708.15  -0.021    0.983
## groupevents_1    29.94    1708.15   0.018    0.986
##

```



```

## Correlation of Fixed Effects:
##      (Intr)
## groupvnts_1 -1.000
## convergence code: 0
## boundary (singular) fit: see ?isSingular
##
## [1] "RR for m_poiss:"
##      RR      CI_lower      CI_upper
## 1.002085e+13 0.000000e+00      Inf
## [1] "Results for m_zip_rifs:"

## Warning in sqrt(diag(vcov)): NaNs produced

## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1 + group + (1 | study_id)
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      0
##
## Random effects:
##
## Conditional model:
## Groups   Name              Variance Std.Dev. Corr
## study_id (Intercept)    5.571     2.360
## groupevents_1 1.483     1.218     0.63
## Number of obs: 8, groups: study_id, 4
##
## Zero-inflation model:
## Groups   Name              Variance Std.Dev.
## study_id (Intercept) 0.4451    0.6672
## Number of obs: 8, groups: study_id, 4
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -0.9285         NA      NA      NA
## groupevents_1 -0.5184         NA      NA      NA
##
## Zero-inflation model:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    3.0383     0.5275   5.760 8.41e-09 ***
## groupevents_1  -1.9961     0.6731  -2.966 0.00302 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

## Warning in sqrt(diag(vcov)): NaNs produced
## Warning in sqrt(diag(vcov)): NaNs produced

## [1] "m_zip_rifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_fifs:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))

```

```

## Zero inflation:          ~1 + group
## Data: data_long
##
##      AIC      BIC   logLik deviance df.resid
##      NA      NA      NA      NA      1
##
## Random effects:
##
## Conditional model:
##   Groups   Name              Variance  Std.Dev.  Corr
##   study_id (Intercept)    3.956e-134 1.989e-67
##           groupevents_1  6.193e-27 7.870e-14 1.00
## Number of obs: 8, groups:  study_id, 4
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -13.605         NA      NA      NA
## groupevents_1    7.441         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)      12.3         NA      NA      NA
## groupevents_1  -189.5         NA      NA      NA
## [1] "m_zip_fifs did not converge properly (no standard errors were computed)."
## [1] "Results for m_zip_ri:"
## Family: poisson ( log )
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:          ~1 + (1 | study_id)
## Data: data_long
##
##      AIC      BIC   logLik deviance df.resid
##      NA      NA      NA      NA      1
##
## Random effects:
##
## Conditional model:
##   Groups   Name              Variance  Std.Dev.  Corr
##   study_id (Intercept)    5.446e-40 2.334e-20
##           groupevents_1  2.201e-21 4.691e-11 0.82
## Number of obs: 8, groups:  study_id, 4
##
## Zero-inflation model:
##   Groups   Name              Variance  Std.Dev.
##   study_id (Intercept) 3.587e-34 1.894e-17
## Number of obs: 8, groups:  study_id, 4
##
## Conditional model:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -48.07         NA      NA      NA
## groupevents_1   41.90         NA      NA      NA
##
## Zero-inflation model:
##               Estimate Std. Error z value Pr(>|z|)

```

```

## (Intercept)  -16.52          NA      NA      NA
## [1] "m_zip_ri did not converge properly (no standard errors were computed.)"
## [1] "Results for m_zip_fi:"
## Family: poisson (log)
## Formula:
## count ~ 1 + group + (1 + group | study_id) + offset(log(n))
## Zero inflation:      ~1
## Data: data_long
##
##      AIC      BIC    logLik deviance df.resid
##      NA      NA      NA      NA      2
##
## Random effects:
##
## Conditional model:
## Groups Name          Variance Std.Dev. Corr
## study_id (Intercept)  1.078e-49 3.284e-25
##      groupevents_1 1.505e-46 1.227e-23 -1.00
## Number of obs: 8, groups: study_id, 4
##
## Conditional model:
##      Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -52.30      NA      NA      NA
## groupevents_1  46.14      NA      NA      NA
##
## Zero-inflation model:
##      Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -17.14      NA      NA      NA
## [1] "m_zip_fi did not converge properly (no standard errors were computed.)"
## [1] "Results for m_cond_binom:"
##      Length Class      Mode
##      1 try-error character
## [1] "RR for m_cond_binom:"
## [1] "There was an error in computing the model. No RR available."
## [1] "Results for m_beta_binom:"
## Family: betabinomial (logit)
## Formula:      cbind(events_1, events_2) ~ 1 + offset(log(group_ratio))
## Data: data2
##
##      AIC      BIC    logLik deviance df.resid
##      4      0      0      0      -1
##
##
## Overdispersion parameter for betabinomial family (): 1
##
## Conditional model:
##      Estimate Std. Error z value Pr(>|z|)
## (Intercept) 3.486e+01 8.395e+07 0 1
## [1] "RR for m_beta_binom:"
##      RR      CI_lower      CI_upper
## 1.381487e+15 0.000000e+00      Inf
## [1] "Results for m_kuss_binom:"
## [1] "Error in optim(par = theta_init_beta, fn = likelihood_kuss, treat_event = data$events_1, : \n
## attr(,"class")

```

```

## [1] "try-error"
## attr(,"condition")
## <simpleError in optim(par = theta_init_beta, fn = likelihood_kuss, treat_event = data$events_1,
## [1] "Error in computing m_kuss_binom."
## [1] "Results for m_cai_binom:"
## $par
##      gamma      psi
## 1509.74422  90.43561
##
## $value
## [1] 0
##
## $counts
## function gradient
##      95      NA
##
## $convergence
## [1] 0
##
## $message
## NULL
##
## $hessian
##      gamma psi
## gamma    0  0
## psi      0  0
##
## [1] "RR for cai_binom:"
## [[1]]
##      RR CI_lower CI_upper
##      0      NA      NA
##
## [[2]]
## [1] "Hessian matrix contained only zeroes and could not be reversed."

```