# Online Supplement A: ERGM Model Terms

In this section, we describe each exponential random graph model term, starting with the least structurally dependent terms (i.e., actor-level covariates) and concluding the most structurally dependent (i.e., triadic and degree terms that induce Markov dependence). Some terms are included as controls (age, gender) or to identify the processes under study due to nesting of marginal effects in network models (i.e., in- and out- degree distributions).

We include four “actor level” covariates to control for family members’ differential propensities to be involved in emotionally supportive relationships based on their personal attributes.

1) *Number of unique exogenous supporters (NUES)*: We add four statistics to the model equal to the number of emotional support partners that were not part of the observed family network for each (i,j) edge, we take the sum for each actor incident on that (in or out) tie. These terms test for the effect of the number of unique exogenous support (NUES) partners each network member reports on their propensity to send and receive ties, respectively. Significant positive values indicate that as the number of NUES goes up, the number of in- and out- ties also goes up. Two of the terms reflect NUES from socially related supporters and two of the terms reflect NUES from biologically related supporters.

2) *Sociality by actor testing-status:* We add two statistics to the model equal to the sum of the number of times an actor that is a) a test recipient or b) a test decliner is incident on an edge in the network (compared with the number of times someone who was c) not-at-risk for receiving testing is incident on ties, e.g. the reference). A positive significant coefficient suggests that actors with that testing-status category is more likely to be involved in emotionally supportive relationships than the reference.

3) *Interaction between in/out tie effects of NUES and testing-status sociality:* To examine whether overall sociality among testers and decliners is moderated by the in- and out-tie effects of both socially and biologically related NUES, we add eight statistics to the model to capture the interaction between those terms. As conditional terms, significant positive values indicate that the tie effect of NUES has a greater impact on sociality for that testing-status than it does for the reference.

4) *Sociality of males:* We add one statistic to the model equal to the sum of the number of times men (gender=1) are incident on ties in the network. When this statistic is positive and significant, it suggests that men are incident on more ties in the network than women.

5) *Absolute Difference in Age*: We add one statistic to the model equal to the absolute difference in age between two actors with an edge between them. When this statistic is positive and significant, it indicates that edges are more likely to form between two actors as their age difference increases.

The next set of terms involve differential mixing between actors. These terms are edge covariates and model the likelihood of ties forming between two actors as a function of the values of the covariate between them.

6) *Gender homophily:* We add one statistic to the model that equals the number of edges incident between actors of the same gender. A significant positive coefficient indicates greater likelihood of ties forming between same-gender partners than different gender partners.

7) *Exogenous shared partners:* We add a single dyadic covariate equal to the number of shared support partners that are not part of the observed family network that two actors have in common. When the coefficient for this statistic is positive and significant, it suggests that actors are more likely to form ties when they share a greater number of exogenous support partners.

We also include several structural terms to the model. These terms involve higher-order network structure, such as reciprocity, triadic, and degree distribution effects.

8) *Baseline Reciprocity and Homophilous Reciprocity:* While we do not have dynamic network data, we include two statistics in the model that capture the number of mutual ties in the network, which is consistent with a social process of reciprocity in emotional support exchange. The first mutuals term captures reciprocity of support overall and the second term models the number of mutuals incident only between family members who share the same genetic test status (receiver<->receiver, decliner<->decliner, and not-at-risk<->not-at-risk).

9) *Geometrically weighted edgewise shared-partner (GWESP) distribution:* We include one statistic in the model equal to the geometrically weighted shared partner distribution of the observed network. The coefficient associated with this triadic term models the propensity for two actors who are connected by an edge to have in common one, two, three or more shared partners. We fix the weighting parameter to be equal to 0.85 based on diagnostic tests (this also facilitates estimation). While the interpretation of this coefficient depends on the distribution of shared partners in the network, in general, a significant positive coefficient would indicate that two family members sharing a greater number of emotional support partners increases the likelihood of ties forming between them.

10) *Geometrically weighted in- and out-degree distributions:* We add two statistics to the model equal to the geometrically weighted in- and out-degree distributions. These terms model the propensity for actors to have zero, one, two, three, and up to *n-1* ties directed toward and away from them, respectively. We fix the weighting parameters to be 0.97 and 0.42, respectively. Like the geometrically weighted shared partner distributions, the interpretation of this coefficient depends on the degree distribution, though in general, positive coefficients reflect decreased likelihood of in/out ties to higher degree actors.

11) *Twopaths:* We add one statistic to the model equal to the number of twopaths between i and k through node j. This term acts to support the principle of marginality to identify the triadic closure effect modeled by the GWESP term. A positive coefficient indicates that adding a single edge to increases the number of twopaths in the network (and thus increases the number of opportunities for triadic closure).

# Online Supplement B: Summary Table of Final Model Results

|  |  |  |  |
| --- | --- | --- | --- |
| **Hypothesis** | **Term(s)** | **Expected Direction** | **Result** |
| H1a : Testing-Status Homophily | Receiver –> Receiver Mixing (ref=other mixing) | "+" | ✔ |
|  | Decliner –> Decliner Mixing (ref=other mixing) | "+" | ✔ |
| H1a : Testing-Status Heterophily | Receiver –> Decliner Mixing (ref=other mixing) | "+" | - |
|  | Decliner –> Receiver Mixing (ref=other mixing) | "+" | **X** |
| H1b: Testing-Status Homophily > Heterophily | " " | "+" | **X** |
| H2 : Testing-Status Reciprocity | Homophilous Reciprocity | "+" | **X** |
| H3a : Shared Exogenous Support Increases Tie Formation | Edgewise Exogenous Shared Partners | "+" | ✔ |
| H3b : Shared Endogenous Support Increases Tie Formation | GW Edgewise Shared-Partner Distribution | "+" | ✔ |
| H4a : Number of unique exogenous supporters decreases in-ties | In-tie effect of NUES | "-" | ✔ |
| H4b : Number of unique exogenous supporters increases out-ties | Out-tie effect of NUES | "+" | ✔ |
| H5 : In/Out-tie effects of NUES moderates overall sociality of family members at risk of disease | Sociality of Receivers X In-tie effect of NUES | "-" | - |
|  | Sociality of Decliners X In-tie effect of NUES | "-" | - |
|  | Sociality of Receivers X Out-tie effect of NUES | "-" | ✔ |

Table 3. Summary of hypotheses, model terms, expected effects (“+”=positive effect, “-”=negative effect), and results (✔= significant effect in expected direction, X = significant in opposite direction, ns= effect not significant).

# Online Supplement C: Alternative Model Results

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Term** | **Model 1** |  | **Model 2** |  | **Model 3** |  | **Model 4** |  | **Final Model** |  |
| Edges | -2.809 (0.724) | \*\*\* | -3.504 (0.800) | \*\*\* | -3.277 (0.768) | \*\*\* | -3.792 (0.788) | \*\*\* | -3.767 (0.810) | \*\*\* |
| Sociality of Receivers (ref=others) | -1.224 (0.306) | \*\*\* | -0.997 (0.372) | \*\* | -1.239 (0.308) | \*\*\* | -0.848 (0.373) | \* | -0.874 (0.379) | \* |
| Sociality of Decliners (ref=others) | -1.361 (0.360) | \*\*\* | -1.474 (0.436) | \*\*\* | -1.433 (0.369) | \*\*\* | -1.601 (0.474) | \*\*\* | -1.654 (0.480) | \*\*\* |
| Edgewise Exogenous Shared Partners | 1.094 (0.175) | \*\*\* | 1.081 (0.171) | \*\*\* | 1.084 (0.177) | \*\*\* | 1.089 (0.181) | \*\*\* | 1.070 (0.180) | \*\*\* |
| Sociality of Males (ref=females) | -0.278 (0.161) |  | -0.274 (0.164) |  | -0.227 (0.162) |  | -0.260 (0.168) |  | -0.273 (0.171) |  |
| Absolute Difference in Age | -0.001 (0.006) |  | -0.000 (0.006) |  | -0.002 (0.006) |  | -0.001 (0.006) |  | -0.001 (0.007) |  |
| Gender Homophily (ref=heterophily) | -0.339 (0.225) |  | -0.378 (0.232) |  | -0.345 (0.226) |  | -0.416 (0.237) |  | -0.431 (0.241) |  |
| Receiver –> Receiver Mixing (ref=other mixing) | 1.831 (0.601) | \*\* | 1.718 (0.665) | \*\* | 1.767 (0.608) | \*\* | 1.639 (0.661) | \* | 1.661 (0.665) | \* |
| Decliner –> Receiver Mixing (ref=other mixing) | 1.700 (0.627) | \*\* | 1.694 (0.635) | \*\* | 1.637 (0.637) | \* | 1.748 (0.643) | \*\* | 1.753 (0.646) | \*\* |
| Receiver –> Decliner Mixing (ref=other mixing) | 0.228 (0.630) |  | 0.230 (0.618) |  | 0.389 (0.634) |  | 0.501 (0.670) |  | 0.501 (0.679) |  |
| Decliner –> Decliner Mixing (ref=other mixing) | 2.267 (0.790) | \*\* | 2.160 (0.842) | \* | 2.451 (0.798) | \*\* | 2.607 (0.872) | \*\* | 2.529 (0.887) | \*\* |
| Homophilous Reciprocity | -2.324 (0.665) | \*\*\* | -2.292 (0.709) | \*\* | -2.340 (0.658) | \*\*\* | -2.251 (0.703) | \*\* | -2.279 (0.698) | \*\* |
| Baseline Reciprocity | 2.278 (0.561) | \*\*\* | 2.429 (0.588) | \*\*\* | 2.486 (0.561) | \*\*\* | 2.531 (0.596) | \*\*\* | 2.584 (0.594) | \*\*\* |
| GW Edgewise Shared Partners Distribution (alpha=0.85) | 1.416 (0.155) | \*\*\* | 1.425 (0.156) | \*\*\* | 1.421 (0.155) | \*\*\* | 1.430 (0.160) | \*\*\* | 1.427 (0.162) | \*\*\* |
| GW Indegree Distribution (alpha=0.97) | 2.134 (0.704) | \*\* | 2.400 (0.740) | \*\* | 2.235 (0.717) | \*\* | 2.232 (0.736) | \*\* | 2.211 (0.737) | \*\* |
| GW Outdegree Distribution (alpha=0.42) | 0.637 (0.515) |  | 0.945 (0.531) |  | 1.054 (0.550) |  | 1.359 (0.562) | \* | 1.356 (0.579) | \* |
| Twopath | -0.215 (0.079) | \*\* | -0.155 (0.083) |  | -0.181 (0.080) | \* | -0.145 (0.081) |  | -0.146 (0.083) |  |
| In-tie effect of All NUES | -0.276 (0.069) | \*\*\* | -0.388 (0.118) | \*\* |  |  |  |  |  |  |
| Out-tie effect of All NUES | 0.051 (0.029) |  | 0.176 (0.064) | \*\* |  |  |  |  |  |  |
| Sociality of Receivers X In-tie effect of All NUES |  |  | 0.085 (0.090) |  |  |  |  |  |  |  |
| Sociality of Decliners X In-tie effect of All NUES |  |  | -0.000 (0.125) |  |  |  |  |  |  |  |
| Sociality of Receivers X Out-tie effect of All NUES |  |  | -0.137 (0.058) | \* |  |  |  |  |  |  |
| Sociality of Decliners X Out-tie effect of All NUES |  |  | 0.103 (0.080) |  |  |  |  |  |  |  |
| In-tie effect of Socially Related NUES |  |  |  |  | -0.338 (0.100) | \*\*\* | -0.411 (0.176) | \* | -0.400 (0.175) | \* |
| Out-tie effect of Socially Related NUES |  |  |  |  | 0.275 (0.072) | \*\*\* | 0.474 (0.118) | \*\*\* | 0.493 (0.123) | \*\*\* |
| In-tie effect of Biologically Related NUES |  |  |  |  | -0.314 (0.107) | \*\* | -0.356 (0.110) | \*\* | -0.477 (0.181) | \*\* |
| Out-tie effect of Biologically Related NUES |  |  |  |  | -0.066 (0.051) |  | -0.017 (0.060) |  | -0.010 (0.090) |  |
| Sociality of Receivers X In-tie effect of Socially Related NUES |  |  |  |  |  |  | 0.101 (0.138) |  | 0.076 (0.139) |  |
| Sociality of Decliners X In-tie effect of Socially Related NUES |  |  |  |  |  |  | -0.029 (0.180) |  | -0.033 (0.179) |  |
| Sociality of Receivers X Out-tie effect of Socially Related NUES |  |  |  |  |  |  | -0.312 (0.103) | \*\* | -0.304 (0.112) | \*\* |
| Sociality of Decliners X Out-tie effect of Socially Related NUES |  |  |  |  |  |  | 0.101 (0.128) |  | 0.091 (0.127) |  |
| Sociality of Receivers X In-tie effect of Biologically Related NUES |  |  |  |  |  |  |  |  | 0.143 (0.157) |  |
| Sociality of Decliners X In-tie effect of Biologically Related NUES |  |  |  |  |  |  |  |  | 0.087 (0.167) |  |
| Sociality of Receivers X Out-tie effect of Biologically Related NUES |  |  |  |  |  |  |  |  | -0.035 (0.096) |  |
| Sociality of Decliners X Out-tie effect of Biologically Related NUES |  |  |  |  |  |  |  |  | 0.062 (0.129) |  |
| AIC | 522.289 |  | 519.081 |  | 511.098 |  | 505.524 |  | 511.878 |  |
| BIC | 614.681 |  | 630.924 |  | 613.216 |  | 627.093 |  | 652.898 |  |
| Log Likelihood | -242.144 |  | -236.54 |  | -234.549 |  | -227.762 |  | -226.939 |  |
| Notes: Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1; NUES=Number of Unique Exogenous Supporters; GW=Geometrically weighted |  |

Table 4. Results of Alternative Family-Block Diagonal Constrained Exponential Random Graph Models