

Migration Survival Analysis Code for the ChitwanABM

Author: Alex Zvoleff

Email: azvoleff@mail.sdsu.edu

Date: July, 2012

Uses survival analysis to parameterize the ChitwanABM using data from the Chitwan Valley Family Study.

Note the following regarding this source dataset, created from the migration_1_preprocess.R script:

1. The data contains only respondents from the CVSF who were present in the dataset, in a "local" neighborhood in Chitwan in the first month of 1996.
2. Only local to distant migrations are coded. A local to distant migration is defined as a person leaving the Chitwan Valley for a location outside the valley (regardless of whether they make a move within Nepal or internationally).
3. Age, household ID, gender, and respondent ID are all coded from the CVFS data.
4. Only 126 months of data were available. Given that one month was used to define the minimum period away from a household to be considered a migrant, there were only 125 months of data to consider (as migrations cannot be conclusively determined within the last one month of data).

Load the data and setup R

```
library(ggplot2)
library(lme4)
```

```
## Loading required package: Matrix
```

```
## Loading required package: lattice
```

```
## Attaching package: 'lme4'
```

```
## The following object(s) are masked from 'package:stats':
##
## AIC, BIC
```

```
library(arm) # for se.coef, se.fixef
```

```
## Loading required package: MASS
```

```
## Loading required package: R2WinBUGS
```

```
## Loading required package: coda
```

```
## Attaching package: 'coda'
```

```
## The following object(s) are masked from 'package:lme4':  
##  
## HPDinterval
```

```
## Loading required package: abind
```

```
## Loading required package: foreign
```

```
## arm (Version 1.5-05, built: 2012-6-6)
```

```
## Working directory is  
## C:/Users/azvoleff/Code/R/Chitwan_R_files/Event_History_Analysis
```

```
## Attaching package: 'arm'
```

```
## The following object(s) are masked from 'package:coda':  
##  
## traceplot
```

```
# theme_update(theme_grey(base_size=10))  
theme_update(theme_bw(base_size = 10))  
# update_geom_defaults('point', aes(size=2)) update_geom_defaults('line',  
# aes(size=.75))  
  
# load('data/migration_data_wideformat-1_months_away.Rdata')  
load("data/migration_data_longformat-1_months_away-up_to_month_36.Rdata")  
# We are considering only LD migrations. So censor the LL migrations, set  
# LD migrations to 1, and set no migration observations (NM) to 0  
migrations.long$migr <- as.character(migrations.long$migr)  
migrations.long$migr[migrations.long$migr == "LL"] <- NA  
migrations.long$migr[migrations.long$migr == "NM"] <- 0  
migrations.long$migr[migrations.long$migr == "LD"] <- 1  
migrations.long$migr <- as.factor(migrations.long$migr)  
migrations.long <- migrations.long[!is.na(migrations.long$migr),  
  ]  
  
# Recode 'other' ethnicity to Terai tibeto-burmese  
migrations.long$ethnic[migrations.long$ethnic == 6] <- 5  
migrations.long$ethnic <- as.factor(migrations.long$ethnic)  
migrations.long$gender <- as.factor(migrations.long$gender)  
  
# To stabilize numerical algorithm (to avoid 'false convergence' error in  
# glmer), try categorizing age by decade, converting time to decades and  
# try adding a continuous age variable in decades. This makes the betas on  
# age and time larger and helps stabilizes the optimization algorithm.  
migrations.long <- migrations.long  
migrations.long$agegrp <- rep("", nrow(migrations.long))  
migrations.long$agegrp[migrations.long$age <= 15] <- "1t15"
```

```

migrations.long$agegrp[migrations.long$age > 15 & migrations.long$age <=
25] <- "gt15lt25"
migrations.long$agegrp[migrations.long$age > 25 & migrations.long$age <=
35] <- "gt25lt35"
migrations.long$agegrp[migrations.long$age > 35 & migrations.long$age <=
45] <- "gt35lt45"
migrations.long$agegrp[migrations.long$age > 45 & migrations.long$age <=
55] <- "gt45lt55"
migrations.long$agegrp[migrations.long$age > 55] <- "gt55"
migrations.long$agegrp <- factor(migrations.long$agegrp, levels = c("lt15",
"gt15lt25", "gt25lt35", "gt35lt45", "gt45lt55", "gt55", ordered = TRUE))
migrations.long$agegrp <- factor(migrations.long$agegrp)
migrations.long$timeyears <- migrations.long$time/12
migrations.long$agedecades <- migrations.long$age/10

```

Basic Statistics

Total number of person-month records: 199107.

First check how many migrations and censored entries. Then check a cross tab of migrations with the categorical predictors:

```
table(migrations.long$migr, exclude = NULL)
```

```
##
##      0      1   <NA>
## 197666 1441      0
```

```
xtabs(~migrations.long$migr + migrations.long$agegrp, exclude = NULL)
```

```
##
##      migrations.long$agegrp
## migrations.long$migr  lt15 gt15lt25 gt25lt35 gt35lt45 gt45lt55 gt55
##      0 79910    32752    24926    22281    17171 20626
##      1   392      509      224      107      85   124
```

```
xtabs(~migrations.long$migr + migrations.long$ethnic, exclude = NULL)
```

```
##
##      migrations.long$ethnic
## migrations.long$migr    1    2    3    4    5
##      0 89025 29672 21378 12200 45391
##      1   718   249   135    97   242
```

```
xtabs(~migrations.long$migr + migrations.long$gender, exclude = NULL)
```

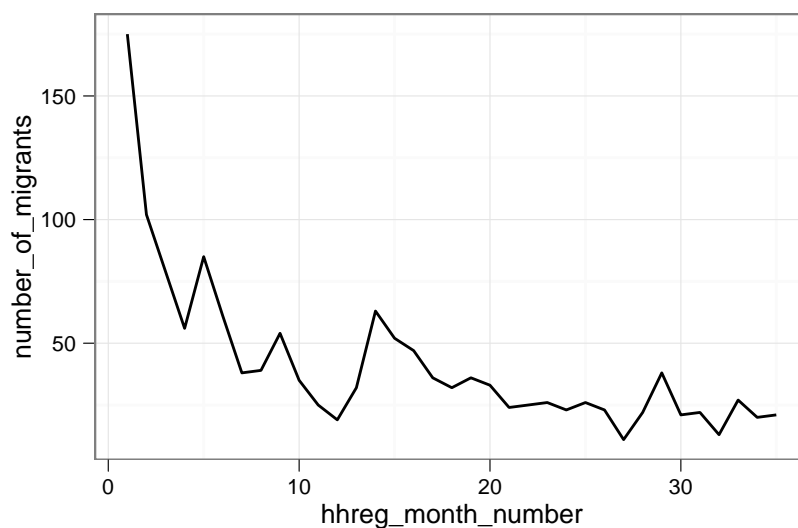
```
##
##      migrations.long$gender
## migrations.long$migr    0    1
##      0 91046 106620
##      1   762   679
```

```
with(migrations.long, xtabs(~agegrp + ethnic + gender, exclude = NULL))
```

```
## , , gender = 0
##
##      ethnic
## agegrp    1    2    3    4    5
## 1t15      17433 6248 5451 1892 9913
## gt15lt25   6594 1891 1133  856 2942
## gt25lt35   3796 1069 1042  689 2636
## gt35lt45   3887 1356 1032  588 2225
## gt45lt55   3674 1186 1037  695 1527
## gt55       5475 2153  934  832 1622
##
## , , gender = 1
##
##      ethnic
## agegrp    1    2    3    4    5
## 1t15      17052 5721 3995 2261 10336
## gt15lt25   9332 2379 1660 1421  5053
## gt25lt35   7227 2217 1806  873  3795
## gt35lt45   6678 2134 1195  951  2342
## gt45lt55   3797 1642 1217  600  1881
## gt55       4798 1925 1011  639  1361
##
```

And look at the number of migrations per time (censoring after 1st migration).

```
migr_ts <- aggregate(migr == 1 ~ time, migrations.long, sum)
names(migr_ts) <- c("hhreg_month_number", "number_of_migrants")
qplot(hhreg_month_number, number_of_migrants, geom = "line", data = migr_ts)
```



Migrations per month (censored)

Run models

Fixed effect model

```
LD_fixed <- glm(migr ~ ethnic + gender + agegrp + timeyears + I(timeyears^2),
  data = migrations.long, family = binomial)
save(LD_fixed, file = "migration_LD_fixed.Rdata")
LD_fixed.results <- data.frame(coef = coef(LD_fixed), odds_ratio = exp(coef(LD_fixed)),
  se = se.coef(LD_fixed))
LD_fixed.results <- round(LD_fixed.results, 4)
summary(LD_fixed)
```

```
##
## Call:
## glm(formula = migr ~ ethnic + gender + agegrp + timeyears + I(timeyears^2),
##      family = binomial, data = migrations.long)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -0.295   -0.134   -0.103   -0.085    3.532
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -4.2480    0.0829  -51.25 < 2e-16 ***
## ethnic2         0.0768    0.0741    1.04  0.300
## ethnic3        -0.1923    0.0944   -2.04  0.042 *
## ethnic4        -0.0223    0.1089   -0.20  0.838
## ethnic5        -0.4046    0.0748   -5.41 6.4e-08 ***
## gender1        -0.3411    0.0534   -6.38 1.7e-10 ***
## agegrp15lt25    1.1559    0.0679   17.01 < 2e-16 ***
## agegrp25lt35    0.6571    0.0845    7.78 7.4e-15 ***
## agegrp35lt45    0.0329    0.1096    0.30  0.764
## agegrp45lt55    0.0365    0.1201    0.30  0.761
## agegrp55        0.1848    0.1037    1.78  0.075 .
## timeyears      -1.1644    0.1186   -9.82 < 2e-16 ***
## I(timeyears^2)  0.2708    0.0423    6.41 1.5e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 17075  on 199106  degrees of freedom
## Residual deviance: 16420  on 199094  degrees of freedom
## AIC: 16446
##
## Number of Fisher Scoring iterations: 8
##
```

```
LD_fixed.results
```

```
##              coef odds_ratio    se
## (Intercept)   -4.2480    0.0143 0.0829
## ethnic2         0.0768    1.0798 0.0741
## ethnic3        -0.1923    0.8251 0.0944
```

```
## ethnic4 -0.0223 0.9779 0.1089
## ethnic5 -0.4046 0.6673 0.0748
## gender1 -0.3411 0.7110 0.0534
## agegrp15lt25 1.1559 3.1769 0.0679
## agegrp25lt35 0.6571 1.9291 0.0845
## agegrp35lt45 0.0329 1.0334 0.1096
## agegrp45lt55 0.0365 1.0372 0.1201
## agegrp55 0.1848 1.2030 0.1037
## timeyears -1.1644 0.3121 0.1186
## I(timeyears^2) 0.2708 1.3111 0.0423
```

Mixed-effects model - random intercept at neighborhood level (age groups)

```
LD_random_int <- glmer(migr ~ ethnic + gender + agegrp + timeyears +
  I(timeyears^2) + (1 | originNBH), data = migrations.long, family = binomial,
  verbose = TRUE)
```

```
## 0: 16415.526: 0.0449707 -4.24803 0.0767564 -0.192269 -0.0223040 -0.404590 -0.341110 1.15589 0.657058 0.0328792 0.0365408 0.184819 -1.16438 0.270829
## 1: 16341.490: 0.509227 -4.24530 0.0763069 -0.192312 -0.0231598 -0.400564 -0.340012 1.15654 0.658169 0.0330163 0.0363943 0.184606 -1.15826 0.284310
## 2: 16339.035: 0.505171 -4.24885 0.0748922 -0.192432 -0.0240926 -0.398973 -0.341869 1.15526 0.658048 0.0325793 0.0358896 0.183977 -1.16433 0.270515
## 3: 16337.748: 0.493899 -4.25438 0.0717640 -0.192361 -0.0262985 -0.394011 -0.344684 1.15302 0.658320 0.0318248 0.0348684 0.182765 -1.16350 0.277857
## 4: 16336.060: 0.467947 -4.26394 0.0666610 -0.192263 -0.0300795 -0.385599 -0.348690 1.14986 0.658666 0.0304365 0.0330063 0.180570 -1.17005 0.267132
## 5: 16333.456: 0.415269 -4.27179 0.0565144 -0.190085 -0.0401903 -0.356311 -0.344029 1.15131 0.662279 0.0277482 0.0282677 0.175531 -1.16297 0.282456
## 6: 16331.659: 0.436479 -4.29991 0.0391077 -0.187955 -0.0582024 -0.311057 -0.351080 1.14414 0.665246 0.0226219 0.0199093 0.167220 -1.16849 0.275064
## 7: 16331.125: 0.448466 -4.29691 0.0349606 -0.179834 -0.0765833 -0.255563 -0.337906 1.15301 0.670100 0.0196088 0.0118447 0.162863 -1.15242 0.274145
## 8: 16330.840: 0.436410 -4.31753 0.0696434 -0.164614 -0.0901385 -0.230925 -0.358390 1.14040 0.653973 0.0202645 0.00526611 0.173285 -1.13221 0.264871
## 9: 16330.815: 0.436325 -4.31756 0.0693003 -0.164573 -0.0900061 -0.230912 -0.357802 1.14061 0.654208 0.0202120 0.00523352 0.173108 -1.13176 0.266257
## 10: 16330.798: 0.436146 -4.31798 0.0685653 -0.164526 -0.0897682 -0.230948 -0.356843 1.14091 0.654616 0.0200727 0.00514193 0.172720 -1.13218 0.265617
## 11: 16330.773: 0.435564 -4.31905 0.0675345 -0.164094 -0.0891968 -0.230972 -0.354775 1.14154 0.655373 0.0197994 0.00488126 0.172036 -1.13163 0.266964
## 12: 16330.717: 0.434493 -4.32331 0.0658438 -0.162430 -0.0876015 -0.231056 -0.351954 1.14241 0.656854 0.0190883 0.00408646 0.170645 -1.13129 0.265374
## 13: 16330.687: 0.434743 -4.32530 0.0619641 -0.161267 -0.0848507 -0.230501 -0.352372 1.14367 0.659666 0.0185813 0.00394606 0.169148 -1.12970 0.266403
## 14: 16330.669: 0.432754 -4.32301 0.0595579 -0.161657 -0.0823539 -0.228689 -0.349635 1.14466 0.661380 0.0195482 0.00510823 0.169139 -1.12865 0.264262
## 15: 16330.644: 0.435699 -4.32757 0.0580346 -0.162810 -0.0823081 -0.228088 -0.347702 1.14400 0.660491 0.0197886 0.00539577 0.168614 -1.13025 0.265891
## 16: 16330.641: 0.435738 -4.32767 0.0575122 -0.162751 -0.0820862 -0.228278 -0.347118 1.14443 0.660896 0.0196438 0.00532995 0.168302 -1.13055 0.265414
## 17: 16330.637: 0.435670 -4.32759 0.0573466 -0.162572 -0.0821236 -0.228528 -0.347105 1.14519 0.661360 0.0193600 0.00517525 0.167991 -1.13047 0.266009
## 18: 16330.633: 0.435539 -4.32739 0.0566412 -0.162015 -0.0820869 -0.229192 -0.347600 1.14617 0.662906 0.0187826 0.00490782 0.167360 -1.13090 0.265686
## 19: 16330.632: 0.434479 -4.32589 0.0547072 -0.161034 -0.0812123 -0.230323 -0.346299 1.14356 0.665081 0.0191396 0.00519553 0.167589 -1.13034 0.265880
## 20: 16330.629: 0.434171 -4.32610 0.0536053 -0.161333 -0.0804734 -0.230763 -0.346079 1.14493 0.663964 0.0192164 0.00528164 0.167357 -1.13073 0.265215
## 21: 16330.625: 0.434019 -4.32627 0.0527617 -0.161775 -0.0797332 -0.231131 -0.346488 1.14664 0.663387 0.0191188 0.00532985 0.166927 -1.13059 0.266061
## 22: 16330.622: 0.434612 -4.32706 0.0535477 -0.162567 -0.0796002 -0.231188 -0.347167 1.14700 0.664837 0.0186083 0.00522703 0.166203 -1.13105 0.265868
## 23: 16330.621: 0.434814 -4.32768 0.0546735 -0.162138 -0.0803690 -0.231578 -0.345492 1.14724 0.664845 0.0183769 0.00513429 0.166384 -1.13149 0.266341
## 24: 16330.619: 0.435240 -4.32764 0.0528534 -0.161432 -0.0799549 -0.231839 -0.345426 1.14711 0.663819 0.0188581 0.00544021 0.166807 -1.13178 0.266031
## 25: 16330.619: 0.435771 -4.32751 0.0513182 -0.162219 -0.0788934 -0.231674 -0.346212 1.14665 0.663927 0.0193435 0.00582337 0.166551 -1.13163 0.266541
## 26: 16330.618: 0.435343 -4.32747 0.0514546 -0.164268 -0.0780659 -0.231466 -0.346003 1.14681 0.664271 0.0194833 0.00599860 0.165867 -1.13185 0.266211
## 27: 16330.617: 0.434827 -4.32777 0.0516448 -0.163082 -0.0789427 -0.232229 -0.345417 1.14789 0.664468 0.0184941 0.00568812 0.166141 -1.13191 0.266418
## 28: 16330.617: 0.434903 -4.32782 0.0515942 -0.163077 -0.0789228 -0.232237 -0.345355 1.14785 0.664533 0.0184915 0.00568484 0.166111 -1.13198 0.266302
## 29: 16330.617: 0.434975 -4.32783 0.0515624 -0.163053 -0.0789069 -0.232348 -0.345290 1.14782 0.664609 0.0185015 0.00567982 0.166075 -1.13194 0.266441
## 30: 16330.616: 0.435083 -4.32790 0.0516159 -0.162879 -0.0789140 -0.232374 -0.345257 1.14773 0.664817 0.0186130 0.00565124 0.165912 -1.13204 0.266335
## 31: 16330.616: 0.435262 -4.32799 0.0517663 -0.162593 -0.0787031 -0.232300 -0.345222 1.14754 0.665368 0.0187977 0.00564553 0.165776 -1.13216 0.266546
## 32: 16330.616: 0.435317 -4.32799 0.0513908 -0.163048 -0.0783928 -0.232268 -0.345081 1.14748 0.665380 0.0185793 0.00577391 0.166075 -1.13218 0.266396
## 33: 16330.615: 0.435321 -4.32794 0.0510071 -0.163068 -0.0784684 -0.232481 -0.345010 1.14750 0.665177 0.0189570 0.00588043 0.165595 -1.13208 0.266470
## 34: 16330.615: 0.435386 -4.32802 0.0507328 -0.162652 -0.0785502 -0.232686 -0.345154 1.14756 0.665304 0.0187948 0.00562409 0.165759 -1.13238 0.266489
## 35: 16330.615: 0.435468 -4.32806 0.0506971 -0.162803 -0.0782188 -0.232565 -0.345062 1.14757 0.665516 0.0183872 0.00564998 0.166155 -1.13244 0.266645
## 36: 16330.615: 0.435479 -4.32808 0.0508464 -0.163083 -0.0779431 -0.232442 -0.344843 1.14757 0.665583 0.0186348 0.00594468 0.165771 -1.13241 0.266507
## 37: 16330.615: 0.435441 -4.32818 0.0508214 -0.163185 -0.0782991 -0.232675 -0.344729 1.14756 0.665701 0.0190655 0.00584802 0.165485 -1.13217 0.266546
## 38: 16330.615: 0.435455 -4.32827 0.0505842 -0.162969 -0.0787551 -0.232975 -0.344732 1.14748 0.665829 0.0187456 0.00588466 0.165596 -1.13213 0.266444
## 39: 16330.615: 0.435515 -4.32817 0.0505838 -0.162671 -0.0782941 -0.232806 -0.344705 1.14757 0.665834 0.0187357 0.00574456 0.165627 -1.13252 0.266627
## 40: 16330.615: 0.435530 -4.32829 0.0504977 -0.162956 -0.0779064 -0.232795 -0.344691 1.14769 0.665939 0.0187651 0.00562987 0.165669 -1.13250 0.266521
## 41: 16330.615: 0.435540 -4.32830 0.0504537 -0.163030 -0.0777896 -0.232814 -0.344667 1.14769 0.665955 0.0186376 0.00581808 0.165611 -1.13241 0.266588
## 42: 16330.615: 0.435547 -4.32826 0.0504108 -0.163006 -0.0779681 -0.232812 -0.344628 1.14767 0.665945 0.0185701 0.00603131 0.165536 -1.13251 0.266579
## 43: 16330.615: 0.435548 -4.32822 0.0503079 -0.163038 -0.0781443 -0.232898 -0.344509 1.14767 0.665992 0.0188745 0.00568521 0.165678 -1.13257 0.266615
## 44: 16330.615: 0.435657 -4.32847 0.0501976 -0.162913 -0.0779826 -0.233064 -0.344339 1.14767 0.666126 0.0187468 0.00568122 0.165401 -1.13251 0.266528
## 45: 16330.615: 0.435671 -4.32854 0.0501533 -0.162759 -0.0779356 -0.233134 -0.344272 1.14769 0.666223 0.0186586 0.00605322 0.165128 -1.13256 0.266698
## 46: 16330.615: 0.435662 -4.32845 0.0499970 -0.162940 -0.0780949 -0.233126 -0.344332 1.14783 0.666419 0.0187523 0.00627119 0.165274 -1.13283 0.266722
## 47: 16330.615: 0.435656 -4.32843 0.0499831 -0.162900 -0.0779199 -0.233196 -0.344318 1.14772 0.666289 0.0185663 0.00595430 0.165221 -1.13254 0.266606
## 48: 16330.615: 0.435655 -4.32843 0.0499794 -0.162900 -0.0779196 -0.233195 -0.344316 1.14773 0.666289 0.0185673 0.00595355 0.165221 -1.13253 0.266618
## 49: 16330.615: 0.435638 -4.32843 0.0499794 -0.162895 -0.0779154 -0.233192 -0.344299 1.14774 0.666290 0.0185813 0.00593982 0.165229 -1.13256 0.266617
## 50: 16330.615: 0.435623 -4.32844 0.0500095 -0.162862 -0.0778657 -0.233185 -0.344300 1.14773 0.666284 0.0186072 0.00592460 0.165243 -1.13257 0.266636
## 51: 16330.615: 0.435640 -4.32843 0.0500200 -0.162831 -0.0778664 -0.233172 -0.344322 1.14777 0.666304 0.0186427 0.00590070 0.165271 -1.13260 0.266637
## 52: 16330.615: 0.435635 -4.32840 0.0500116 -0.162862 -0.0778635 -0.233167 -0.344314 1.14775 0.666294 0.0186190 0.00586705 0.165282 -1.13264 0.266658
## 53: 16330.615: 0.435635 -4.32840 0.0500110 -0.162862 -0.0778636 -0.233167 -0.344313 1.14775 0.666294 0.0186196 0.00586693 0.165282 -1.13264 0.266654
## 54: 16330.615: 0.435635 -4.32840 0.0500101 -0.162862 -0.0778635 -0.233167 -0.344310 1.14775 0.666295 0.0186209 0.00586677 0.165282 -1.13265 0.266657
## 55: 16330.615: 0.435634 -4.32841 0.0500094 -0.162860 -0.0778611 -0.233167 -0.344308 1.14775 0.666295 0.0186241 0.00587011 0.165285 -1.13265 0.266655
## 56: 16330.615: 0.435633 -4.32842 0.0500083 -0.162857 -0.0778554 -0.233167 -0.344304 1.14775 0.666297 0.0186312 0.00587745 0.165292 -1.13264 0.266656
## 57: 16330.615: 0.435631 -4.32842 0.0500061 -0.162845 -0.0778430 -0.233168 -0.344301 1.14775 0.666292 0.0186492 0.00588283 0.165273 -1.13265 0.266657
## 58: 16330.615: 0.435633 -4.32843 0.0500000 -0.162853 -0.0778455 -0.233169 -0.344298 1.14777 0.666308 0.0186593 0.00589237 0.165289 -1.13264 0.266656
## 59: 16330.615: 0.435637 -4.32841 0.0500004 -0.162834 -0.0778622 -0.233165 -0.344282 1.14776 0.666310 0.0186464 0.00588265 0.165286 -1.13269 0.266673
## 60: 16330.615: 0.435637 -4.32841 0.0500001 -0.162834 -0.0778622 -0.233165 -0.344282 1.14776 0.666310 0.0186468 0.00588244 0.165286 -1.13269 0.266672
## 61: 16330.615: 0.435636 -4.32841 0.0499998 -0.162835 -0.0778622 -0.233165 -0.344282 1.14776 0.666310 0.0186474 0.00588223 0.165286 -1.13269 0.266673
## 62: 16330.615: 0.435636 -4.32841 0.0499994 -0.162836 -0.0778624 -0.233165 -0.344283 1.14776 0.666310 0.0186486 0.00588072 0.165286 -1.13270 0.266673
```

```
save(LD_random_int, file = "migration_LD_random_int.Rdata")
LD_random_int.results <- data.frame(coef = fixef(LD_random_int),
  odds_ratio = exp(fixef(LD_random_int)), se = se.fixef(LD_random_int))
```

```
LD_random_int.results <- round(LD_random_int.results, 4)
summary(LD_random_int)
```

```
## Length Class Mode
##      1      mer    S4
```

```
LD_random_int.results
```

```
##              coef odds_ratio      se
## (Intercept)  -4.3284      0.0132 0.0939
## ethnic2       0.0500      1.0513 0.0913
## ethnic3      -0.1628      0.8497 0.1101
## ethnic4      -0.0779      0.9251 0.1236
## ethnic5      -0.2332      0.7920 0.1013
## gender1      -0.3443      0.7087 0.0542
## agegrp15lt25  1.1478      3.1511 0.0693
## agegrp25lt35  0.6663      1.9470 0.0855
## agegrp35lt45  0.0186      1.0188 0.1110
## agegrp45lt55  0.0059      1.0059 0.1218
## agegrp55      0.1653      1.1797 0.1052
## timeyears    -1.1327      0.3222 0.1194
## I(timeyears^2) 0.2667      1.3056 0.0425
```

Mixed-effects model - random intercepts at individual and neighborhood level (age groups)

```
LD_random_int_2level <- glmer(migr ~ ethnic + gender + agegrp + timeyears +
  I(timeyears^2) + (1 | respid) + (1 | originNBH), data = migrations.long,
  family = binomial, verbose = TRUE)
```

```
## 0: 16415.687: 0.322196 0.0449707 -4.24803 0.0767564 -0.192269 -0.0223040 -0.404590 -0.341110 1.15589 0.657058 0.0328792 0.0365408 0.184819 -1.16438 0.270829
## 1: 16412.965: 0.322558 0.0609097 -4.25678 0.0752329 -0.193214 -0.0228705 -0.406051 -0.345376 1.15332 0.655808 0.0321359 0.0359448 0.183968 -1.17182 0.259525
## 2: 16346.874: 0.335200 0.287836 -4.32520 0.0630113 -0.201265 -0.0272903 -0.416560 -0.377850 1.13532 0.646689 0.0261507 0.0310359 0.177023 -1.18937 0.283982
## 3: 16343.230: 0.337507 0.300131 -4.31994 0.0634813 -0.200730 -0.0273759 -0.413968 -0.373978 1.13802 0.647956 0.0263844 0.0310765 0.177120 -1.18205 0.297147
## 4: 16340.572: 0.339938 0.314790 -4.31821 0.0631643 -0.200510 -0.0279326 -0.411198 -0.371473 1.13996 0.648896 0.0262076 0.0307228 0.176681 -1.18529 0.283416
## 5: 16336.720: 0.345787 0.350886 -4.31283 0.0625778 -0.199855 -0.0290866 -0.404596 -0.365286 1.14453 0.651278 0.0260334 0.0301027 0.175955 -1.17623 0.297888
## 6: 16333.697: 0.359247 0.425837 -4.32019 0.0563228 -0.199787 -0.0346678 -0.387541 -0.360691 1.14914 0.655080 0.0236210 0.0266386 0.171710 -1.18319 0.271036
## 7: 16329.462: 0.389401 0.446607 -4.34887 0.0358647 -0.197966 -0.0537924 -0.332839 -0.357594 1.15447 0.665797 0.0166998 0.0161045 0.160004 -1.16946 0.293301
## 8: 16326.599: 0.442023 0.433360 -4.38263 0.0252424 -0.195067 -0.0715809 -0.286439 -0.362972 1.15716 0.671716 0.0110999 0.00642481 0.152637 -1.16330 0.282834
## 9: 16314.356: 0.754656 0.411724 -4.47638 0.0754521 -0.184546 -0.0856680 -0.275146 -0.364308 1.16977 0.659293 0.0102381 -0.00495937 0.162714 -1.11379 0.266476
## 10: 16309.120: 0.890786 0.400736 -4.51916 0.0950158 -0.180679 -0.0910532 -0.270700 -0.365053 1.17706 0.655276 0.00921961 -0.0101664 0.165763 -1.09162 0.262423
## 11: 16306.856: 0.890917 0.391372 -4.53352 0.0912074 -0.182433 -0.0911008 -0.273181 -0.371978 1.17550 0.655185 0.00766860 -0.0112310 0.163556 -1.09072 0.275972
## 12: 16305.050: 0.894134 0.383763 -4.54904 0.0897405 -0.183976 -0.0913926 -0.276160 -0.377037 1.17527 0.654575 0.00619627 -0.0125487 0.161796 -1.09683 0.263017
## 13: 16300.699: 0.911099 0.366929 -4.58292 0.0980868 -0.185863 -0.0928305 -0.283647 -0.377118 1.18203 0.651963 0.00423817 -0.0159451 0.161021 -1.08270 0.274196
## 14: 16167.077: 1.53191 0.00227260 -5.43275 0.486228 -0.205638 -0.138954 -0.491578 -0.234990 1.40244 0.586631 -0.0128158 -0.0977878 0.206630 -0.624253 0.148491
## 15: 16137.257: 2.18849 0.00000 -6.59698 0.731441 -0.239092 -0.0851381 -0.682220 0.0439488 2.00069 0.800410 -0.0535850 -0.198665 0.177526 0.327119 -0.134839
## 16: 16066.021: 2.62700 0.00000 -7.95296 0.459376 -0.238054 0.0935214 -0.752468 -0.126001 2.23084 1.32761 -0.0269735 -0.187313 0.130681 1.21177 -0.415844
## 17: 15937.857: 3.15966 0.00000 -8.91336 1.05860 -0.601518 -0.225069 0.373581 0.0559732 2.26228 1.52705 0.401966 0.0705367 0.233024 1.19331 -0.334121
## 18: 15902.790: 3.19742 0.00000 -8.90172 1.05337 -0.596642 -0.222068 0.367305 0.0513468 2.25943 1.52636 0.402636 0.0726753 0.235648 1.21725 -0.266280
## 19: 15881.857: 3.24945 0.00000 -8.91271 1.03790 -0.582995 -0.224577 0.354671 0.0256708 2.25711 1.51680 0.401141 0.0752049 0.238766 1.18932 -0.309913
## 20: 15849.227: 3.32364 0.00000 -8.94752 1.00617 -0.507980 -0.273638 0.378793 -0.00958749 2.32362 1.47422 0.404089 0.0873418 0.254591 1.18344 -0.252868
## 21: 15806.261: 3.47353 0.00000 -9.11470 0.925978 -0.340499 -0.399679 0.399549 -0.00883958 2.40154 1.45153 0.390410 0.100285 0.270087 1.16755 -0.290354
## 22: 15745.290: 3.69656 0.00000 -9.44610 0.882122 -0.286798 -0.505511 0.278145 0.161614 2.22555 1.74786 0.310214 0.0414435 0.200016 1.45991 -0.332687
## 23: 15601.983: 4.24175 0.00000 -10.0613 0.887799 -0.682353 -0.417089 0.389261 -0.341608 2.68421 1.58566 0.353871 -0.0460498 0.0865121 2.05989 -0.522713
## 24: 15592.313: 4.83999 0.00000 -10.8937 0.476614 -0.718171 -0.165102 0.405887 0.0687481 2.90319 1.20424 0.506602 0.0652295 0.170240 1.98783 -0.265557
## 25: 15398.120: 5.12271 0.00000 -11.3984 0.355301 -0.698175 -0.0680566 0.378425 0.294256 2.92203 1.18239 0.523733 0.110852 0.203562 1.97418 -0.423150
## 26: 15094.584: 6.56635 0.00000 -14.0275 1.29362 0.249374 -0.371729 0.356457 0.457695 2.98368 2.64069 -0.00521770 0.262534 0.302341 3.23852 -0.654256
## 27: 14560.305: 8.70730 0.00000 -16.4724 0.517928 0.349697 -0.301988 -0.0425910 0.318280 2.11763 1.57644 0.754670 0.314999 0.379343 4.30221 -0.736697
## 28: 14408.366: 10.1219 0.00000 -18.5379 0.218848 -0.620013 -0.118726 0.304614 0.365413 2.04869 0.836757 -0.823245 0.693381 0.856265 6.24388 -1.27241
## 29: 14234.042: 13.4167 0.00000 -23.0109 0.877987 -1.97365 0.198016 0.121828 -0.352600 3.64970 1.82624 1.11511 -1.56004 -1.89607 8.43803 -1.67204
## 30: 14193.237: 13.4244 1.01289e-10 -23.0048 0.878144 -1.97143 0.198356 0.121295 -0.351319 3.64252 1.82917 1.11554 -1.55776 -1.89362 8.46358 -1.60034
## 31: 14185.041: 13.4392 0.0302130 -23.0125 0.851079 -1.96350 0.205565 0.116705 -0.358164 3.62216 1.83838 1.11472 -1.55467 -1.89751 8.49463 -1.55162
## 32: 14182.440: 13.4435 0.0296209 -23.0163 0.849783 -1.96209 0.205230 0.114087 -0.362035 3.61328 1.83868 1.11378 -1.55303 -1.89575 8.49301 -1.56034
## 33: 14181.976: 13.4447 0.0294802 -23.0170 0.849482 -1.96171 0.205157 0.113464 -0.362914 3.61105 1.83880 1.11358 -1.55260 -1.89529 8.48978 -1.56105
## 34: 14181.070: 13.4470 0.0291969 -23.0185 0.848876 -1.96094 0.205011 0.112205 -0.364680 3.60653 1.83906 1.11316 -1.55173 -1.89435 8.48881 -1.56216
## 35: 14180.713: 13.4480 0.0290831 -23.0191 0.848632 -1.96062 0.204954 0.111696 -0.365385 3.60468 1.83918 1.11299 -1.55137 -1.89396 8.48850 -1.56240
## 36: 14180.642: 13.4482 0.0290604 -23.0192 0.848583 -1.96056 0.204942 0.111594 -0.365526 3.60431 1.83920 1.11296 -1.55130 -1.89388 8.48844 -1.56243
## 37: 14180.500: 13.4486 0.0290149 -23.0194 0.848486 -1.96043 0.204919 0.111391 -0.365807 3.60357 1.83925 1.11289 -1.55115 -1.89372 8.48833 -1.56250
## 38: 14180.443: 13.4488 0.0289968 -23.0195 0.848447 -1.96038 0.204910 0.111309 -0.365920 3.60327 1.83927 1.11286 -1.55110 -1.89366 8.48828 -1.56252
## 39: 14180.329: 13.4491 0.0289605 -23.0197 0.848369 -1.96028 0.204892 0.111147 -0.366145 3.60268 1.83930 1.11281 -1.55098 -1.89354 8.48819 -1.56256
## 40: 14180.284: 13.4492 0.0289460 -23.0198 0.848337 -1.96024 0.204885 0.111081 -0.366234 3.60244 1.83932 1.11279 -1.55093 -1.89349 8.48816 -1.56258
## 41: 14180.275: 13.4493 0.0289431 -23.0198 0.848331 -1.96023 0.204883 0.111068 -0.366252 3.60240 1.83932 1.11278 -1.55092 -1.89348 8.48815 -1.56258
## 42: 14180.203: 13.4495 0.0289199 -23.0199 0.848281 -1.96016 0.204871 0.110964 -0.366396 3.60201 1.83935 1.11275 -1.55085 -1.89340 8.48810 -1.56260
## 43: 14180.200: 13.4495 0.0289190 -23.0199 0.848279 -1.96016 0.204871 0.110960 -0.366402 3.60200 1.83935 1.11275 -1.55085 -1.89339 8.48810 -1.56260
## 44: 14180.199: 13.4495 0.0289188 -23.0199 0.848279 -1.96016 0.204871 0.110959 -0.366403 3.60200 1.83935 1.11275 -1.55085 -1.89339 8.48810 -1.56260
## 45: 14180.195: 13.4495 0.0289173 -23.0199 0.848276 -1.96016 0.204870 0.110952 -0.366412 3.60197 1.83935 1.11275 -1.55084 -1.89339 8.48809 -1.56261
```

```
## 46: 14180.190: 13.4495 0.0289173 -23.0201 0.848276 -1.96016 0.204870 0.110952 -0.366412 3.60197 1.83935 1.11275 -1.55084 -1.89339 8.48809 -1.56261
## 47: 14180.181: 13.4495 0.0289202 -23.0201 0.848264 -1.96015 0.204870 0.110939 -0.366431 3.60192 1.83935 1.11274 -1.55083 -1.89338 8.48809 -1.56261
## 48: 14180.178: 13.4495 0.0289190 -23.0201 0.848262 -1.96014 0.204869 0.110933 -0.366439 3.60190 1.83935 1.11274 -1.55083 -1.89337 8.48809 -1.56261
## 49: 14180.176: 13.4495 0.0289090 -23.0201 0.848262 -1.96014 0.204869 0.110933 -0.366458 3.60190 1.83935 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 50: 14180.175: 13.4495 0.0289087 -23.0201 0.848261 -1.96014 0.204869 0.110932 -0.366459 3.60190 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 51: 14180.175: 13.4495 0.0289086 -23.0201 0.848261 -1.96014 0.204869 0.110932 -0.366460 3.60190 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 52: 14180.175: 13.4495 0.0289086 -23.0201 0.848261 -1.96014 0.204869 0.110932 -0.366460 3.60190 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 53: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 54: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 55: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 56: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 57: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 58: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 59: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 60: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 61: 14180.174: 13.4495 0.0289084 -23.0201 0.848261 -1.96014 0.204869 0.110931 -0.366461 3.60189 1.83936 1.11274 -1.55083 -1.89337 8.48804 -1.56261
## 62: 14152.962: 13.6124 0.131206 -23.1669 0.715940 -1.88664 0.210601 0.0361826 -0.538260 3.33644 1.87759 1.02631 -1.48694 -1.86905 8.38956 -1.56908
## 63: 14029.858: 14.3180 0.112753 -22.9780 0.491288 -2.05147 -0.145439 -0.361057 -0.300226 2.12309 1.58714 0.268750 -1.55925 -2.38515 8.48877 -1.52491
## 64: 13979.680: 14.6007 0.00000 -22.7592 0.293176 -1.15916 -0.785190 0.182349 -0.0410882 0.981429 0.460424 -0.451188 -0.876894 -1.71670 8.63023 -1.53780
## 65: 13954.087: 15.0289 0.00000 -22.7400 -0.814848 -0.795149 -1.87236 -1.08162 -0.0108881 0.870357 1.13331 0.303041 0.278578 0.801540 8.63669 -1.49279
## 66: 13932.161: 15.1153 0.00000 -22.7738 -0.647476 -1.13048 -0.595100 -1.10183 -0.0491663 0.696797 1.04878 0.207600 0.652175 -0.0220437 8.61840 -1.48482
## 67: 13924.411: 15.1955 0.00000 -22.8062 -0.508935 -1.19486 0.344112 -0.89133 -0.085276 0.522562 0.921664 -0.0531679 -0.600746 -0.00805763 8.60119 -1.47938
## 68: 13918.693: 15.2872 0.00000 -22.8318 -0.479922 -1.16437 -1.01217 -0.940599 -0.121368 0.833717 0.855720 -0.116112 -0.952154 -0.650725 8.58960 -1.49810
## 69: 13907.642: 15.2567 0.00000 -22.8320 -0.365229 -0.651310 -0.386101 -0.851287 -0.122178 0.806011 0.678899 -0.102607 -0.400385 -0.433285 8.58969 -1.50272
## 70: 13903.649: 15.4428 0.00000 -22.8123 -0.418832 -0.565816 -0.0904441 -0.946466 -0.0970327 0.762764 0.572014 -0.182751 -0.226814 -0.477948 8.59920 -1.49662
## 71: 13899.953: 15.6481 0.00000 -22.8274 -0.391365 -0.574350 -0.0543818 -1.04751 -0.114900 0.795562 0.539681 -0.120553 -0.235085 -0.484334 8.59108 -1.49438
## 72: 13899.944: 15.6487 0.00000 -22.8274 -0.391361 -0.574404 -0.0544908 -1.04769 -0.114952 0.795665 0.539699 -0.120537 -0.235220 -0.484308 8.59105 -1.49438
## 73: 13899.922: 15.6498 0.00000 -22.8275 -0.391234 -0.574428 -0.0546206 -1.04792 -0.115109 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 74: 13899.921: 15.6498 1.19119e-12 -22.8275 -0.391234 -0.574428 -0.0546207 -1.04792 -0.115110 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 75: 13899.920: 15.6498 7.37788e-12 -22.8275 -0.391234 -0.574428 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 76: 13899.920: 15.6498 7.40481e-12 -22.8275 -0.391234 -0.574428 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 77: 13899.920: 15.6498 7.40481e-12 -22.8275 -0.391234 -0.574429 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 78: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574429 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 79: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574429 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49437
## 80: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574429 -0.0546210 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235344 -0.484081 8.59099 -1.49436
## 81: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 82: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 83: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 84: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 85: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 86: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 87: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 88: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 89: 13899.920: 15.6498 2.88476e-22 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795925 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 90: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795926 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 91: 13899.920: 15.6498 0.00000 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795926 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 92: 13899.920: 15.6498 2.47660e-15 -22.8275 -0.391234 -0.574430 -0.0546219 -1.04792 -0.115112 0.795926 0.539901 -0.120302 -0.235345 -0.484081 8.59099 -1.49436
## 93: 13898.133: 15.6499 0.00000 -22.9275 -0.391223 -0.575081 -0.0551497 -1.04792 -0.115189 0.796003 0.540056 -0.121430 -0.235760 -0.484005 8.59099 -1.49427
## 94: 13897.027: 15.6516 0.00520741 -23.0272 -0.395070 -0.576367 -0.0551916 -1.04836 -0.115252 0.796903 0.540237 -0.122588 -0.236679 -0.485369 8.59099 -1.49074
## 95: 13896.551: 15.6523 0.00786329 -23.0364 -0.397077 -0.576732 -0.0550289 -1.04858 -0.115217 0.797309 0.540266 -0.122706 -0.236699 -0.486137 8.59099 -1.48902
## 96: 13848.378: 16.4624 0.0121444 -23.9669 -0.175265 -0.577819 -0.0176981 -1.12745 -0.246467 0.869491 0.540482 -0.145259 -0.271177 -0.351819 8.59099 -1.35783
## 97: 13781.941: 19.0310 0.0398558 -26.3213 -0.160211 -0.438473 -0.118661 -1.26551 -0.537000 0.03992 0.545778 -0.196895 -0.253900 -0.330548 8.59099 -1.05137
## 98: 13763.700: 20.5912 0.0198666 -27.7140 -0.0438442 -0.401387 -0.180407 -0.709575 1.08443 0.549508 -0.230084 -0.369999 -0.276029 -0.276029 8.59099 -0.899393
## 99: 13755.789: 21.9559 0.0388804 -28.9155 -0.0263187 -0.386898 -0.255022 -0.997412 -0.834636 1.07795 0.554257 -0.255223 -0.372675 -0.284545 8.59099 -0.769711
## 100: 13753.679: 22.6696 0.0625312 -29.5485 0.0155795 -0.410148 -0.295987 -0.795895 -0.893138 1.05447 0.557210 -0.267875 -0.352421 -0.279392 8.59099 -0.702752
## 101: 13753.050: 22.9324 0.0872543 -29.7808 0.0354362 -0.437342 -0.321064 -0.638471 -0.903521 1.02853 0.558818 -0.271628 -0.326267 -0.283681 8.59099 -0.680060
## 102: 13752.776: 22.9342 0.107224 -29.7754 0.0493040 -0.460205 -0.335410 -0.533551 -0.887923 1.00801 0.559384 -0.270313 -0.299341 -0.287092 8.59099 -0.683614
## 103: 13752.622: 22.8056 0.121261 -29.6465 0.0597078 -0.474875 -0.341957 -0.476794 -0.860080 0.995821 0.559206 -0.266481 -0.276219 -0.286615 8.59099 -0.700585
## 104: 13752.546: 22.6914 0.126324 -29.5295 0.0645072 -0.476707 -0.340424 -0.473425 -0.838849 0.995428 0.558646 -0.263351 -0.266822 -0.281614 8.59099 -0.714977
## 105: 13752.470: 22.6088 0.129767 -29.4382 0.0682145 -0.472523 -0.333604 -0.485191 -0.819119 1.00069 0.557794 -0.260708 -0.263093 -0.271821 8.59099 -0.726279
## 106: 13752.332: 22.5600 0.136275 -29.3665 0.0733953 -0.461086 -0.317449 -0.505898 -0.791324 1.01102 0.556158 -0.257789 -0.261280 -0.252913 8.59099 -0.736126
## 107: 13752.076: 22.5899 0.149451 -29.3557 0.0834555 -0.438445 -0.280379 -0.535282 -0.748486 1.02711 0.552809 -0.254702 -0.259696 -0.219254 8.59099 -0.740766
## 108: 13751.724: 22.7388 0.166839 -29.4716 0.0985008 -0.410047 -0.219319 -0.559817 -0.700363 1.04142 0.547652 -0.250609 -0.254176 -0.181297 8.59099 -0.732393
## 109: 13751.664: 22.7651 0.168703 -29.4980 0.100500 -0.407062 -0.210439 -0.560385 -0.695265 1.04198 0.546898 -0.253103 -0.252100 -0.178163 8.59099 -0.728995
## 110: 13751.520: 22.8134 0.171237 -29.5543 0.104588 -0.401927 -0.191025 -0.559336 -0.685893 1.04183 0.545223 -0.253298 -0.245798 -0.174149 8.59099 -0.724663
## 111: 13751.450: 22.8306 0.171801 -29.5778 0.106307 -0.399586 -0.181649 -0.558511 -0.681848 1.04143 0.544421 -0.253379 -0.242818 -0.173165 8.59099 -0.722413
## 112: 13750.812: 22.9254 0.173387 -29.7732 0.127457 -0.381109 -0.0906530 -0.552219 -0.636094 1.04212 0.535285 -0.253345 -0.183569 -0.156678 8.59099 -0.704389
## 113: 13750.688: 22.9513 0.172863 -29.8182 0.130184 -0.375633 -0.0712181 -0.545900 -0.626694 1.04026 0.533242 -0.253425 -0.170483 -0.156583 8.59099 -0.700167
## 114: 13750.662: 22.9565 0.172445 -29.8271 0.130716 -0.374188 -0.071553 -0.544368 -0.624920 1.03975 0.532811 -0.253451 -0.167942 -0.156846 8.59099 -0.699326
## 115: 13750.609: 22.9675 0.171270 -29.8444 0.131744 -0.370815 -0.0593544 -0.540603 -0.621562 1.03856 0.531946 -0.253513 -0.162894 -0.157666 8.59099 -0.697694
## 116: 13750.587: 22.9719 0.170625 -29.8512 0.132145 -0.369224 -0.0561726 -0.539005 -0.620256 1.03805 0.531586 -0.253541 -0.160908 -0.158088 8.59099 -0.697051
## 117: 13750.540: 22.9801 0.168938 -29.8646 0.133027 -0.365417 -0.0492021 -0.535734 -0.617510 1.03699 0.530803 -0.253591 -0.156960 -0.159039 8.59099 -0.695790
## 118: 13750.520: 22.9832 0.168117 -29.8699 0.133398 -0.363681 -0.0463010 -0.534316 -0.616368 1.03655 0.530466 -0.253610 -0.155247 -0.159458 8.59099 -0.695296
## 119: 13750.515: 22.9837 0.167924 -29.8709 0.133475 -0.363294 -0.04456863 -0.534008 -0.616130 1.03646 0.530395 -0.253613 -0.154895 -0.159555 8.59099 -0.695200
## 120: 13750.506: 22.9848 0.167494 -29.8729 0.133608 -0.362406 -0.0445450 -0.533346 -0.615667 1.03626 0.530247 -0.253621 -0.154120 -0.159788 8.59099 -0.695009
## 121: 13750.506: 22.9848 0.167475 -29.8730 0.133615 -0.362369 -0.0444954 -0.533318 -0.615647 1.03626 0.530241 -0.253621 -0.154086 -0.159796 8.59099 -0.695001
## 122: 13750.505: 22.9849 0.167301 -29.8732 0.133617 -0.362310 -0.0444110 -0.533241 -0.615628 1.03623 0.530231 -0.253623 -0.154036 -0.159832 8.59099 -0.694984
## 123: 13750.505: 22.9849 0.167412 -29.8733 0.133622 -0.362280 -0.04433615 -0.533215 -0.615613 1.03622 0.530226 -0.253624 -0.154020 -0.159842 8.59099 -0.694979
## 124: 13750.504: 22.9850 0.167378 -29.8734 0.133626 -0.362220 -0.0443293 -0.533161 -0.615591 1.03621 0.530217 -0.253625 -0.153934 -0.159861 8.59099 -0.694967
## 125: 13750.504: 22.9850 0.167362 -29.8734 0.133626 -0.362194 -0.0443046 -0.533137 -0.615582 1.03620 0.530213 -0.253625 -0.153911 -0.159872 8.59099 -0.694962
## 126: 13750.503: 22.9850 0.167345 -29.8735 0.133627 -0.362165 -0.0442753 -0.533109 -0.615569 1.03619 0.530209 -0.253625 -0.153885 -0.159885 8.59099 -0.694958
## 127: 13750.501: 22.9850 0.167200 -29.8738 0.133633 -0.361929 -0.0440326 -0.532870 -0.615461 1.03612 0.530172 -0.253626 -0.153664 -0.159989 8.59099 -0.694928
## 128: 13750.500: 22.9850 0.167142 -29.8739 0.133644 -0.361823 -0.0439391 -0.532789 -0.615411 1.03610 0.530157 -0.253626 -0.153564 -0.160017 8.59099 -0.694918
## 129: 13750.498: 22.9850 0.167010 -29.8742 0.133673 -0.361655 -0.0436998 -0.532613 -0.615323 1.03606 0.53012
```


LD_random_int_2level.results

##		coef	odds_ratio	se
##	(Intercept)	-29.8767	0.0000	1.1524
##	ethnic2	0.1340	1.1433	1.6250
##	ethnic3	-0.3602	0.6975	2.0818
##	ethnic4	-0.0403	0.9605	2.3966
##	ethnic5	-0.5307	0.5882	1.6483
##	gender1	-0.6145	0.5409	1.1752
##	agegrp15lt25	1.0355	2.8166	0.6540
##	agegrp25lt35	0.5298	1.6986	0.8051
##	agegrp35lt45	-0.2536	0.7760	1.0812
##	agegrp45lt55	-0.1527	0.8584	1.4005
##	agegrp55	-0.1608	0.8515	1.8496
##	timeyears	8.5910	5382.9495	0.4849
##	I(timeyears^2)	-0.6947	0.4992	0.1556

Mixed-effects model - random intercept at neighborhood level (continuous age in decades)

```
LD_random_int_contage <- glmer(migr ~ ethnic + gender + agedecades +
  timeyears + I(timeyears^2) + (1 | originNBH), data = migrations.long, family = binomial,
  verbose = TRUE)
```

##	0:	16756.499:	0.0449707	-3.77632	0.0239561	-0.259528	-0.00954322	-0.414141	-0.266185	-0.0181336	-1.21367	0.281247
##	1:	16678.340:	0.523482	-3.77322	0.0242981	-0.259763	-0.0103844	-0.410060	-0.265003	-0.0159687	-1.20743	0.294638
##	2:	16674.188:	0.519764	-3.77641	0.0232772	-0.259941	-0.0112600	-0.408644	-0.266801	-0.0290209	-1.21279	0.282557
##	3:	16673.002:	0.505678	-3.78013	0.0209202	-0.259836	-0.0138271	-0.402189	-0.269264	-0.0312027	-1.21026	0.292194
##	4:	16671.663:	0.491738	-3.78348	0.0191490	-0.259820	-0.0157712	-0.397508	-0.271185	-0.0305441	-1.21482	0.281381
##	5:	16670.511:	0.476594	-3.78529	0.0175015	-0.259607	-0.0178407	-0.391830	-0.272198	-0.0239019	-1.21233	0.288656
##	6:	16669.406:	0.460515	-3.78887	0.0156326	-0.259534	-0.0201970	-0.385989	-0.273518	-0.0284557	-1.21495	0.282971
##	7:	16668.146:	0.432774	-3.79515	0.0105174	-0.258656	-0.0283877	-0.363344	-0.273819	-0.0209618	-1.21237	0.288056
##	8:	16667.556:	0.443457	-3.80698	0.00421332	-0.257599	-0.0398136	-0.333298	-0.275656	-0.0340511	-1.21172	0.289257
##	9:	16666.760:	0.453504	-3.81720	-0.00138056	-0.256051	-0.0511505	-0.303153	-0.278231	-0.0209200	-1.21294	0.282351
##	10:	16666.615:	0.451284	-3.81751	-0.00140622	-0.255837	-0.0517374	-0.301557	-0.277951	-0.0243790	-1.20972	0.290768
##	11:	16666.392:	0.448892	-3.81807	0.000451804	-0.254545	-0.0537797	-0.296180	-0.274946	-0.0272796	-1.20960	0.284483
##	12:	16666.200:	0.448265	-3.81834	0.00354548	-0.252531	-0.0562746	-0.289359	-0.271367	-0.0247988	-1.20574	0.285236
##	13:	16666.079:	0.448040	-3.82431	0.00538098	-0.250650	-0.0589318	-0.283142	-0.274521	-0.0253190	-1.20470	0.283985
##	14:	16665.926:	0.446369	-3.83302	0.00643375	-0.244771	-0.0616113	-0.268339	-0.271240	-0.0243426	-1.19747	0.284445
##	15:	16665.868:	0.444422	-3.83228	0.00782784	-0.242622	-0.0616850	-0.262691	-0.266930	-0.0252699	-1.19463	0.279272
##	16:	16665.820:	0.444445	-3.83536	0.0102188	-0.242585	-0.0611204	-0.262169	-0.275381	-0.0225804	-1.19321	0.280005
##	17:	16665.796:	0.443870	-3.83583	0.0101001	-0.242554	-0.0613136	-0.261755	-0.275443	-0.0242334	-1.19322	0.280230
##	18:	16665.795:	0.443023	-3.83613	0.00999532	-0.242451	-0.0616105	-0.260955	-0.275280	-0.0234722	-1.19277	0.281322
##	19:	16665.779:	0.442821	-3.83634	0.00994753	-0.242438	-0.0616959	-0.260777	-0.275309	-0.0239336	-1.19305	0.280636
##	20:	16665.762:	0.440468	-3.83784	0.00955675	-0.242151	-0.0626840	-0.258326	-0.275056	-0.0241784	-1.19331	0.279838
##	21:	16665.728:	0.443542	-3.84067	0.00896476	-0.241343	-0.0646883	-0.252762	-0.272214	-0.0236482	-1.19246	0.280721
##	22:	16665.721:	0.445496	-3.84171	0.0112554	-0.238814	-0.0665331	-0.247223	-0.272690	-0.0243844	-1.18968	0.278675
##	23:	16665.701:	0.443158	-3.84590	0.0151951	-0.235607	-0.0654126	-0.248394	-0.271938	-0.0232600	-1.18651	0.278482
##	24:	16665.695:	0.442592	-3.85001	0.00954086	-0.236805	-0.0622725	-0.247394	-0.271229	-0.0231906	-1.18764	0.278528
##	25:	16665.694:	0.441237	-3.84519	0.00678038	-0.239199	-0.0613022	-0.243416	-0.273818	-0.0232861	-1.18684	0.279393
##	26:	16665.684:	0.440354	-3.84453	0.00927319	-0.239980	-0.0634845	-0.242864	-0.273971	-0.0239167	-1.18815	0.278640
##	27:	16665.676:	0.440802	-3.84581	0.0110614	-0.239480	-0.0661884	-0.243155	-0.273318	-0.0232041	-1.18931	0.279581
##	28:	16665.672:	0.441253	-3.84714	0.0108801	-0.236267	-0.0672394	-0.243134	-0.272922	-0.0234038	-1.18801	0.278858
##	29:	16665.669:	0.441274	-3.84843	0.0124944	-0.236872	-0.0657415	-0.241352	-0.272472	-0.0233284	-1.18570	0.278406
##	30:	16665.667:	0.442121	-3.84922	0.0136618	-0.238840	-0.0655903	-0.238666	-0.273650	-0.0232335	-1.18646	0.278207
##	31:	16665.664:	0.441569	-3.84748	0.0124700	-0.236995	-0.0673618	-0.237393	-0.274128	-0.0231244	-1.18785	0.279079
##	32:	16665.663:	0.440745	-3.84762	0.0125512	-0.236966	-0.0680135	-0.237406	-0.272911	-0.0235629	-1.18772	0.278709
##	33:	16665.661:	0.440769	-3.84853	0.0121253	-0.237095	-0.0680606	-0.237648	-0.272464	-0.0232088	-1.18648	0.278555
##	34:	16665.660:	0.441081	-3.84937	0.0117490	-0.236296	-0.0675877	-0.237591	-0.272883	-0.0232007	-1.18562	0.278066
##	35:	16665.659:	0.441164	-3.85000	0.0129157	-0.235699	-0.0672251	-0.237112	-0.272722	-0.0232174	-1.18611	0.278523
##	36:	16665.658:	0.440892	-3.85042	0.0131554	-0.235988	-0.0686450	-0.236909	-0.272352	-0.0232160	-1.18563	0.278146
##	37:	16665.657:	0.440881	-3.85047	0.0124958	-0.235071	-0.0686494	-0.236067	-0.272535	-0.0230019	-1.18471	0.277929
##	38:	16665.657:	0.441289	-3.85083	0.0122835	-0.234520	-0.0677297	-0.234923	-0.272347	-0.0232122	-1.18500	0.277878
##	39:	16665.656:	0.441426	-3.85144	0.0124592	-0.235335	-0.0686276	-0.235039	-0.272700	-0.0231641	-1.18404	0.277766
##	40:	16665.656:	0.441097	-3.85186	0.0133654	-0.234501	-0.0677810	-0.234722	-0.272826	-0.0229862	-1.18459	0.277772
##	41:	16665.656:	0.440985	-3.85237	0.0135828	-0.233826	-0.0670119	-0.234010	-0.272006	-0.0229703	-1.18506	0.278208
##	42:	16665.655:	0.440884	-3.85259	0.0131622	-0.233764	-0.0682269	-0.233954	-0.271858	-0.0231983	-1.18411	0.277701
##	43:	16665.654:	0.441450	-3.85248	0.0129003	-0.233380	-0.0695077	-0.233298	-0.272393	-0.0230493	-1.18425	0.277815
##	44:	16665.654:	0.441294	-3.85311	0.0133689	-0.233407	-0.0688746	-0.233055	-0.272581	-0.0230385	-1.18300	0.277307
##	45:	16665.654:	0.441412	-3.85409	0.0130941	-0.234549	-0.0691904	-0.232812	-0.271933	-0.0228714	-1.18300	0.277408
##	46:	16665.654:	0.441138	-3.85416	0.0136941	-0.234225	-0.0694741	-0.232699	-0.272110	-0.0230505	-1.18316	0.277501

```
## 47: 16665.654: 0.441062 -3.85422 0.0140523 -0.233590 -0.0692245 -0.232388 -0.272046 -0.0229438 -1.18300 0.277496
## 48: 16665.654: 0.441244 -3.85432 0.0140775 -0.233163 -0.0688254 -0.231951 -0.271882 -0.0229238 -1.18336 0.277410
## 49: 16665.654: 0.441285 -3.85446 0.0139895 -0.232967 -0.0687009 -0.231904 -0.271943 -0.0229385 -1.18305 0.277413
## 50: 16665.654: 0.441245 -3.85450 0.0139982 -0.232958 -0.0687344 -0.231879 -0.272032 -0.0229879 -1.18304 0.277414
## 51: 16665.654: 0.441235 -3.85449 0.0139952 -0.232967 -0.0687643 -0.231877 -0.272045 -0.0229402 -1.18304 0.277432
## 52: 16665.654: 0.441192 -3.85459 0.0139423 -0.232990 -0.0692038 -0.231875 -0.272089 -0.0229341 -1.18269 0.277304
## 53: 16665.654: 0.441272 -3.85465 0.0141292 -0.232996 -0.0692144 -0.231648 -0.272179 -0.0229278 -1.18274 0.277319
## 54: 16665.654: 0.441293 -3.85477 0.0141465 -0.232749 -0.0690909 -0.231570 -0.272175 -0.0229204 -1.18265 0.277279
## 55: 16665.654: 0.441269 -3.85475 0.0141441 -0.232744 -0.0690773 -0.231518 -0.272177 -0.0229218 -1.18267 0.277290
## 56: 16665.654: 0.441269 -3.85475 0.0141441 -0.232744 -0.0690773 -0.231518 -0.272177 -0.0229218 -1.18267 0.277290
```

```
save(LD_random_int_contage, file = "migration_LD_random_int_contage.Rdata")
LD_random_int_contage.results <- data.frame(coef = fixef(LD_random_int_contage),
      odds_ratio = exp(fixef(LD_random_int_contage)), se = se.fixef(LD_random_int_contage))
LD_random_int_contage.results <- round(LD_random_int_contage.results,
      4)
summary(LD_random_int_contage)
```

```
## Length Class Mode
## 1 mer S4
```

```
LD_random_int_contage.results
```

```
##          coef odds_ratio    se
## (Intercept) -3.8548      0.0212 0.0900
## ethnic2      0.0142      1.0143 0.0915
## ethnic3     -0.2327      0.7924 0.1098
## ethnic4     -0.0691      0.9332 0.1237
## ethnic5     -0.2316      0.7933 0.1013
## gender1     -0.2722      0.7617 0.0537
## agedecades  -0.0229      0.9773 0.0138
## timeyears   -1.1827      0.3065 0.1192
## I(timeyears^2) 0.2773      1.3196 0.0425
```

Mixed-effects model - random intercepts at individual and neighborhood level (continuous age in decades)

```
LD_random_int_contage_2level <- glmer(migr ~ ethnic + gender + agedecades +
      timeyears + I(timeyears^2) + (1 | respid) + (1 | originNBH), data = migrations.long,
      family = binomial, verbose = TRUE)
```

```
## 0: 16755.168: 0.322196 0.0449707 -3.77632 0.0239561 -0.259528 -0.00954322 -0.414141 -0.266185 -0.0181336 -1.21367 0.281247
## 1: 16752.948: 0.322673 0.0516994 -3.77999 0.0233301 -0.259901 -0.00978949 -0.414754 -0.268030 -0.0275839 -1.21691 0.276219
## 2: 16750.384: 0.324400 0.0616683 -3.77979 0.0233923 -0.259933 -0.00976255 -0.414736 -0.267990 -0.0225354 -1.21418 0.283501
## 3: 16689.175: 0.378752 0.491181 -3.82836 0.0161490 -0.266526 -0.0129786 -0.422252 -0.293317 -0.0100155 -1.21433 0.330092
## 4: 16672.200: 0.379549 0.488522 -3.83506 0.0145703 -0.267059 -0.0142070 -0.420978 -0.296099 -0.0381522 -1.23363 0.280710
## 5: 16666.053: 0.405202 0.472561 -3.85863 0.00314336 -0.267344 -0.0274316 -0.385904 -0.297149 -0.0412715 -1.22507 0.304817
## 6: 16663.916: 0.408525 0.469575 -3.85728 0.00315242 -0.267071 -0.0280584 -0.383230 -0.295602 -0.0250252 -1.22579 0.298709
## 7: 16663.584: 0.412084 0.464754 -3.85849 0.00257077 -0.266952 -0.0292247 -0.379835 -0.295054 -0.0280262 -1.22657 0.294676
## 8: 16663.125: 0.417104 0.463256 -3.85983 0.00194343 -0.266801 -0.0306004 -0.375721 -0.294303 -0.0253799 -1.22432 0.298641
## 9: 16662.396: 0.429370 0.462022 -3.86566 0.000107287 -0.266699 -0.0340190 -0.366486 -0.293998 -0.0280172 -1.22457 0.294934
## 10: 16648.466: 0.777471 0.531022 -4.03123 -0.0376407 -0.265735 -0.112457 -0.162986 -0.305517 -0.0363214 -1.19765 0.307396
## 11: 16639.106: 1.02307 0.518018 -4.16364 -0.0458200 -0.267523 -0.146781 -0.0891577 -0.333544 -0.0253066 -1.19072 0.291311
## 12: 16636.469: 1.22514 0.522910 -4.34000 -0.0664845 -0.273963 -0.190245 -0.000778780 -0.362207 -0.0258803 -1.16276 0.338227
## 13: 16624.886: 1.15106 0.479209 -4.43025 -0.0797839 -0.282991 -0.202278 0.00852181 -0.360491 -0.0239278 -1.15233 0.310238
## 14: 16615.988: 1.17288 0.452448 -4.42873 -0.0570903 -0.280394 -0.192711 -0.0195253 -0.276654 -0.0183482 -1.06859 0.293944
## 15: 16611.862: 1.26177 0.446648 -4.46637 -0.0531374 -0.277591 -0.199519 -0.00889440 -0.281690 -0.0401291 -1.02974 0.250740
## 16: 16598.161: 1.31262 0.426263 -4.52657 -0.0684790 -0.277611 -0.217783 0.0255296 -0.339584 -0.0249271 -0.995789 0.267944
## 17: 16578.832: 1.40036 0.321977 -4.69488 -0.108575 -0.289608 -0.256138 0.0621615 -0.381280 -0.0416239 -1.00575 0.259867
## 18: 16008.881: 6.10192 0.00000 -9.85002 -0.603087 -0.531009 -1.18087 1.02371 -0.759708 -0.0905176 0.444147 -0.143618
## 19: 15389.645: 7.69944 0.0204098 -12.0174 -0.750851 -0.615793 -1.52971 1.23352 -0.771810 -0.0407222 1.47530 -0.261101
## 20: 15099.136: 7.71355 0.0207670 -12.0001 -0.745809 -0.613432 -1.52727 1.23043 -0.762057 0.0122861 1.54208 -0.106299
## 21: 15071.230: 7.81157 0.0225445 -12.1118 -0.743517 -0.609599 -1.54373 1.21911 -0.762271 0.0143236 1.63236 -0.0715674
## 22: 15065.206: 7.81457 0.0219254 -12.1157 -0.742006 -0.609320 -1.54270 1.21270 -0.763181 0.00474551 1.63087 -0.0840029
## 23: 15058.287: 7.82649 0.0200770 -12.1249 -0.736275 -0.607969 -1.53896 1.19175 -0.764116 -0.0144353 1.63777 -0.0958967
## 24: 15047.854: 7.86426 0.0188337 -12.1564 -0.729122 -0.605463 -1.53845 1.16807 -0.763395 -0.0180747 1.67749 -0.0742773
## 25: 14337.803: 13.3963 0.193880 -19.3793 -1.00921 -0.549423 -2.78626 1.64613 -1.12801 -0.0384156 5.82694 -0.951856
```

##	26:	14260.269:	13.5368	0.193313	-19.5900	-0.959942	-0.340016	-2.99347	1.11472	-0.433868	-0.0905841	5.55049	-0.775143
##	27:	14251.187:	13.5434	0.191216	-19.5856	-0.955803	-0.339013	-2.99104	1.10656	-0.431678	-0.0674365	5.57523	-0.726068
##	28:	14245.094:	13.5431	0.190383	-19.5637	-0.935203	-0.336989	-2.99545	1.07570	-0.447242	-0.0781867	5.59594	-0.758455
##	29:	14215.143:	13.5256	0.233135	-19.2178	-0.646957	-0.329145	-3.07837	0.758915	-0.639227	-0.154989	5.98398	-0.876505
##	30:	14052.629:	16.5301	0.193910	-23.4952	0.107784	-1.83027	-3.36304	1.11005	-0.727796	0.0102974	7.67039	-0.984343
##	31:	14009.104:	16.5304	0.191341	-23.5026	0.107042	-1.82969	-3.36234	1.10429	-0.730508	-0.00923603	7.65373	-1.03497
##	32:	13998.898:	16.5793	0.185797	-23.5712	0.0544020	-1.80699	-3.34814	1.09043	-0.726510	-0.0161012	7.69181	-1.06598
##	33:	13986.579:	16.6977	0.170613	-23.7278	-0.0609510	-1.74988	-3.31030	1.04925	-0.713958	-0.0190082	7.80084	-1.10131
##	34:	13985.353:	16.6996	0.169607	-23.7277	-0.0602591	-1.74884	-3.30927	1.04524	-0.713080	-0.0165414	7.80630	-1.09390
##	35:	13983.763:	16.7057	0.165692	-23.7300	-0.0582647	-1.74540	-3.30582	1.03067	-0.711243	-0.0154713	7.81756	-1.08835
##	36:	13980.682:	16.7301	0.159168	-23.7604	-0.0718560	-1.73124	-3.29497	1.00976	-0.708430	-0.0220252	7.83909	-1.10762
##	37:	13980.515:	16.7303	0.159061	-23.7604	-0.0717794	-1.73112	-3.29486	1.00932	-0.708335	-0.0217515	7.83969	-1.10683
##	38:	13980.483:	16.7304	0.159038	-23.7604	-0.0717634	-1.73110	-3.29483	1.00922	-0.708315	-0.0216990	7.83981	-1.10668
##	39:	13980.420:	16.7305	0.158991	-23.7604	-0.0717312	-1.73105	-3.29478	1.00903	-0.708276	-0.0215950	7.84006	-1.10637
##	40:	13980.395:	16.7305	0.158972	-23.7604	-0.0717182	-1.73103	-3.29476	1.00895	-0.708261	-0.0215542	7.84015	-1.10625
##	41:	13980.345:	16.7306	0.158933	-23.7604	-0.0716918	-1.73099	-3.29472	1.00879	-0.708229	-0.0214732	7.84035	-1.10602
##	42:	13980.326:	16.7306	0.158917	-23.7604	-0.0716811	-1.73097	-3.29471	1.00873	-0.708217	-0.0214414	7.84043	-1.10592
##	43:	13980.322:	16.7306	0.158914	-23.7604	-0.0716790	-1.73097	-3.29470	1.00872	-0.708214	-0.0214351	7.84044	-1.10591
##	44:	13980.291:	16.7307	0.158888	-23.7604	-0.0716618	-1.73094	-3.29468	1.00861	-0.708194	-0.0213845	7.84057	-1.10576
##	45:	13980.290:	16.7307	0.158887	-23.7604	-0.0716611	-1.73094	-3.29468	1.00861	-0.708193	-0.0213825	7.84057	-1.10575
##	46:	13980.290:	16.7307	0.158887	-23.7604	-0.0716610	-1.73094	-3.29468	1.00861	-0.708193	-0.0213821	7.84058	-1.10575
##	47:	13980.289:	16.7307	0.158886	-23.7604	-0.0716607	-1.73094	-3.29467	1.00860	-0.708193	-0.0213813	7.84058	-1.10575
##	48:	13980.289:	16.7307	0.158886	-23.7604	-0.0716606	-1.73094	-3.29467	1.00860	-0.708193	-0.0213810	7.84058	-1.10575
##	49:	13980.289:	16.7307	0.158886	-23.7604	-0.0716604	-1.73094	-3.29467	1.00860	-0.708192	-0.0213804	7.84058	-1.10574
##	50:	13980.289:	16.7307	0.158886	-23.7604	-0.0716604	-1.73094	-3.29467	1.00860	-0.708192	-0.0213804	7.84058	-1.10574
##	51:	13980.288:	16.7307	0.158885	-23.7604	-0.0716599	-1.73094	-3.29467	1.00860	-0.708192	-0.0213791	7.84058	-1.10574
##	52:	13980.288:	16.7307	0.158885	-23.7604	-0.0716598	-1.73094	-3.29467	1.00860	-0.708192	-0.0213786	7.84058	-1.10574
##	53:	13980.287:	16.7307	0.158884	-23.7604	-0.0716594	-1.73094	-3.29467	1.00860	-0.708191	-0.0213776	7.84059	-1.10574
##	54:	13980.287:	16.7307	0.158884	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213776	7.84059	-1.10574
##	55:	13980.287:	16.7307	0.158884	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213775	7.84059	-1.10574
##	56:	13980.287:	16.7307	0.158884	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213775	7.84059	-1.10574
##	57:	13980.287:	16.7307	0.158884	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213773	7.84059	-1.10573
##	58:	13980.287:	16.7307	0.158880	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213773	7.84059	-1.10573
##	59:	13980.286:	16.7307	0.158880	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213772	7.84059	-1.10573
##	60:	13980.286:	16.7307	0.158880	-23.7604	-0.0716399	-1.73094	-3.29467	1.00860	-0.708191	-0.0213772	7.84059	-1.10573
##	61:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00860	-0.708191	-0.0213771	7.84059	-1.10573
##	62:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00860	-0.708191	-0.0213770	7.84059	-1.10573
##	63:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00860	-0.708191	-0.0213770	7.84059	-1.10573
##	64:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00860	-0.708191	-0.0213770	7.84059	-1.10573
##	65:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00860	-0.708191	-0.0213770	7.84059	-1.10573
##	66:	13980.286:	16.7307	0.158880	-23.7604	-0.0716398	-1.73094	-3.29467	1.00859	-0.708191	-0.0213770	7.84059	-1.10573
##	67:	13980.214:	16.7307	0.153231	-23.7910	-0.0702060	-1.73094	-3.29467	1.00859	-0.708191	-0.0213770	7.84059	-1.10573
##	68:	13978.515:	16.7339	0.151434	-23.7906	-0.0689678	-1.72917	-3.29290	1.00164	-0.706869	-0.0181191	7.84885	-1.09611
##	69:	13978.441:	16.7344	0.151415	-23.7906	-0.0689754	-1.72998	-3.29196	1.00099	-0.706783	-0.0181797	7.84934	-1.09625
##	70:	13978.345:	16.7348	0.151392	-23.7906	-0.0689785	-1.72889	-3.28912	1.00065	-0.707125	-0.0182422	7.84960	-1.09629
##	71:	13978.310:	16.7347	0.151389	-23.7906	-0.0689818	-1.72870	-3.28796	1.00063	-0.706893	-0.0182928	7.84993	-1.09641
##	72:	13978.198:	16.7350	0.151361	-23.7906	-0.0689886	-1.72767	-3.28587	0.999963	-0.706967	-0.0183090	7.85043	-1.09655
##	73:	13978.196:	16.7350	0.151360	-23.7906	-0.0689888	-1.72765	-3.28577	0.999954	-0.706969	-0.0183110	7.85044	-1.09656
##	74:	13978.172:	16.7350	0.151356	-23.7906	-0.0689904	-1.72752	-3.28500	0.999881	-0.706984	-0.0183274	7.85055	-1.09659
##	75:	13978.170:	16.7350	0.151351	-23.7906	-0.0689878	-1.72751	-3.28498	0.999861	-0.706982	-0.0183280	7.85057	-1.09659
##	76:	13978.169:	16.7351	0.151349	-23.7906	-0.0689872	-1.72751	-3.28498	0.999856	-0.706981	-0.0183281	7.85057	-1.09659
##	77:	13978.168:	16.7351	0.151347	-23.7906	-0.0689860	-1.72751	-3.28498	0.999847	-0.706980	-0.0183283	7.85058	-1.09659
##	78:	13978.168:	16.7351	0.151346	-23.7906	-0.0689855	-1.72751	-3.28498	0.999843	-0.706980	-0.0183284	7.85058	-1.09659
##	79:	13978.167:	16.7351	0.151344	-23.7906	-0.0689845	-1.72751	-3.28498	0.999835	-0.706979	-0.0183285	7.85058	-1.09659
##	80:	13978.167:	16.7351	0.151344	-23.7906	-0.0689841	-1.72750	-3.28498	0.999832	-0.706979	-0.0183286	7.85059	-1.09659
##	81:	13978.166:	16.7351	0.151342	-23.7906	-0.0689833	-1.72750	-3.28497	0.999826	-0.706978	-0.0183287	7.85059	-1.09659
##	82:	13978.166:	16.7351	0.151341	-23.7906	-0.0689830	-1.72750	-3.28497	0.999824	-0.706978	-0.0183288	7.85059	-1.09659
##	83:	13978.166:	16.7351	0.151341	-23.7906	-0.0689829	-1.72750	-3.28497	0.999823	-0.706978	-0.0183288	7.85059	-1.09659
##	84:	13978.166:	16.7351	0.151341	-23.7906	-0.0689828	-1.72750	-3.28497	0.999822	-0.706977	-0.0183288	7.85059	-1.09659
##	85:	13978.166:	16.7351	0.151341	-23.7906	-0.0689828	-1.72750	-3.28497	0.999822	-0.706977	-0.0183341	7.85059	-1.09659
##	86:	13978.165:	16.7351	0.151341	-23.7906	-0.0689825	-1.72750	-3.28497	0.999820	-0.706977	-0.0183341	7.85059	-1.09659
##	87:	13978.165:	16.7351	0.151340	-23.7906	-0.0689824	-1.72750	-3.28497	0.999820	-0.706977	-0.0183341	7.85059	-1.09659
##	88:	13978.165:	16.7351	0.151340	-23.7906	-0.0689822	-1.72750	-3.28497	0.999818	-0.706977	-0.0183341	7.85060	-1.09659
##	89:	13978.165:	16.7351	0.151340	-23.7906	-0.0689822	-1.72750	-3.28497	0.999818	-0.706977	-0.0183341	7.85060	-1.09659
##	90:	13978.165:	16.7351	0.151340	-23.7906	-0.0689820	-1.72750	-3.28497	0.999816	-0.706977	-0.0183341	7.85060	-1.09659
##	91:	13978.165:	16.7351	0.151340	-23.7906	-0.0689820	-1.72750	-3.28497	0.999816	-0.706977	-0.0183341	7.85060	-1.09659
##	92:	13978.165:	16.7351	0.151339	-23.7906	-0.0689817	-1.72750	-3.28497	0.999814	-0.706977	-0.0183341	7.85060	-1.09659
##	93:	13978.164:	16.7351	0.151339	-23.7906	-0.0689815	-1.72750	-3.28497	0.999813	-0.706976	-0.0183342	7.85060	-1.09659
##	94:	13978.164:	16.7351	0.151339	-23.7906	-0.0689815	-1.72750	-3.28497	0.999813	-0.706976	-0.0183342	7.85060	-1.09659
##	95:	13978.164:	16.7351	0.151339	-23.7906	-0.0689815	-1.72750	-3.28497	0.999812	-0.706976	-0.0183342	7.85060	-1.09659
##	96:	13978.164:	16.7351	0.151339	-23.7906	-0.0689815	-1.72750	-3.28497	0.999812	-0.706976	-0.0183363	7.85060	-1.09659
##	97:	13978.164:	16.7351	0.151338	-23.7906	-0.0689814	-1.72750	-3.28497	0.999811	-0.706976	-0.0183363	7.85060	-1.09659
##	98:	13978.164:	16.7351	0.151338	-23.7906	-0.0689813	-1.72750	-3.28497	0.999811	-0.706976	-0.0183363	7.85060	-1

```
## 122: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999800 -0.706975 -0.0183451 7.85061 -1.09659
## 123: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999799 -0.706975 -0.0183451 7.85061 -1.09659
## 124: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999799 -0.706975 -0.0183451 7.85061 -1.09659
## 125: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999799 -0.706975 -0.0183451 7.85061 -1.09659
## 126: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999799 -0.706975 -0.0183451 7.85061 -1.09659
## 127: 13978.163: 16.7351 0.151335 -23.7906 -0.0689798 -1.72750 -3.28497 0.999799 -0.706975 -0.0183451 7.85061 -1.09659
## 128: 13978.157: 16.7351 0.151334 -23.7909 -0.0689797 -1.72747 -3.28486 0.999789 -0.706985 -0.0183451 7.85061 -1.09659
## 129: 13978.157: 16.7351 0.151334 -23.7909 -0.0689797 -1.72746 -3.28483 0.999787 -0.706988 -0.0183451 7.85061 -1.09659
## 130: 13978.156: 16.7351 0.151334 -23.7909 -0.0689797 -1.72746 -3.28482 0.999786 -0.706989 -0.0183451 7.85061 -1.09659
## 131: 13978.156: 16.7351 0.151334 -23.7909 -0.0689797 -1.72746 -3.28482 0.999785 -0.706989 -0.0183451 7.85061 -1.09659
## 132: 13978.156: 16.7351 0.151334 -23.7909 -0.0689796 -1.72745 -3.28481 0.999785 -0.706990 -0.0183451 7.85061 -1.09659
## 133: 13978.156: 16.7351 0.151334 -23.7909 -0.0689796 -1.72745 -3.28481 0.999784 -0.706990 -0.0183451 7.85062 -1.09659
## 134: 13978.156: 16.7351 0.151333 -23.7909 -0.0689792 -1.72745 -3.28481 0.999781 -0.706990 -0.0183452 7.85062 -1.09659
## 135: 13978.155: 16.7351 0.151333 -23.7909 -0.0689790 -1.72745 -3.28481 0.999780 -0.706990 -0.0183452 7.85062 -1.09659
## 136: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 137: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 138: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 139: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 140: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 141: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 142: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 143: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 144: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 145: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 146: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 147: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 148: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
## 149: 13978.155: 16.7351 0.151332 -23.7909 -0.0689787 -1.72745 -3.28481 0.999778 -0.706989 -0.0183453 7.85062 -1.09659
```

```
## Warning: false convergence (8)
```

```
save(LD_random_int_contage_2level, file = "migration_LD_random_int_contage_2level.Rdata")
LD_random_int_contage_2level.results <- data.frame(coef = fixef(LD_random_int_contage_2level),
  odds_ratio = exp(fixef(LD_random_int_contage_2level)), se = se.fixef(LD_random_int_contage_2level))
LD_random_int_contage_2level.results <- round(LD_random_int_contage_2level.results,
  4)
summary(LD_random_int_contage_2level)
```

```
## Length Class Mode
##      1     mer    S4
```

```
LD_random_int_contage_2level.results
```

```
##              coef odds_ratio      se
## (Intercept)  -23.7909      0.0000 0.9381
## ethnic2       -0.0690      0.9333 1.1794
## ethnic3       -1.7275      0.1777 1.5468
## ethnic4       -3.2848      0.0374 1.8123
## ethnic5        0.9998      2.7177 1.0913
## gender1       -0.7070      0.4931 0.8354
## agedecades    -0.0183      0.9818 0.2294
## timeyears      7.8506    2567.3246 0.4124
## I(timeyears^2) -1.0966      0.3340 0.1280
```

Discussion

The fixed effect model (using GLM with a person-history dataset)