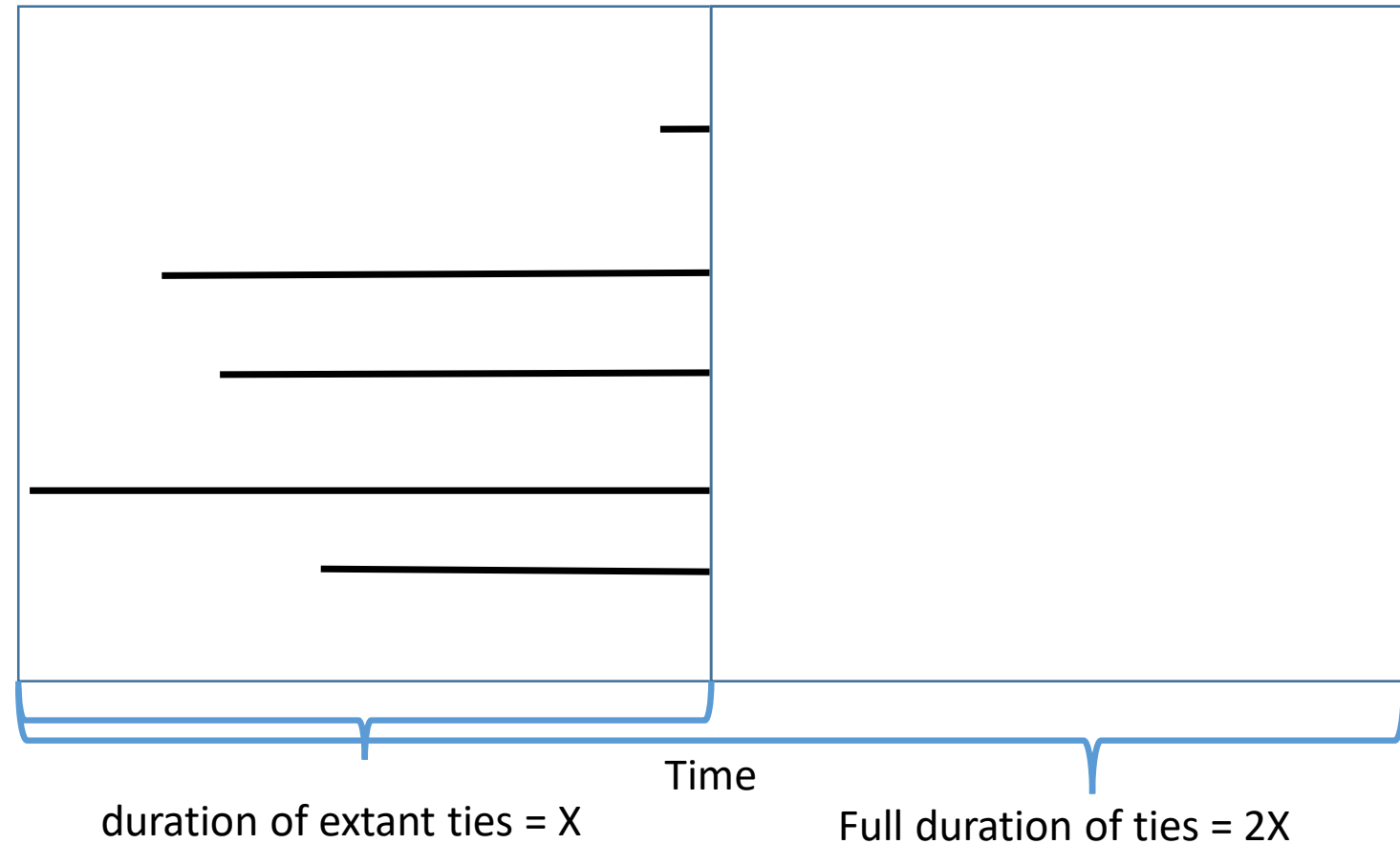


Partnerships durations: Do  
they meet our expectations?

NMG/SHAMP 7/17/2018

# Partnership duration are based on extant ties

- Extant ties are active at the cross-section



# Expectations

- Duration / Persistence is a memoryless process
  - Follows an exponential (geometric) distribution
- The mean duration of extant ties at any given point in the simulation should equal the observed duration of extant ties
- The full duration of the ties taken from any point in the simulation should be 2 times the duration of extant ties
  - The expected future duration is equal to the past duration

# Simulation details

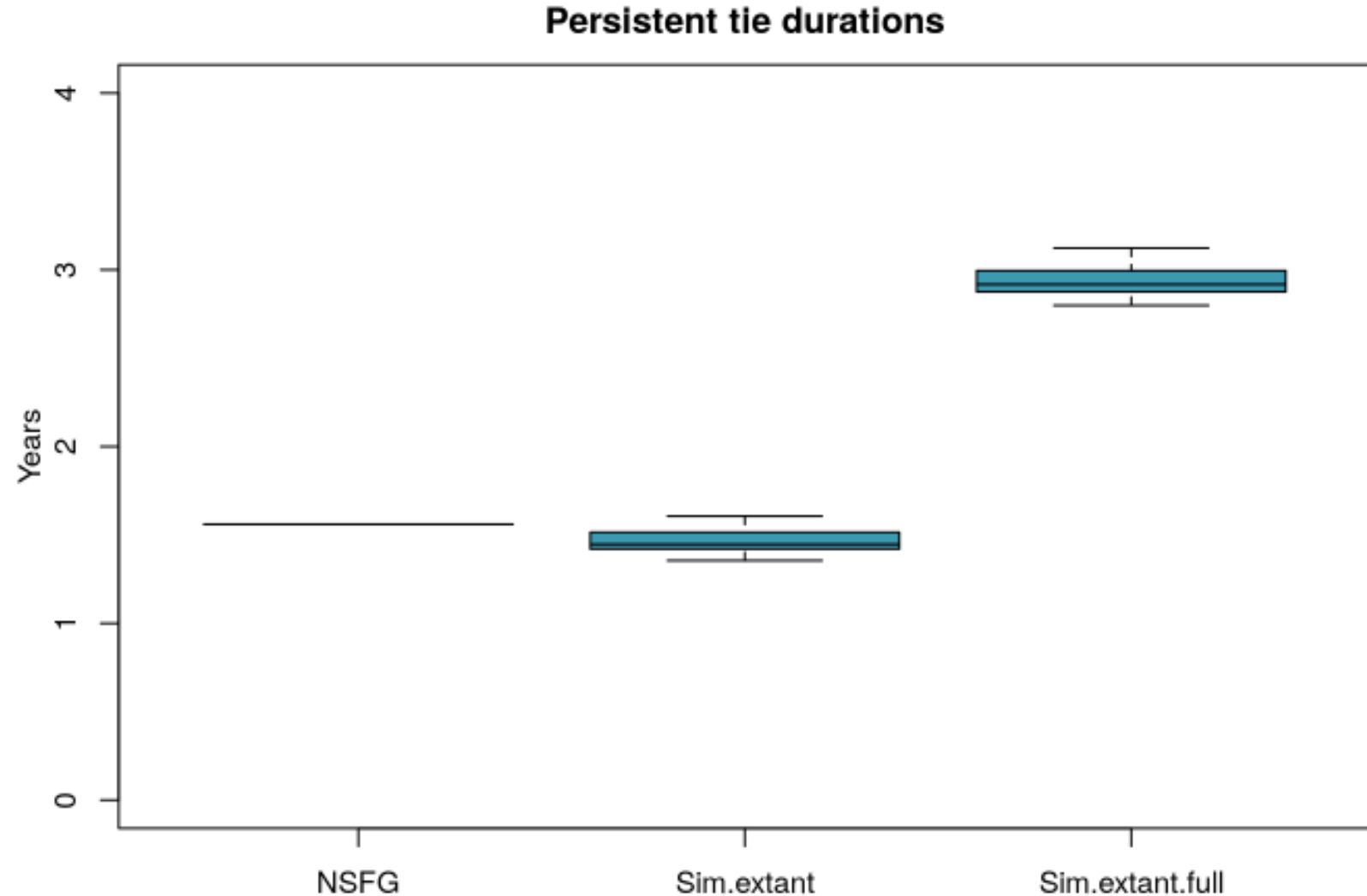
- Population ~ 50,000 nodes
- Sex (50% male and 50% female)
- **Age 18-45**
- Formation ~ edges + nodecov("age") + nodecov("agesq") + absdiff("sqrt.age.adj") + offset(nodematch("sex", diff = FALSE)) )
- Dissolution ~ offset(edges)

# Notes on Dissolution and Duration

- Dissolution is modeled as a hazard
  - Edges only is a single rate
- The hazards can be conditional on nodal attributes or graph features
  - `nodefactor(race)` is 5 coefficients defining the race specific deviation from the rate defined for the edges term
- Dissolution is NOT conditional on tie duration
  - It is a function of the duration input parameter
- Formation is NOT conditional on tie duration

# Duration of Persistent ties

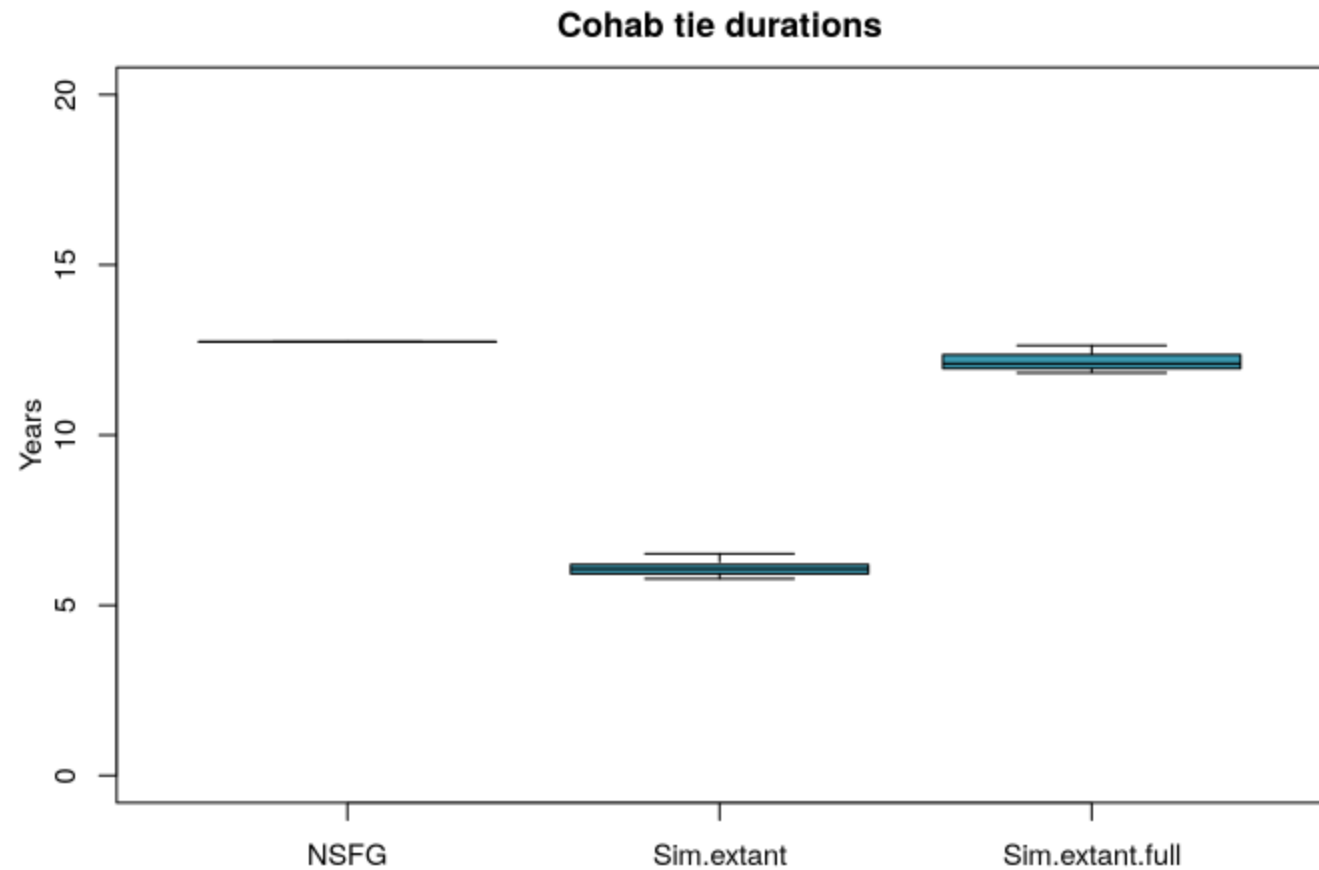
- NSFG - mean duration from the data
- Sim.extant – mean duration of extant ties from 100 time slices over 100 years of simulation
- Sim.extant – mean duration of the total relationship durations of ties that were active (extant) from 100 time slices over 100 years of simulation



Data			
Mean duration	1.56	1.46	2.94

# Duration of Cohab ties

- NSFG - mean duration from the data
- Sim.extant – mean duration of extant ties from 100 time slices over 100 years of simulation
- Sim.extant – mean duration of the total relationship durations of ties that were active (extant) from 100 time slices over 100 years of simulation



Data			
Mean duration	12.74	6.04	12.17

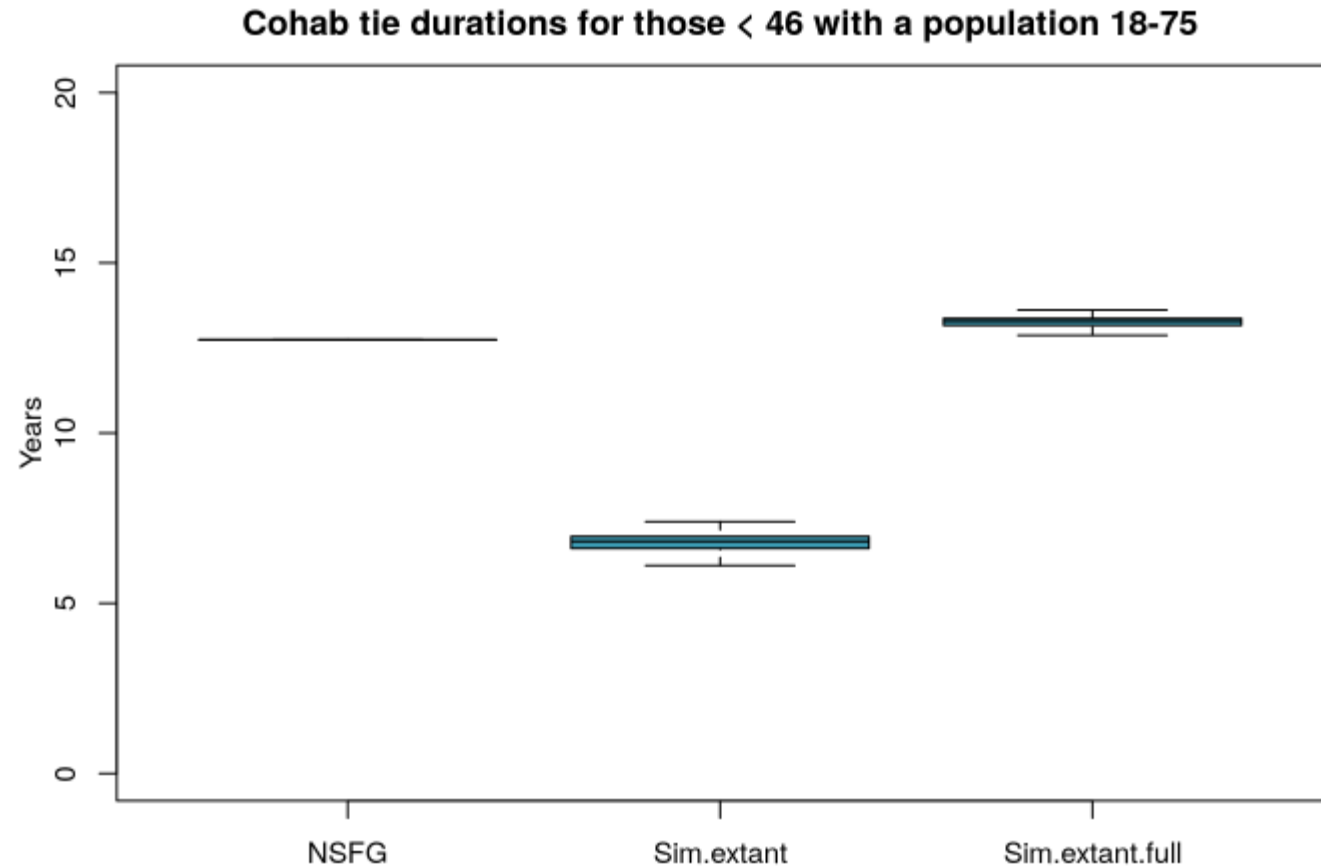
# New Simulation details

- Population ~ 50,000 nodes
- Sex (50% male and 50% female)
- **Age 18-75**
- Formation ~ edges + nodecov("age") + nodecov("agesq") + absdiff("sqrt.age.adj") + offset(nodematch("sex", diff = FALSE)) )
- Dissolution ~ offset(edges)



# Duration of Cohab ties

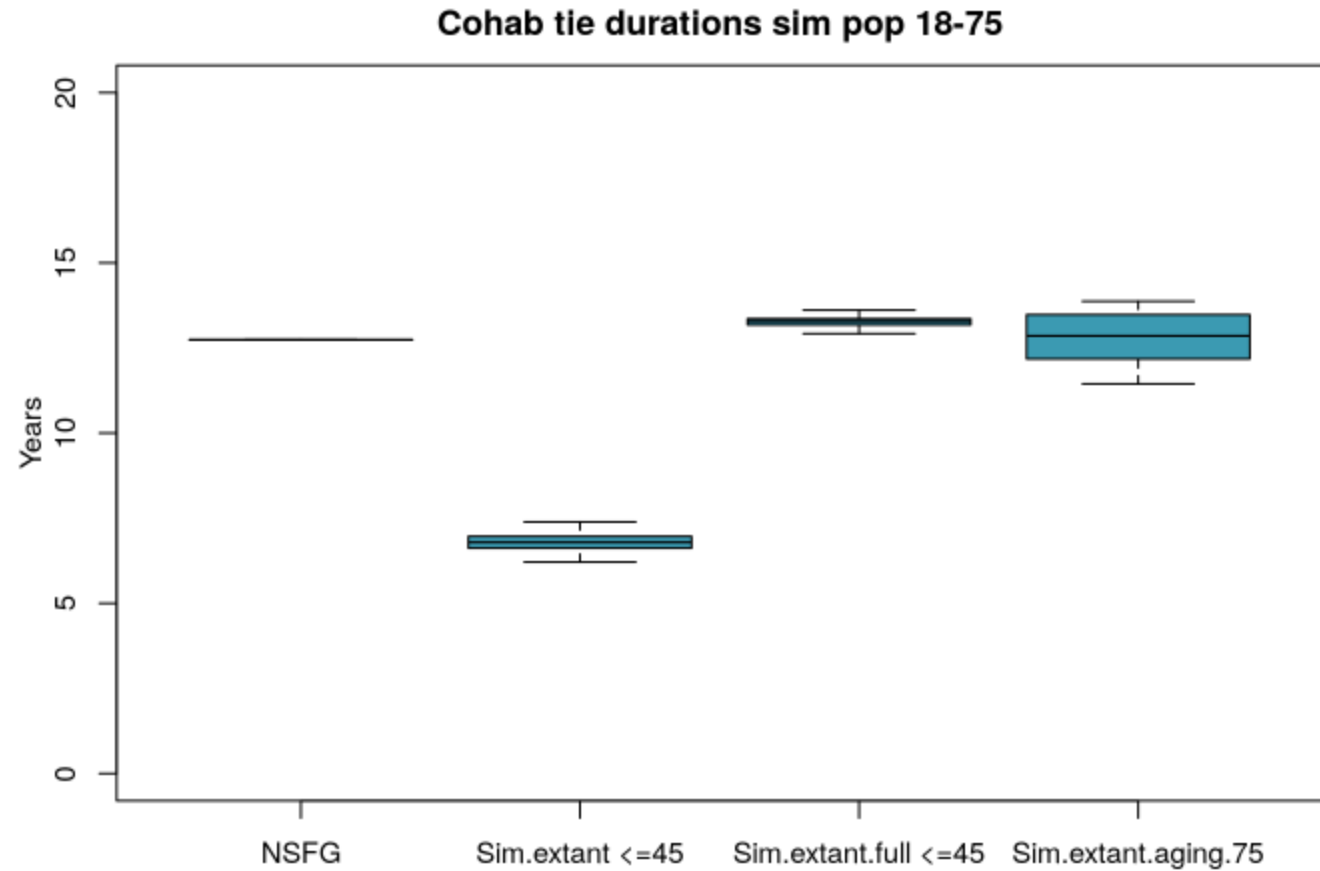
- NSFG - mean duration from the data
- Sim.extant – mean duration of extant ties from 100 time slices over 100 years of simulation (**among 18-45 year olds** )
- Sim.extant – mean duration of the total relationship durations of ties that were active (extant) from 100 time slices over 100 years of simulation(**among 18-45 year olds** )



Data			
Mean duration	12.74	6.75	13.29
With 18-45 sim	12.74	6.04	12.17

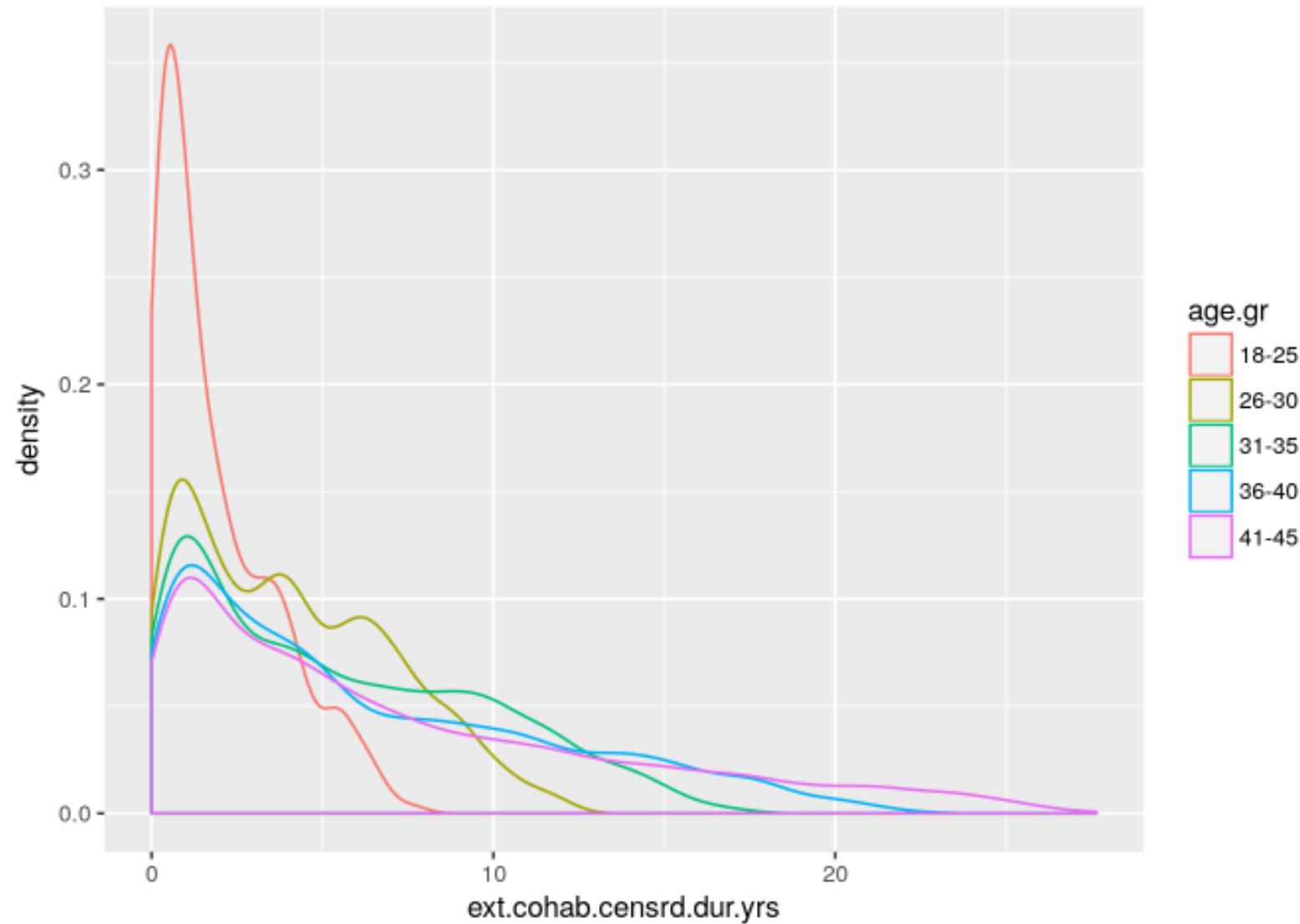
# Duration of Cohab ties

- Sim.extant.aging – mean duration of extant ties from 100 time slices over 100 years of simulation(**among the entire population 18-75 year olds** )

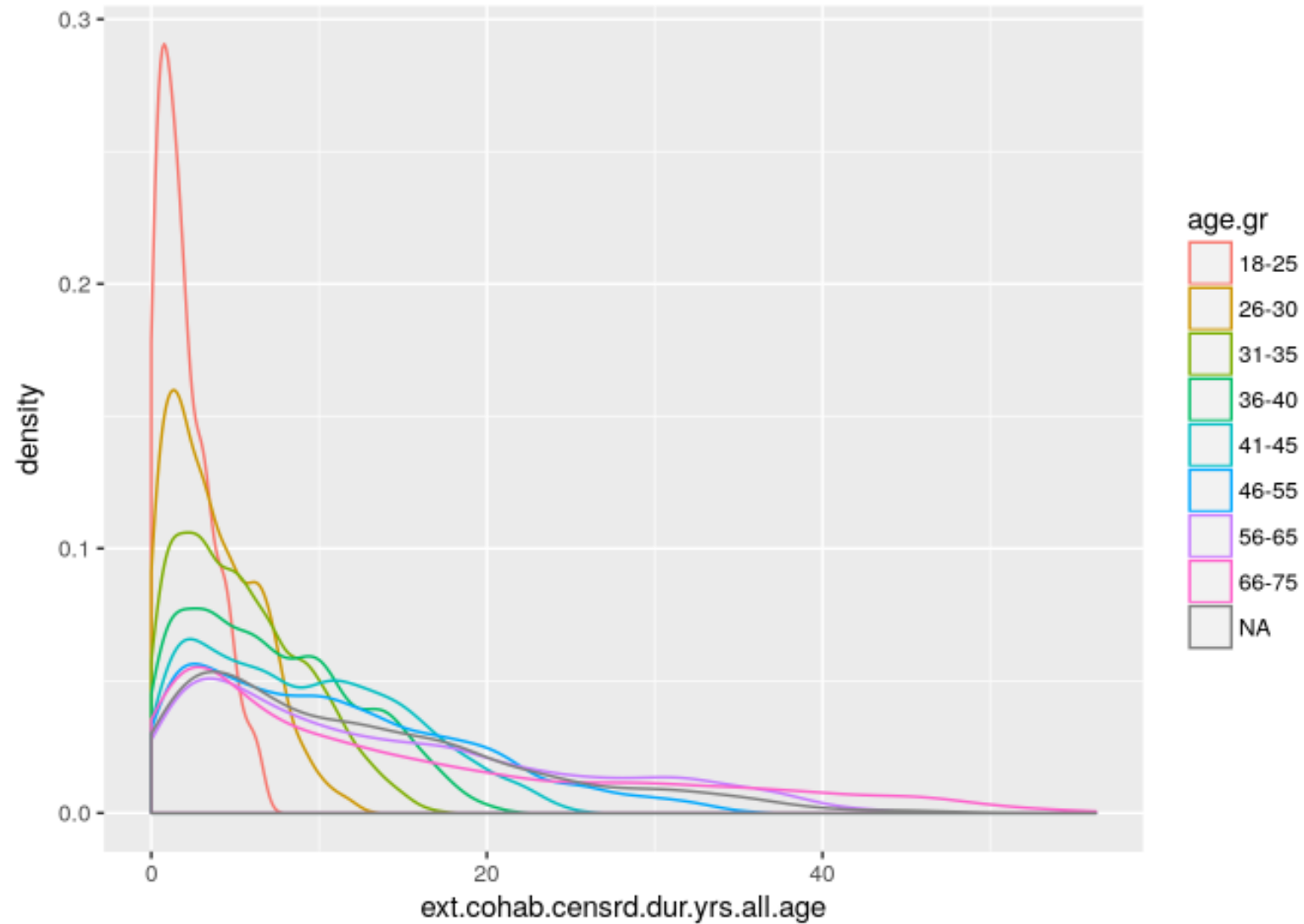


Data				
Mean duration	12.74	6.75	13.29	12.87

## Duration of extant ties by age (sim pop **age 18-45**)

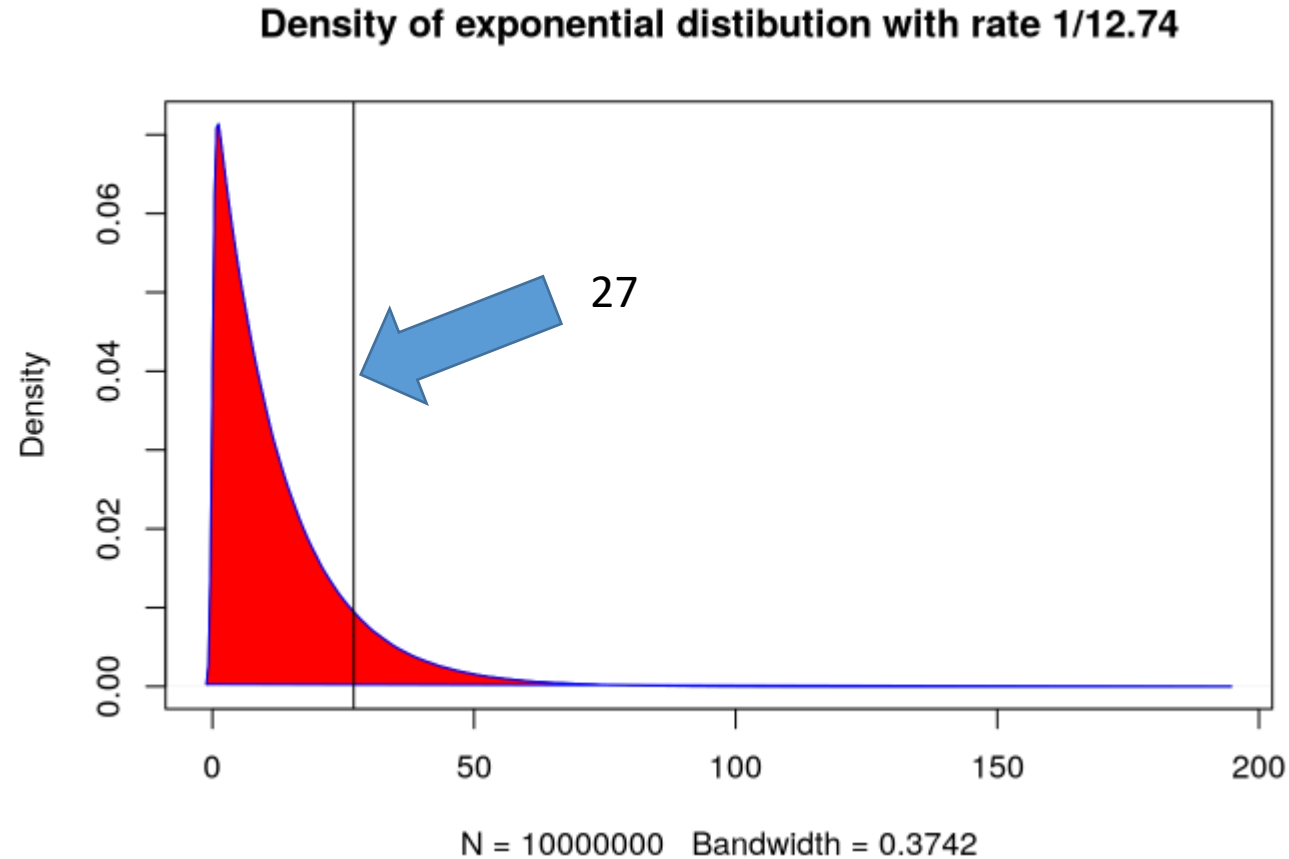


## Duration of extant ties by age (sim pop age 18-75)



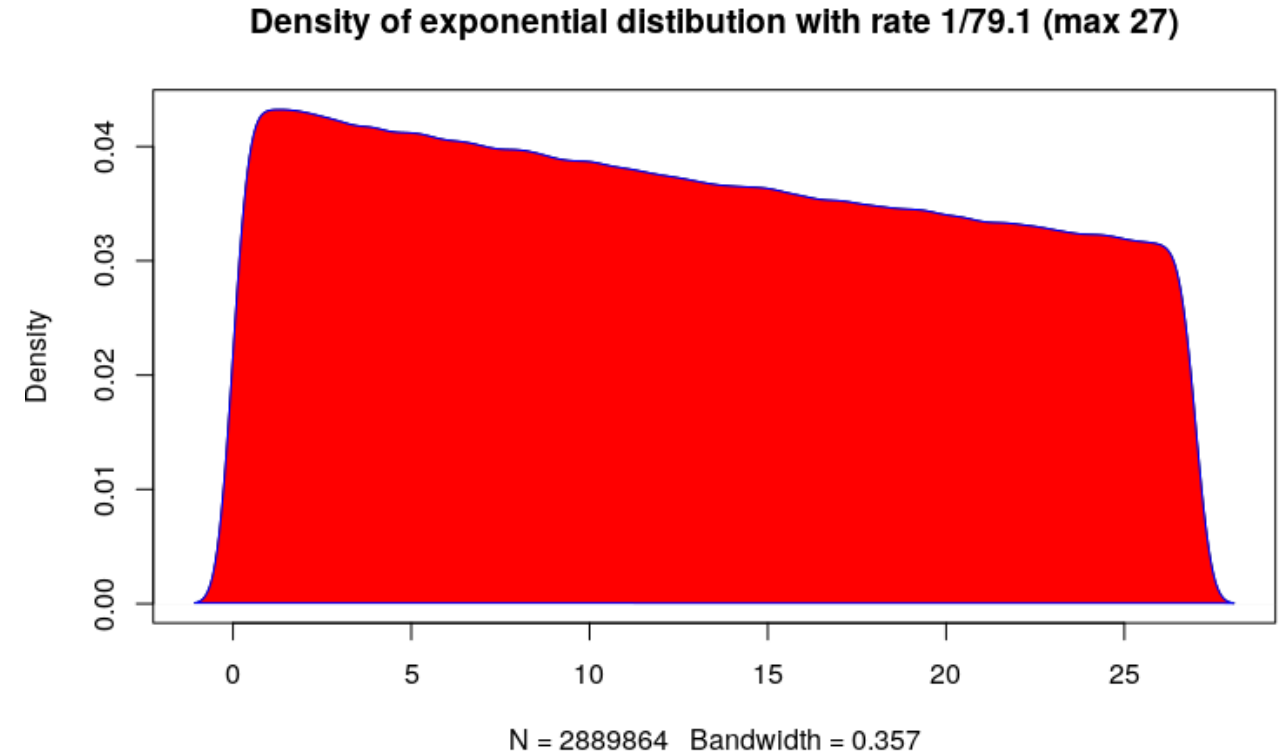
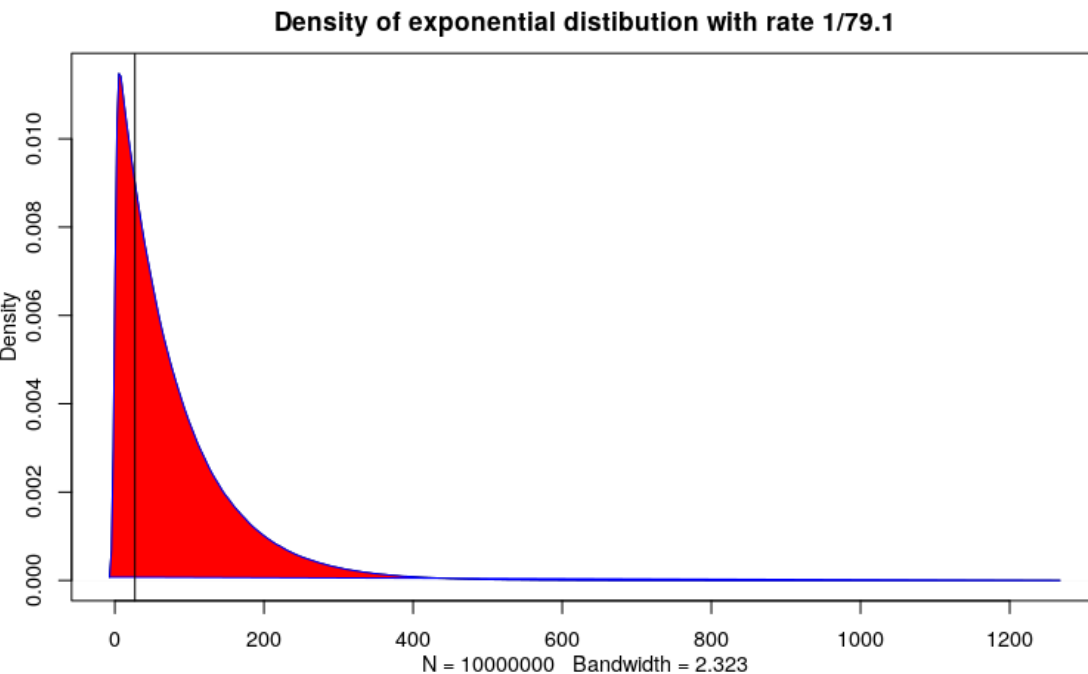
# Simulated Exponential distribution of tie durations if the mean duration is 12.74

- Mean = 12.736
- A substantial fraction of the expected durations are not possible in our simulation
- Excluding just those ties that can not exist
  - Mean = 9.05



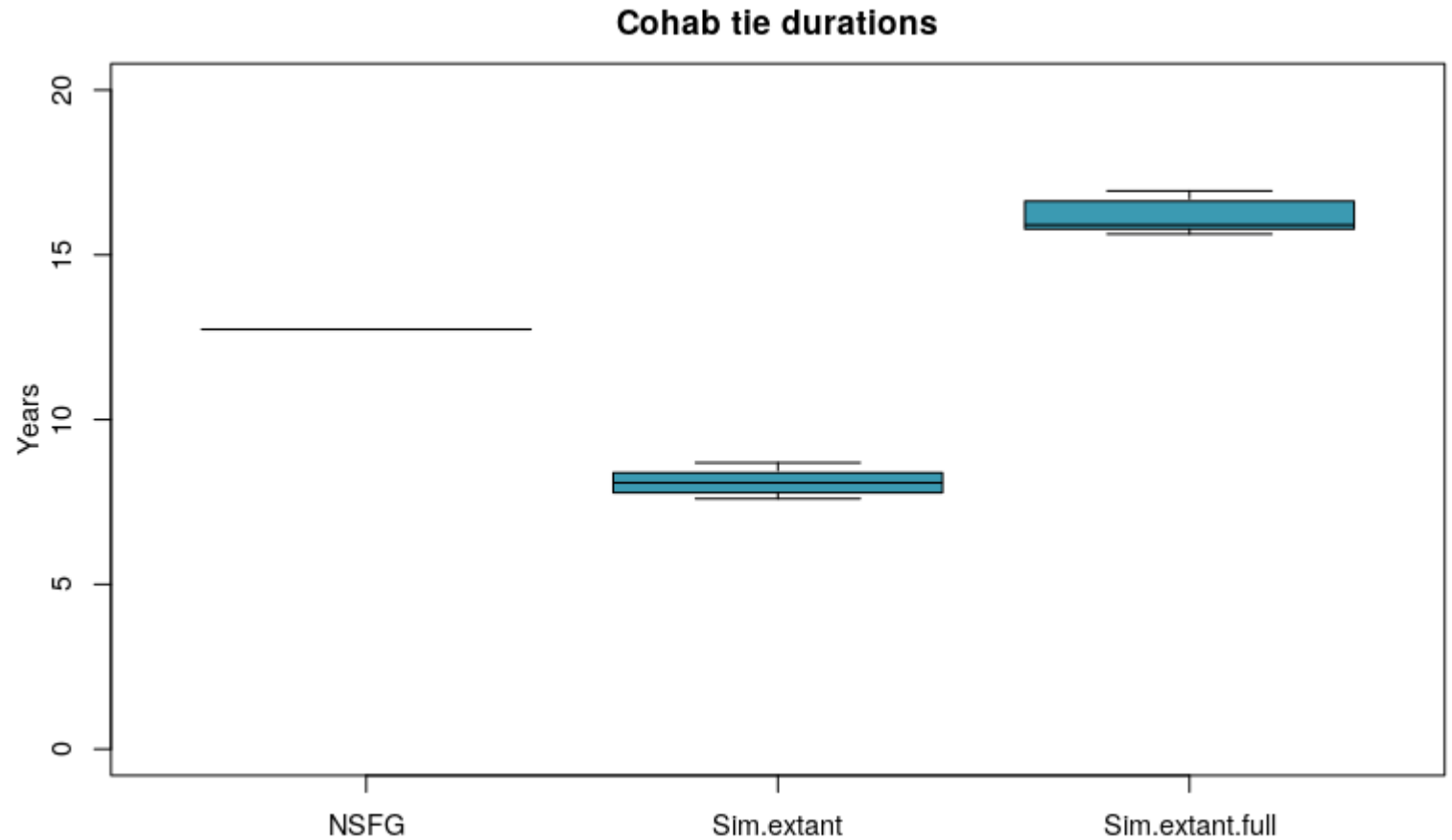
# Solution?

- Back calculate the target mean duration required to reach the observed mean
- Example
  - Exponential distribution mean such that the mean durations of ties  $< 27 = 12.73$
  - Exponential distribution mean = 79.14



# Simulating pop 18-45 with duration parameter 79.14 years

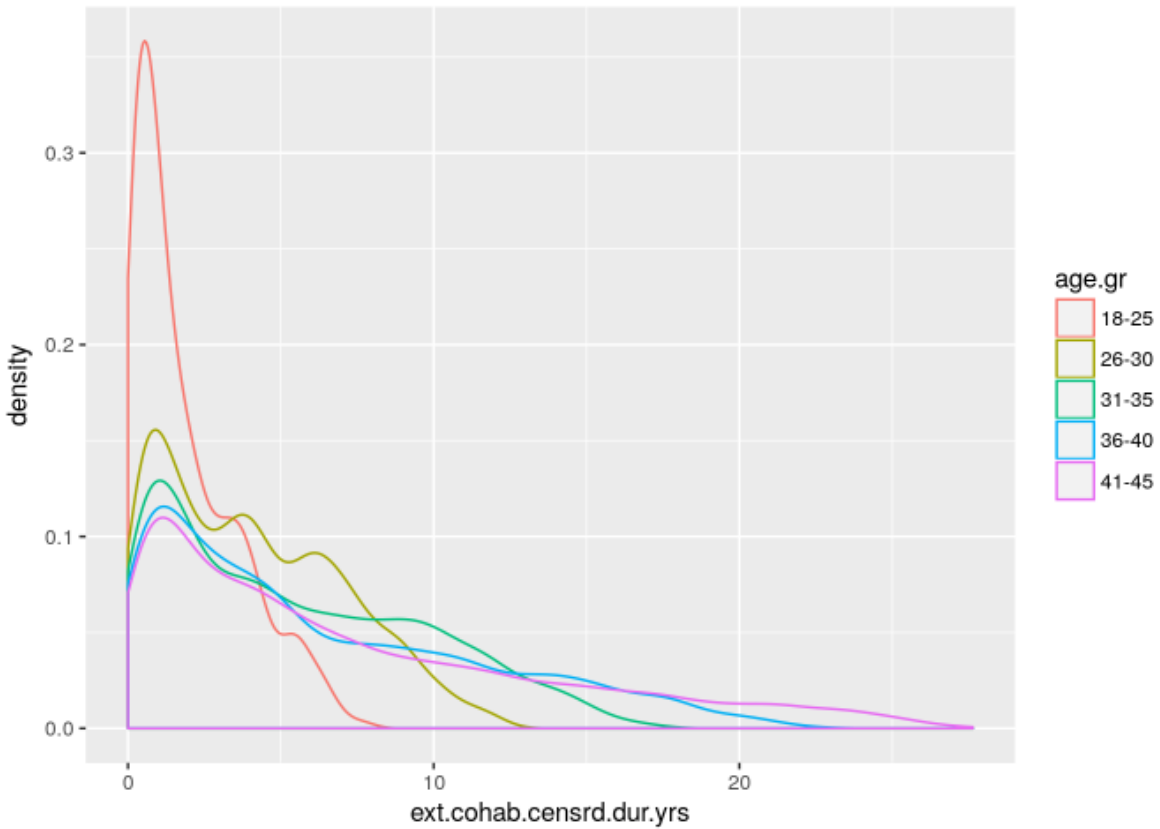
- The adjusted target improves the simulated durations by 2.1 years
- Still 4.7 years short
- The example calculation only accounts for censoring relationships with the possibility of a 27 year duration
- Many long duration partnerships are still being censored



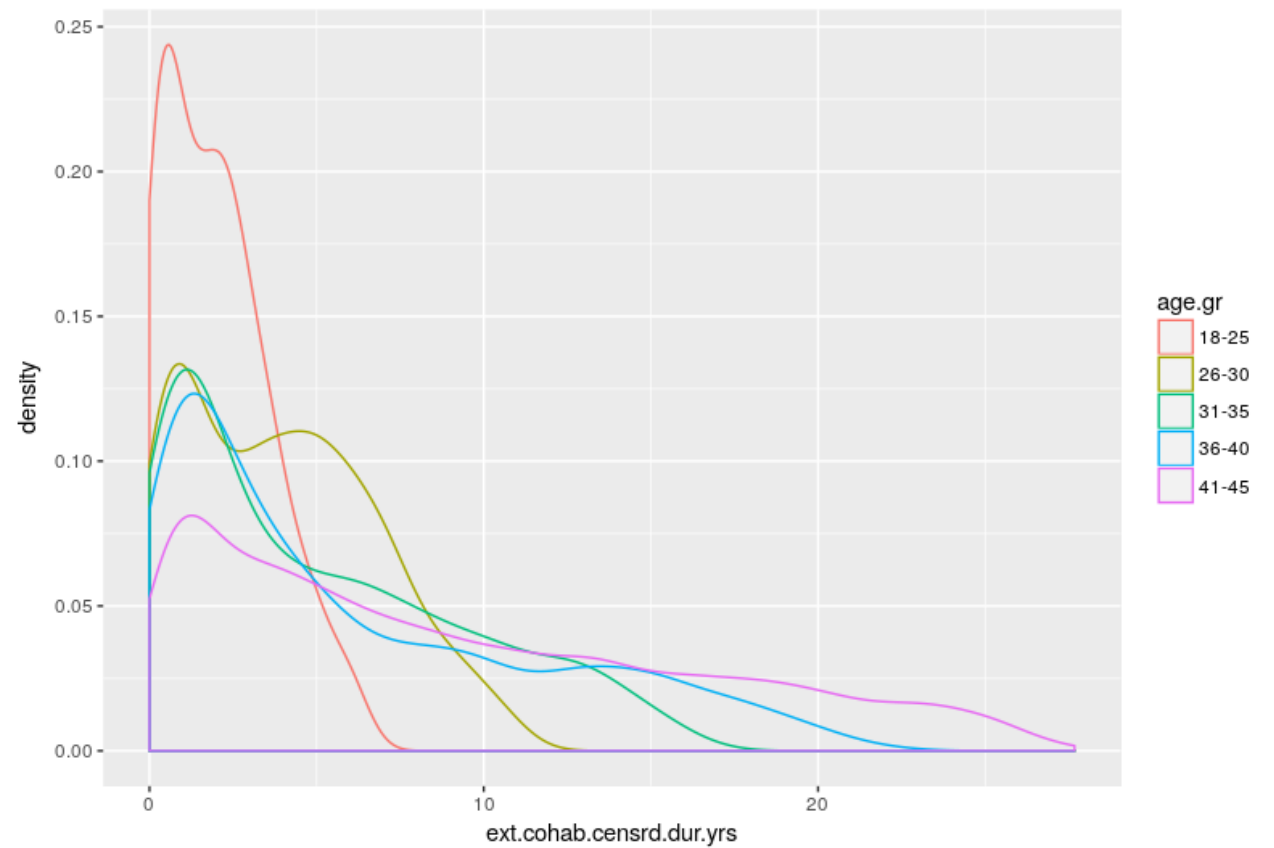
Data			
Mean duration	12.74	6.04	12.17
With 79.14 target	12.74	8.1	16.14

# There is an increase in the longer durations partnerships

Cohab duration parameter 12.74



Cohab duration parameter 79.14

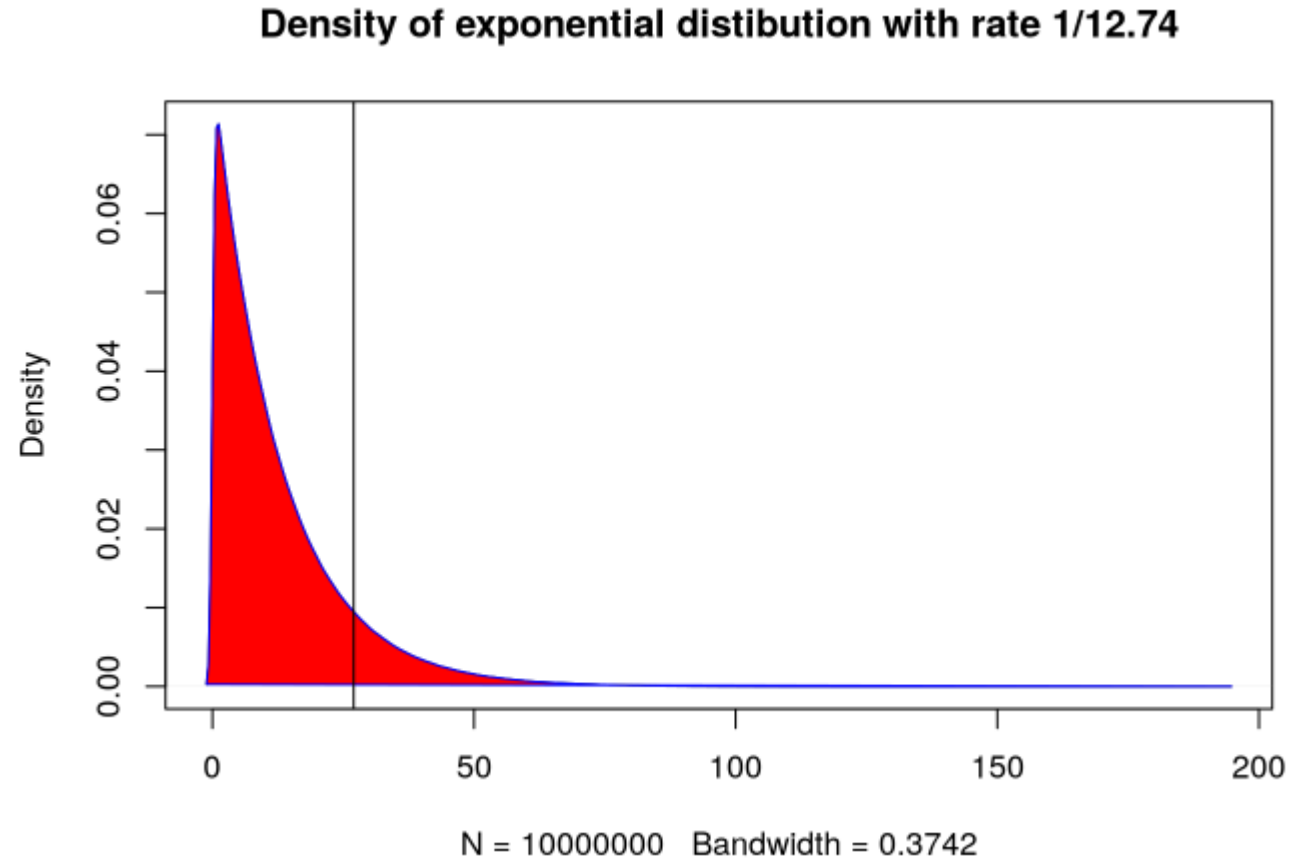


But what about the short relationships???



# Does the exponential distribution even reflect the cohabitation social process

- Mean = 12.736
- 7.6% < 1 year
- 14.5% < 2 years
- Processes that lead up to the cohab designation are baked in
  - Dating
  - Engagements
- The simulation 14.5% of ties as less than 2 years which must be balanced with very long duration ties that are not possible



# NSFG cohab durations

 To help protect your privacy, PowerPoint has blocked automatic download of this picture.

# Conclusions

- For long duration partnerships in a sex network with limited age range the exponential (geometric) distribution is a poor fit
  - The right tail of the target distribution can't be fit
- For partnerships with social definitions that imply duration the exponential (geometric) distribution is a poor fit
  - Cohabs by definition are partnerships of a non-trivial duration – it takes time to become a cohab
  - The exponential (geometric) distribution has high density on the far left of the distribution

# Solutions

- Create a node factor for durations
  - Very low prior distribution for dissolution probability if the duration class is < 2 years