Meeting 09-08-23

2023-08-07

1.1 Is there still as sizeable proportion of infections occuring within household?

Using the logit model which includes all the data. Recall from the previous Rmd:

$1:$ Female to male, out-of-household $2:$ Female to male, same household $3:$ Male to female, out-of-household $4:$ Male to female, same household

```
# Load CmdStanR fits
fit_norm <- readRDS(here::here("data", "logit_pairs_draws_ordered.rds"))
#fit_beta <- readRDS(here::here("data", "beta_pairs_draws_ordered.rds"))

# Extract rates (eta)
eta_draws <- as_draws_matrix(fit_norm$draws("eta"))
eta_sums <- rowSums(eta_draws)

eta_prop <- eta_draws / eta_sums

# Check proportion of HH vs OOH
eta_HH_prop <- rowSums(eta_prop[, c(2,4)])
summary(eta_HH_prop)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.2850  0.3458  0.3593  0.3591  0.3723  0.4398
```

```
print(quantile(eta_HH_prop, c(0.025, 0.975))) # 95% CI
```

```
##      2.5%     97.5%
## 0.3209107 0.3979944
```

Is there a specific time which we should start the modelling from (i.e a date/round for which we start counting the intervention as 'significant'?)

1.2 Does HH proportion change with community (fishing vs inland?)

First we observe a quirk with the data:

```
# Load in pairs data
filename <- here::here("data", "pairs_tsi.csv")
pairs_tsi <- read.csv(filename)
setDT(pairs_tsi)

# Check whether same household pairs are the same community
```

```r
same_hh_pairs <- pairs_tsi[same_hh == 1]
source_comm <- same_hh_pairs[,.(COMM.SOURCE)]
recip_comm <- same_hh_pairs[,.(COMM.RECIPIENT)]

t(source_comm == recip_comm) # Observation 81 is false
```

```
##             [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12]
## COMM.SOURCE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE  TRUE  TRUE  TRUE
##             [,13] [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,24] [,25] [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,35] [,36] [,37] [,38] [,39] [,40] [,41] [,42] [,43] [,44] [,45]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,46] [,47] [,48] [,49] [,50] [,51] [,52] [,53] [,54] [,55] [,56]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,57] [,58] [,59] [,60] [,61] [,62] [,63] [,64] [,65] [,66] [,67]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,68] [,69] [,70] [,71] [,72] [,73] [,74] [,75] [,76] [,77] [,78]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,79] [,80] [,81] [,82] [,83] [,84] [,85] [,86] [,87] [,88] [,89]
## COMM.SOURCE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##             [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97] [,98] [,99] [,100]
## COMM.SOURCE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE   TRUE
##             [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108] [,109]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,128] [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,137] [,138] [,139] [,140] [,141] [,142] [,143] [,144] [,145]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,146] [,147] [,148] [,149] [,150] [,151] [,152] [,153] [,154]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,155] [,156] [,157] [,158] [,159] [,160] [,161] [,162] [,163]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,164] [,165] [,166] [,167] [,168] [,169] [,170] [,171] [,172]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,173] [,174] [,175] [,176] [,177] [,178] [,179] [,180] [,181]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,182] [,183] [,184] [,185] [,186] [,187] [,188] [,189] [,190]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,191] [,192] [,193] [,194] [,195] [,196] [,197] [,198] [,199]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,200] [,201] [,202] [,203] [,204] [,205] [,206] [,207] [,208]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,209] [,210] [,211] [,212] [,213] [,214] [,215] [,216] [,217]
## COMM.SOURCE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE   TRUE
##             [,218] [,219]
## COMM.SOURCE   TRUE   TRUE
```

The 81st entry of the same_hh data set has a source and recipient from the same household but different community! Do we ignore this data point? (Yes in this model).

We should fit the model to four groups:

- Same household, fishing (1)
- Same household, inland (2)
- Different household, fishing* (4)
- Different household, inland* (5)

But how do we decide which community if the source and recipient are not from the same community? Just from source/recipient community or add a seperate group from an inter-community transmission (3). (The model picked uses the last option, so we now have five groups)

```
# Load CmdStanR fit
fit_1_2 <- readRDS(here::here("data", "logit_pairs_draws_1-2.rds"))
print(fit_1_2, max_rows = 1000)
```

```
##                  variable   mean median    sd   mad     q5    q95 rhat
##   lp__                    601.31 601.49 11.73 11.71 581.66 620.25 1.02
##   v[1,1]                    0.64   0.88  0.38  0.18   0.06   1.00 1.06
##   v[2,1]                    0.69   0.93  0.39  0.11   0.01   1.00 1.01
##   v[3,1]                    0.72   0.96  0.36  0.06   0.03   1.00 1.01
##   v[4,1]                    0.22   0.06  0.33  0.07   0.00   0.97 1.06
##   v[5,1]                    0.80   0.98  0.33  0.03   0.02   1.00 1.04
##   v[1,2]                    0.72   0.87  0.31  0.18   0.11   1.00 1.01
##   v[2,2]                    0.68   0.81  0.33  0.27   0.03   1.00 1.00
##   v[3,2]                    0.70   0.82  0.30  0.24   0.10   1.00 1.00
##   v[4,2]                    0.56   0.58  0.37  0.58   0.02   1.00 1.01
##   v[5,2]                    0.70   0.82  0.30  0.25   0.11   1.00 1.01
##   alpha[1]                  0.80   0.76  0.29  0.27   0.41   1.35 1.01
##   alpha[2]                  0.82   0.78  0.31  0.28   0.42   1.40 1.00
##   alpha[3]                  0.81   0.77  0.28  0.26   0.43   1.33 1.00
##   alpha[4]                  0.99   0.94  0.35  0.34   0.49   1.64 1.01
##   alpha[5]                  0.77   0.73  0.27  0.25   0.40   1.27 1.01
##   eta[1]                  116.96 116.66 10.90 10.81  99.43 135.48 1.00
##   eta[2]                  102.94 102.59 10.20 10.17  86.76 120.25 1.00
##   eta[3]                   72.91  72.55  8.55  8.39  59.44  87.67 1.00
##   eta[4]                  178.03 177.70 13.37 13.22 156.65 200.70 1.00
##   eta[5]                  143.02 142.74 11.87 11.86 123.98 162.78 1.00
##   mus_1[1,1]               -0.92  -0.73  0.70  0.23  -1.49  -0.51 1.05
##   mus_1[2,1]               -1.36  -0.58  2.26  0.19  -5.32  -0.37 1.00
##   mus_1[3,1]               -1.26  -0.87  1.24  0.19  -3.45  -0.64 1.01
##   mus_1[4,1]               -2.75  -2.16  2.12  1.80  -6.46  -0.69 1.06
##   mus_1[5,1]               -0.67  -0.38  1.17  0.11  -2.09  -0.23 1.04
##   mus_1[1,2]                1.35  -0.30  3.30  0.68  -0.90   8.69 1.05
##   mus_1[2,2]                0.99  -0.17  2.99  0.58  -1.08   7.77 1.00
##   mus_1[3,2]                1.46  -0.02  3.27  1.22  -0.94   8.63 1.01
##   mus_1[4,2]               -0.93  -0.80  0.92  0.30  -2.48  -0.09 1.04
##   mus_1[5,2]                1.70   0.35  3.21  0.93  -0.53   8.90 1.04
##   mus_1[1,3]                6.77   5.29  6.84  7.24  -0.46  19.85 1.03
##   mus_1[2,3]                6.48   4.96  6.72  7.18  -0.44  19.39 1.00
##   mus_1[3,3]                6.93   5.29  6.61  6.43  -0.62  19.58 1.01
##   mus_1[4,3]                2.12  -0.22  5.01  0.67  -0.73  13.69 1.02
```

```
## mus_1[5,3]                   7.52   6.34   6.68  7.57   -0.14   20.04 1.03
## mus_2[1,1]                  -1.61  -0.88   2.30  0.36   -2.48   -0.56 1.06
## mus_2[2,1]                  -0.78  -0.78   2.57  0.18   -2.96    0.52 1.01
## mus_2[3,1]                  -0.99  -0.89   2.09  0.18   -1.56   -0.10 1.01
## mus_2[4,1]                  -0.98  -0.98   2.05  0.53   -2.14    0.33 1.03
## mus_2[5,1]                  -0.70  -0.76   2.23  0.13   -2.04   -0.36 1.04
## mus_2[1,2]                  -0.62  -0.53   6.43  2.42  -11.73   11.44 1.04
## mus_2[2,2]                  -1.49  -1.07   5.94  2.47   -9.77    9.74 1.00
## mus_2[3,2]                  -0.41  -0.89   6.41  1.65  -11.38   11.77 1.00
## mus_2[4,2]                  -1.20  -1.04   1.92  0.46   -2.53    0.12 1.01
## mus_2[5,2]                  -1.36  -2.00   6.52  2.67  -11.16   11.38 1.01
## mus_2[1,3]                  -0.25  -0.51   8.42  5.51  -14.54   14.87 1.02
## mus_2[2,3]                  -0.23  -0.69   8.49  6.12  -14.71   14.75 1.00
## mus_2[3,3]                  -0.15  -0.71   8.37  5.53  -14.71   14.54 1.00
## mus_2[4,3]                  -0.64  -0.75   5.51  0.61   -9.95    9.40 1.01
## mus_2[5,3]                  -0.39  -0.69   8.89  6.94  -15.24   15.39 1.02
## Sigmas[1,1,1,1]              0.82   0.83   0.80  0.19    0.14    1.25 1.03
## Sigmas[2,1,1,1]              1.42   0.96   8.58  0.21    0.41    2.22 1.00
## Sigmas[3,1,1,1]              1.47   0.96   3.83  0.32    0.39    3.41 1.00
## Sigmas[4,1,1,1]              2.60   1.69   5.20  1.63    0.26    7.20 1.02
## Sigmas[5,1,1,1]              0.94   0.83   2.45  0.13    0.40    1.14 1.03
## Sigmas[1,2,1,1]              1.78   0.77  16.09  0.41    0.19    3.66 1.01
## Sigmas[2,2,1,1]              2.18   0.71  17.92  0.49    0.21    6.16 1.00
## Sigmas[3,2,1,1]              2.70   0.66  15.69  0.61    0.17    7.98 1.00
## Sigmas[4,2,1,1]              2.63   0.64   8.83  0.47    0.18    9.50 1.03
## Sigmas[5,2,1,1]              1.93   0.69  10.83  0.51    0.18    4.96 1.01
## Sigmas[1,3,1,1]              2.18   0.65  14.21  0.53    0.16    6.23 1.01
## Sigmas[2,3,1,1]              4.89   0.73  96.15  0.57    0.18    9.15 1.00
## Sigmas[3,3,1,1]              8.42   0.70 268.51  0.65    0.17    8.78 1.00
## Sigmas[4,3,1,1]              3.38   0.64  31.90  0.26    0.23    7.68 1.02
## Sigmas[5,3,1,1]              3.72   0.69  40.94  0.59    0.17    8.24 1.00
## Sigmas[1,1,2,1]              0.11   0.19   0.49  0.23   -0.36    0.41 1.03
## Sigmas[2,1,2,1]              0.14   0.28   2.35  0.18   -0.72    0.64 1.00
## Sigmas[3,1,2,1]              0.26   0.09   2.56  0.16   -0.25    0.97 1.00
## Sigmas[4,1,2,1]             -0.20  -0.02   2.20  0.51   -1.81    0.95 1.01
## Sigmas[5,1,2,1]              0.03   0.09   0.74  0.10   -0.46    0.26 1.03
## Sigmas[1,2,2,1]              0.09   0.09   4.37  0.29   -0.99    0.97 1.01
## Sigmas[2,2,2,1]              0.28   0.25   5.96  0.52   -1.90    2.20 1.00
## Sigmas[3,2,2,1]              0.05   0.05   5.51  0.31   -1.68    2.16 1.00
## Sigmas[4,2,2,1]              0.01   0.08   3.05  0.30   -1.34    0.94 1.01
## Sigmas[5,2,2,1]             -0.11   0.02   7.97  0.33   -1.55    1.64 1.01
## Sigmas[1,3,2,1]             -0.03   0.01   5.87  0.36   -1.84    1.85 1.00
## Sigmas[2,3,2,1]              0.34   0.09  21.53  0.48   -2.43    2.70 1.00
## Sigmas[3,3,2,1]             -3.31   0.00  86.96  0.42   -2.44    2.50 1.00
## Sigmas[4,3,2,1]             -0.30   0.24  10.77  0.22   -1.39    1.02 1.01
## Sigmas[5,3,2,1]              0.01   0.02  17.26  0.39   -2.40    2.29 1.00
## Sigmas[1,1,1,2]              0.11   0.19   0.49  0.23   -0.36    0.41 1.03
## Sigmas[2,1,1,2]              0.14   0.28   2.35  0.18   -0.72    0.64 1.00
## Sigmas[3,1,1,2]              0.26   0.09   2.56  0.16   -0.25    0.97 1.00
## Sigmas[4,1,1,2]             -0.20  -0.02   2.20  0.51   -1.81    0.95 1.01
## Sigmas[5,1,1,2]              0.03   0.09   0.74  0.10   -0.46    0.26 1.03
## Sigmas[1,2,1,2]              0.09   0.09   4.37  0.29   -0.99    0.97 1.01
## Sigmas[2,2,1,2]              0.28   0.25   5.96  0.52   -1.90    2.20 1.00
## Sigmas[3,2,1,2]              0.05   0.05   5.51  0.31   -1.68    2.16 1.00
```

```
## Sigmas[4,2,1,2]           0.01   0.08   3.05 0.30 -1.34    0.94 1.01
## Sigmas[5,2,1,2]          -0.11   0.02   7.97 0.33 -1.55    1.64 1.01
## Sigmas[1,3,1,2]          -0.03   0.01   5.87 0.36 -1.84    1.85 1.00
## Sigmas[2,3,1,2]           0.34   0.09  21.53 0.48 -2.43    2.70 1.00
## Sigmas[3,3,1,2]          -3.31   0.00  86.96 0.42 -2.44    2.50 1.00
## Sigmas[4,3,1,2]          -0.30   0.24  10.77 0.22 -1.39    1.02 1.01
## Sigmas[5,3,1,2]           0.01   0.02  17.26 0.39 -2.40    2.29 1.00
## Sigmas[1,1,2,2]           0.76   0.81   0.67 0.35  0.19    1.19 1.03
## Sigmas[2,1,2,2]           1.59   1.28   2.94 0.57  0.33    3.36 1.00
## Sigmas[3,1,2,2]           1.17   0.96   2.47 0.22  0.47    1.70 1.01
## Sigmas[4,1,2,2]           1.02   0.71   2.87 0.41  0.22    2.07 1.01
## Sigmas[5,1,2,2]           1.01   0.97   0.74 0.20  0.46    1.37 1.02
## Sigmas[1,2,2,2]           1.26   0.52   5.17 0.31  0.16    3.64 1.02
## Sigmas[2,2,2,2]           3.10   1.37  10.10 1.45  0.21    8.95 1.00
## Sigmas[3,2,2,2]           2.01   0.83  10.51 0.58  0.19    5.43 1.00
## Sigmas[4,2,2,2]           0.95   0.76   2.32 0.32  0.22    1.60 1.00
## Sigmas[5,2,2,2]           2.13   0.74  10.80 0.59  0.19    5.90 1.00
## Sigmas[1,3,2,2]           1.93   0.63   7.24 0.53  0.17    6.45 1.00
## Sigmas[2,3,2,2]           3.98   0.98  22.85 0.95  0.18    9.68 1.00
## Sigmas[3,3,2,2]           7.72   0.77  97.00 0.69  0.17    8.58 1.00
## Sigmas[4,3,2,2]           2.80   0.83  14.33 0.38  0.22    4.48 1.01
## Sigmas[5,3,2,2]           2.97   0.73  13.53 0.65  0.18    8.49 1.00
## weights[1,1]              0.64   0.88   0.38 0.18  0.06    1.00 1.06
## weights[2,1]              0.69   0.93   0.39 0.11  0.01    1.00 1.01
## weights[3,1]              0.72   0.96   0.36 0.06  0.03    1.00 1.01
## weights[4,1]              0.22   0.06   0.33 0.07  0.00    0.97 1.06
## weights[5,1]              0.80   0.98   0.33 0.03  0.02    1.00 1.04
## weights[1,2]              0.27   0.08   0.33 0.12  0.00    0.83 1.04
## weights[2,2]              0.19   0.03   0.28 0.04  0.00    0.89 1.01
## weights[3,2]              0.21   0.03   0.30 0.04  0.00    0.88 1.00
## weights[4,2]              0.41   0.26   0.36 0.34  0.01    0.97 1.02
## weights[5,2]              0.14   0.01   0.25 0.02  0.00    0.80 1.03
## weights[1,3]              0.08   0.00   0.20 0.01  0.00    0.67 1.04
## weights[2,3]              0.12   0.01   0.27 0.01  0.00    0.92 1.00
## weights[3,3]              0.07   0.01   0.18 0.01  0.00    0.52 1.01
## weights[4,3]              0.37   0.27   0.37 0.39  0.00    0.96 1.02
## weights[5,3]              0.06   0.00   0.18 0.00  0.00    0.61 1.03
## cumprod_one_minus_v[1,1]  0.36   0.12   0.38 0.18  0.00    0.94 1.06
## cumprod_one_minus_v[2,1]  0.31   0.07   0.39 0.11  0.00    0.99 1.01
## cumprod_one_minus_v[3,1]  0.28   0.04   0.36 0.06  0.00    0.97 1.01
## cumprod_one_minus_v[4,1]  0.78   0.94   0.33 0.07  0.03    1.00 1.06
## cumprod_one_minus_v[5,1]  0.20   0.02   0.33 0.03  0.00    0.98 1.04
## cumprod_one_minus_v[1,2]  0.08   0.00   0.20 0.01  0.00    0.67 1.04
## cumprod_one_minus_v[2,2]  0.12   0.01   0.27 0.01  0.00    0.92 1.00
## cumprod_one_minus_v[3,2]  0.07   0.01   0.18 0.01  0.00    0.52 1.01
## cumprod_one_minus_v[4,2]  0.37   0.27   0.37 0.39  0.00    0.96 1.02
## cumprod_one_minus_v[5,2]  0.06   0.00   0.18 0.00  0.00    0.61 1.03
## ess_bulk ess_tail
##      411     1814
##       76       37
##      286      510
##      259      337
##       68      267
##      139       97
```

```
##         435      3656
##         855      1089
##        1581      3827
##         469       636
##         847      2946
##         460      1022
##         841      1139
##        1292      2671
##         979      2017
##         622       728
##       23253     12722
##       26085     14460
##       23326     13601
##       23599     13336
##       20206     12445
##          85        44
##         295       338
##         321       352
##          58       222
##         152       110
##         113       121
##         343       640
##         331       524
##         137       267
##         171       123
##         156       116
##         404       807
##         409       510
##         381      2415
##         218       157
##          87        43
##         728       279
##         965       401
##        1603       776
##         419       133
##        3782      2801
##        6045      4948
##        4791      3930
##         876       796
##        3148      4685
##       15073      8453
##       15805     10685
##       12784      9510
##        4574      2251
##       14315     10732
##         578       590
##        3253      1025
##        1244      1109
##         244      2282
##        2217       511
##        5918      2861
##        6158      5775
##        2316      6727
##         148       394
```

```
##          5502        4204
##          2527        5780
##          5918        3753
##          2795        2619
##           995         466
##          5520        4101
##           206        1547
##          1111         521
##          1540         723
##          1003        5810
##           737         493
##           960        2584
##          3494        5650
##          5855        4193
##          1730         580
##          3486        3482
##          6047        4654
##          2572        3690
##          3562        2190
##           748         201
##          4957        3510
##           206        1547
##          1111         521
##          1540         723
##          1003        5810
##           737         493
##           960        2584
##          3494        5650
##          5855        4193
##          1730         580
##          3486        3482
##          6047        4654
##          2572        3690
##          3562        2190
##           748         201
##          4957        3510
##           238         877
##          1410         750
##          3601         932
##          1872        2228
##          2558         450
##          2946        2711
##          2656        6846
##          4362        3749
##          2222        1442
##          3626        3383
##          4217        4036
##          3153        3104
##          2630        1709
##           734         203
##          4126        2761
##            76          37
##           286         510
##           259         337
```

```
##         68       267
##        139        97
##        110      1253
##        486       642
##        327       844
##        215       963
##        210       649
##        137        79
##        390       581
##        375       436
##        296       897
##        201       104
##         76        37
##        286       510
##        259       337
##         68       267
##        139        97
##        137        79
##        390       581
##        375       436
##        296       897
##        201       104
```

Now we calculate confidence intervals for the proportion of HH infections for both fishing and inland communities:

```r
# Extract rates (eta)
eta_draws <- as_draws_matrix(fit_1_2$draws("eta"))
eta_sums <- rowSums(eta_draws)

eta_prop <- eta_draws / eta_sums

# Check proportion of HH vs OOH for both fishing and inland
eta_HH_fishing <- eta_prop[, 1] / rowSums(eta_prop[, c(1, 4)])
eta_HH_inland <- eta_prop[, 2] / rowSums(eta_prop[, c(2, 5)])

print(quantile(eta_HH_fishing, c(0.025, 0.975))) # 95% CI
```

```
##      2.5%     97.5%
## 0.3409573 0.4538992
```

```r
print(quantile(eta_HH_inland, c(0.025, 0.975))) # 95% CI
```

```
##      2.5%     97.5%
## 0.3565298 0.4799180
```

The confidence intervals have a good amount of overlap which suggests there might not be any change in proportion of infections which are within HH between the two communities.

1.3 Is the proportion of HH transmissions larger MF or FM?

We use the same model and draws from Q1.1:

```r
# Extract rates (eta)
eta_draws <- as_draws_matrix(fit_norm$draws("eta"))
eta_sums <- rowSums(eta_draws)

eta_prop <- eta_draws / eta_sums

# Check proportion of HH vs OOH for both MF and FM
eta_HH_MF <- eta_prop[, 4] / rowSums(eta_prop[, c(3, 4)])
eta_HH_FM <- eta_prop[, 2] / rowSums(eta_prop[, c(1, 2)])

print(quantile(eta_HH_MF, c(0.025, 0.975))) # 95% CI
```

```
##      2.5%     97.5%
## 0.3183093 0.4202151
```

```r
print(quantile(eta_HH_FM, c(0.025, 0.975))) # 95% CI
```

```
##      2.5%     97.5%
## 0.2879586 0.4062843
```

Again, there is a significant overlap it seems so potentially not a huge difference.

3

We use the same fit as above. We treat "young" as being aged 15-24.

```r
#library(parallel)
#n_cores <- detectCores() - 1
source(here::here("helper-functions", "plot_normal.R"))
```

```
## Warning: package 'ggpubr' was built under R version 4.2.3
```

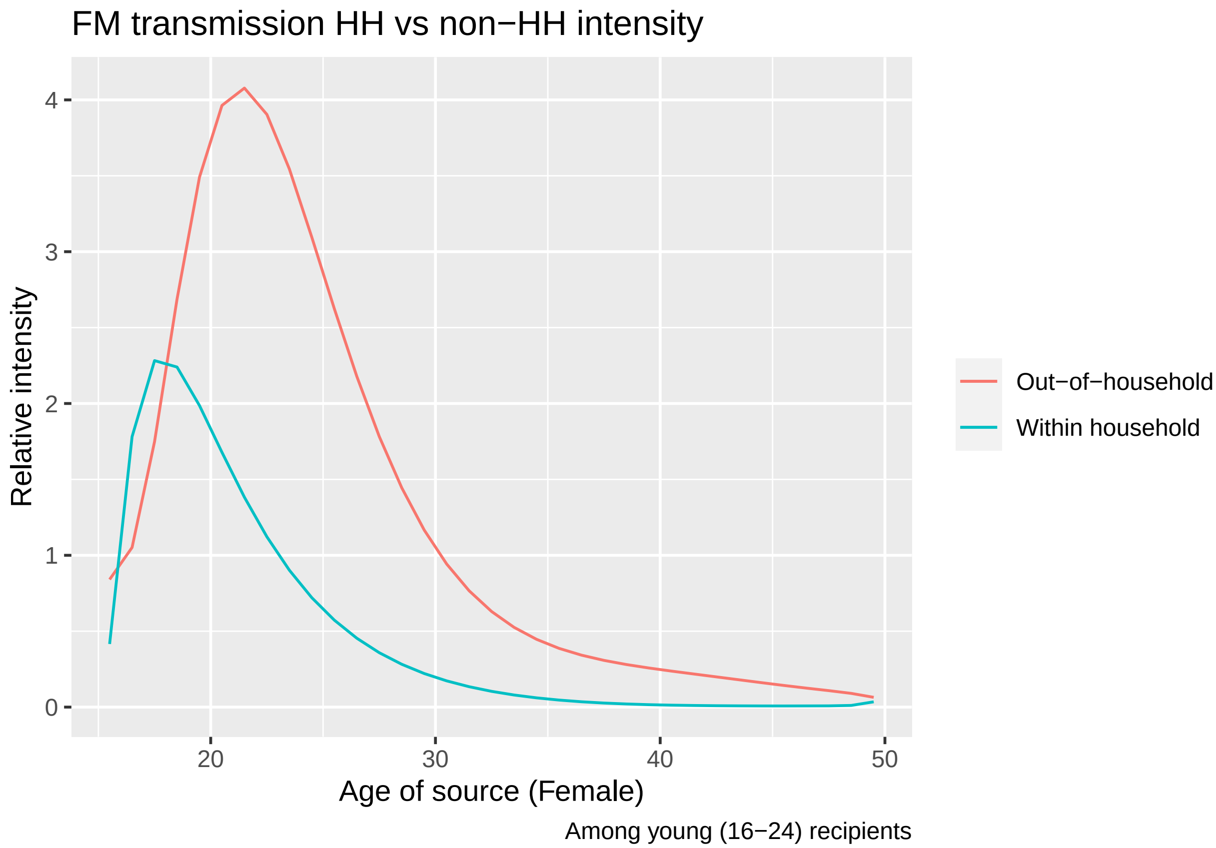
```r
ages <- seq(15.5, 49.5, by = 1)
draws <- seq(100, 5000, by = 100)
grid <- expand.grid(ages, ages)

final_intensities <- list() # one entry per group
eta_draws <- as_draws_matrix(fit_norm$draws("eta"))

for (group in 1:4){
  # Calculate densities for 50 iterations
  intensities <- lapply(draws, plot_normal, fit = fit_norm, chain_no = 1,
                        group_no = group, ages = ages, plot = FALSE)
  etas <- as.numeric(eta_draws[draws, group])

  for (index in 1:length(etas)){
    intensities[[index]] <- etas[index] * intensities[[index]]
  }

  # Calculate mean density
```

```
  intensity_matrix <- matrix(unlist(intensities), nrow = 50, byrow = TRUE)
  final_intensity <- apply(intensity_matrix, 2, mean)
  final_intensities[[group]] <- final_intensity
}
```

3.1 Are young men predominantly affected by older women through non-HH?

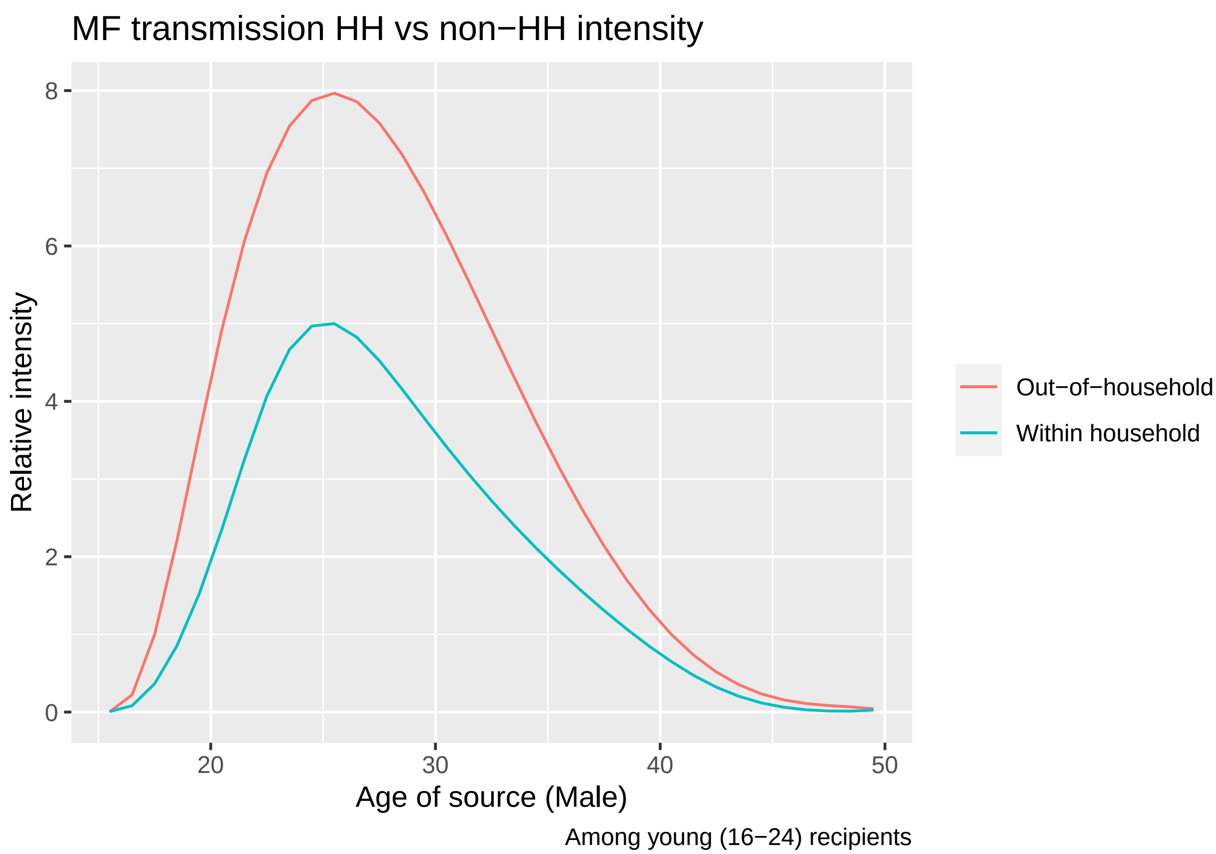
We want the F -> M groups for HH and non-HH respectively (so group 1 for OOH and group 2 for HH)

```
# Extract relevant intensities and combine into one data.table
intensity_FM_OOH <- final_intensities[[1]]
intensity_FM_HH <- final_intensities[[2]]

recip_15_24_indices <- which(grid$Var2 < 24) # X: Source, Y: Recipient

yng_grid <- grid[recip_15_24_indices, ]
yng_grid$FM_OOH <- intensity_FM_OOH[recip_15_24_indices]
yng_grid$FM_HH <- intensity_FM_HH[recip_15_24_indices]

setDT(yng_grid)

# Calculate intensities among young people by age of source
yng_grid[, FM_OOH_sum := sum(FM_OOH), by = Var1]
yng_grid[, FM_HH_sum := sum(FM_HH), by = Var1]

# Drop unnecessary columns
#yng_grid[, c("FM_OOH", "FM_HH", "Var2") := NULL]

# Plot intensities

p <- ggplot(yng_grid, aes(x = Var1)) +
  geom_line(aes(y = FM_OOH_sum, color = "Out-of-household")) +
  geom_line(aes(y = FM_HH_sum, color = "Within household")) +
  labs(x = "Age of source (Female)", y = "Relative intensity",
       title = "FM transmission HH vs non-HH intensity",
       caption = "Among young (16-24) recipients",
       color = NULL)
p
```



Now repeat the analysis for M -> F transmissions

```
# Extract relevant intensities and add to previous data.table
intensity_MF_OOH <- final_intensities[[3]]
intensity_MF_HH <- final_intensities[[4]]

yng_grid$MF_OOH <- intensity_MF_OOH[recip_15_24_indices]
yng_grid$MF_HH <- intensity_MF_HH[recip_15_24_indices]

# Calculate intensities among young people by age of source
yng_grid[, MF_OOH_sum := sum(MF_OOH), by = Var1]
yng_grid[, MF_HH_sum := sum(MF_HH), by = Var1]

# Drop unnecessary columns
#yng_grid[, c("MF_OOH", "MF_HH", "Var2") := NULL]

# Plot intensities

p <- ggplot(yng_grid, aes(x = Var1)) +
  geom_line(aes(y = MF_OOH_sum, color = "Out-of-household")) +
  geom_line(aes(y = MF_HH_sum, color = "Within household")) +
  labs(x = "Age of source (Male)", y = "Relative intensity",
       title = "MF transmission HH vs non-HH intensity",
       caption = "Among young (16-24) recipients",
       color = NULL)
p
```


MF transmission HH vs non−HH intensity
Relative intensity
8
6
4
2
0
20
30
40
50
Age of source (Male)
Among young (16−24) recipients
Out−of−household
Within household