

## **Adolescent Friendship Formation and Mental Health: A Stochastic Actor-Based Model of Help-Seeking Behavior\***

**Marlon P. Mundt<sup>a</sup> and Larissa I. Zakletskaia<sup>b</sup>**

### **Abstract**

This study investigates how adolescent peer friendship formation relates to help-seeking behavior and how the structure of peer social networks contributes to the creation of social connections by psychological counseling recipients. The study sample comprised 2,264 adolescents ages 12-19 from the National Longitudinal Study of Adolescent Health (Add Health). Stochastic actor-based modeling simulated the co-dependence of peer friendship networks and adolescent help-seeking behavior from an initial data state to a final data state while accounting for social selection and influence effects in the same model. Results indicated that adolescents who sought psychological counseling in the past year nominated 65% more peers as friends than otherwise identical adolescents who did not use psychological services. Adolescent psychological counseling did not contribute to the loss of friends. Users of psychological services were twice as likely to be named as friends in highly interconnected peer

---

\*This work was supported by NIAAA 1K01 AA018410-01. This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due to Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website ([www.cpc.unc.edu/addhealth](http://www.cpc.unc.edu/addhealth)). Grant P01-HD31921 did not provide direct support for this analysis.

social networks (i.e. more friendship connections among their friends), as opposed to individuals in less interconnected peer groups. The findings indicate improved social functioning of adolescents as a result of psychological counseling. The results advocate for use of psychological services and point to the necessity of wide-spread screening and early detection and treatment of mental ill-health among U.S. adolescents. Group interventions targeting building social skills to enhance peer group social network interconnectivity may promote better social connections for adolescent users of psychological counseling.

**Keywords:** social networks; psychological counseling; social skills; adolescent; actor-based modeling

---

<sup>a</sup>Corresponding author: Department of Family Medicine and Community Health and Department of Population Health Sciences, University of Wisconsin School of Medicine and Public Health, 1100 Delaplaine Court, Madison WI 53715, E-mail address: marlon.mundt@fammed.wisc.edu.

<sup>b</sup>Department of Family Medicine and Community Health, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin

## Introduction

Adolescent mental ill-health is a pervasive public health problem. The National Comorbidity Survey Replication–Adolescent Supplement (NCS-A) indicates that the prevalence of psychological disorders with severe impairment and/or distress is 22.2% among a nationally representative sample of U.S. adolescents age 13-18 years old (Merikangas et al., 2010). Poor mental health among adolescents is linked with impaired social interactions, violent behaviors, worse educational outcomes, substance abuse, self-harm and suicide (Brooks, Harris, Thrall, & Woods, 2002; DuRant et al., 2000; Jalongo, Werthamer, & Kellam, 1999; Paxton, Valois, Watkins, Huebner, & Drane, 2007). There is a growing awareness that pediatric psychological counseling is crucial for promoting social connections and emotional health among children, which have been identified as U.S. national priorities (Tolan & Dodge, 2005).

Despite the high prevalence of mental health problems, adolescents are reluctant to seek psychological counseling or counseling resources may not be available (Cama et al., 2017). Only 36% of U.S. youth (12-17 years old) with major depression receive treatment (Nguyen & David, 2017). Similarly, only 25% of Australian children and 20% of German adolescents meeting DSM-IV anxiety and depressive disorders criteria receive professional help (Essau, 2005; Evans & Annenberg Foundation Trust at Sunnylands., 2005).

The reasons behind the alarmingly low rates of psychological counseling use among adolescents are not fully understood. Peer social effects may play a role in adolescents' help-seeking behavior (Gulliver, Griffiths, & Christensen, 2010; Lindsey, Joe, & Nebbitt, 2010; Moody, Feinberg, Osgood, & Gest, 2010; Pescosolido, Perry, Martin, McLeod, & Jensen, 2007). Negative perceptions of psychological counseling by peers have been implicated in low rates of psychological counseling among adolescents (Chandra & Minkovitz, 2007; Gulliver et al., 2010; Hoagwood, Burns, Kiser, Ringeisen, & Schoenwald, 2001; McKay & Bannon, 2004). Roughly 60% of adolescents with mental health needs perceive that they are treated differently or rejected by peers in their social networks (Moses, 2010). Available literature lacks a full understanding of the social peer effects experienced by adolescent users of psychological counseling.

Previous studies that link users of adolescent psychological counseling with peer rejection suffer from two important methodological concerns. First, prior studies do not control for alternative explanatory mechanisms by which adolescents choose or reject their friends (e.g., selection and influence). Adolescent friendships may be shaped by social selection, or homophily, the tendency to select friends with similar characteristics (de la Haye, Robins, Mohr, & Wilson, 2011; Essau, 2005; Kiuru, Burk, Laursen, Nurmi, & Salmela-Aro, 2012; Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010; Mercken, Steglich, Knibbe, & De Vries, 2012; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012; Mercken, Sleddens, de Vries, & Steglich, 2013; Shoham et al., 2012; Van Zalk, Kerr, Branje, Stattin, & Meeus, 2010). As such, an adolescent might base friendship selection or rejection not only on help-seeking behavior, but also on similarities in personal attributes (e.g. cognitive ability, alcohol use, or sports).

Second, prior studies rely on traditional statistical methods (e.g., regression, structural equation models) that do not control for the interdependent nature between adolescent help-seeking behavior and friendship formation. Socialization (or influence), the tendency to adopt behaviors,

attitudes, or norms of their friends, may contribute to adolescent help-seeking behavior (Prinstein, 2007). Adolescent recipients of psychological counseling may impact others' help-seeking behavior. Influence effects in peer groups create dependency pathways between friendship formation and the use of psychological services, and thus, violate the independence assumptions of commonly used statistical methods (Shalizi & Thomas, 2011).

A recent analytical approach to the analysis of friendships and psychological counseling use is stochastic actor-based modeling (Snijders, van de Bunt, & Steglich, 2010), which allows for selection and influence effects in the same model. Stochastic actor-based modeling simulates the co-dependence of friendship formation and help-seeking behavior from an initial data state to a final data state while simultaneously accounting for social selection and influence effects. Stochastic actor-based model studies have been successfully applied to the study of friendship formation and adolescent alcohol use, tobacco use, exercise, and depression in peer social networks (de la Haye et al., 2011; Kiuru et al., 2012; Kiuru et al., 2010; Mercken et al., 2012; Mercken et al., 2012; Mercken et al., 2013; Shoham et al., 2012; Van Zalk et al., 2010). To the best of our knowledge, no prior research has specifically focused on peer effects and help-seeking behavior while controlling for selection and influence effects in a single model. Without clear guidance on the causal pathways between adolescent friendship ties and adolescent help-seeking behavior, interventions for improving adolescent mental health may be ill-informed.

The present study investigates how adolescent peer friendship formation relates to help-seeking behavior among U.S. adolescents while simultaneously accounting for selection and influence effects. We use stochastic actor-based modeling to test the following research questions:

Research Question #1: How does adolescent psychological counseling use relate to peer friendship formation and maintenance?

Research Question #2: How does friendship network structure influence the uptake of help-seeking behaviors?

## **Method**

### ***Participants***

*Data Source.* This study uses survey data from the National Longitudinal Study of Adolescent Health (Add Health). Add Health employed a stratified sampling design based on region of the country, urbanicity, school funding, and racial composition to enroll a nationally representative sample of U.S. high schools and middle schools (Harris et al., 2012). Add Health initially asked all 7th through 12th graders at the 132 participating schools to respond to an in-school survey. A randomly selected sample of 20,745 students from the in-school survey respondents participated in the Wave I in-home survey, which was administered between April and December, 1995. The Wave I survey collected information on social and demographic characteristics of the respondents, education of parents, risk behaviors, health status, health care use, and friendships. A Wave II in-home survey was conducted approximately one year after Wave I. The Wave II survey (n=14,738) took place between April and December, 1996. The Wave II content was

similar to Wave I, including health care use and in-school friends. The University of North Carolina Institutional Review Board approved all study procedures.

*Analysis Sample.* The participating Add Health schools were drawn from 16 saturated-sample schools, where all students in attendance were included in the sampling frame for the in-home survey. Seven schools were excluded from the sample due to analytical constraints. The study sample for the present analysis is comprised of 2,264 Add Health subjects from 9 schools in the saturated school subsample. Subjects who completed the Wave I survey, but were non-responders at Wave II, were included in the model using the SIENA imputation procedure (Ripley, Snijders, & Preciado, 2011). In this approach, outgoing ties sent by non-responders are imputed and treated as non-informative for statistical computations using last observation carry forward while incoming ties are allowed to vary and to contribute to the estimation calculations. We excluded subjects who did not name or were not named by at least one friend at either wave because responses from study participants whose social connections lay fully outside of the school network could bias study findings. Over 80% of excluded subjects indicated friendship nominations outside of the school network.

Low friendship network stability between study waves raises doubts about the reliability of the friendship data reported and may heighten the possibility of convergence failure in the iterative estimation process. The Jaccard index (Real & Vargas, 1996) measures network stability as the proportion of friendship ties within each school that remain unchanged from Wave I to Wave II out of the total number of ties reported at either wave. A Jaccard index of 0.20 or higher is generally required for inclusion in a stochastic actor-based model analysis (Ripley et al., 2011). A total of 7 schools did not meet the Jaccard index criteria and were excluded from the analysis. One possible explanation for low network stability is that friendships modulate when students transition from middle school to high school. Schools that were excluded from the analysis were smaller schools (mean sample size of 71 students), and a majority were middle schools (5 out of 7).

### ***Measures***

Variables were chosen *a priori* based on previous findings linking adolescent friendships and psychological counseling use (Kataoka et al., 2002; Schaefer, Kornienko, & Fox, 2011). The analysis included behavioral and descriptive characteristics, such as alcohol use, academic achievement, physical health, and sensation seeking which could provide alternative bases for both mental health treatment seeking behavior and friendship formation.

*Psychological Counseling Use.* In both the Wave I and Wave II surveys, students were asked a binary yes/no question: ‘In the past year, have you received psychological or emotional counseling?’

*Social Networks.* At both Wave I and Wave II of the study, students provided responses to: “Name your 5 best male and 5 best female friends from your school roster.” We created a directed friendship matrix within each school to assess social network parameters.

*Individual Characteristics.* Students provided age, grade, and race/ethnicity at the Wave I in-home interview. We control for educational attainment with the Add Health Picture Vocabulary Test (AHPVT), a computerized, abridged version of the Peabody Picture Vocabulary Test—Revised. In this instrument, the interviewer reads a word aloud and the respondent selects the illustration that best fits its meaning. Each word has four simple, black-and-white illustrations arranged in a multiple-choice format. There are 87 items on the AHPVT, and raw scores are standardized by age. We used mother’s education level, categorized as less than high school, completed high school, some college, or college degree as a proxy for socioeconomic status.

*Depression.* A 19-item modified version of the Center for Epidemiological Studies Depression Scale (CES-D) was used to measure depression (Radloff, 1991; Roberts, Lewinsohn, & Seeley, 1991). Scores were summed across all items for a total CES-D score ranging from 0 to 57. A dichotomous depression variable ( $CES-D \geq 24$ ) was used in the analysis. Using a CES-D score of 24 as the cut point to indicate symptoms of depression among adolescents has been shown to optimize sensitivity and specificity for Diagnostic and Statistical Manual of Mental Disorders, Revised Fourth Edition major depressive disorders (Lehrer, Buka, Gortmaker, & Shrier, 2006).

*Alcohol Use.* At the Wave I in-home interview, students answered, “How often did you consume alcohol in the past year?” Categorical responses included never, 1 or 2 times, 3 to 12 times, monthly but not weekly, weekly, and more than once a week.

*Self-Rated Physical Health.* A single self-rated health item (Boardman, 2006) was asked as follows: ‘In general, would you say your health is?’ with potential responses ‘(1) Excellent, (2) Very good, (3) Good, (4) Fair, (5) Poor.’

*Sensation Seeking.* We used answers to, ‘In the past year, how often did you race on a bike, on a skateboard or roller blades, in a boat or in a car?’ as a proxy for sensation seeking. Studies show that bicycle, skateboard, or car racing is correlated with sensation seeking disposition (Lewis, 2006).

## **Data Analyses**

*Stochastic Actor-Based Modeling.* The analysis uses stochastic actor-based modeling (Snijders et al., 2010) to assess the co-dependence of psychological counseling use and friendship connections. The stochastic actor-based model simulates modifications in friendship connections and psychological counseling use from Wave I to Wave II through individual mini-steps. Each mini-step is evaluated by choosing a random adolescent  $i$  among all network members and randomly assigning whether the next action will be a friendship change or psychological counseling use change. In a potential friendship change, the student  $i$  might change an outgoing tie to student  $j$  so as to maximize the objective function for social network structure and a random unexplained influence. The probability of a tie change from student  $i$  to student  $j$  is given by:

$$p(x_i, x_j) = f_i^X (\beta, x(i \rightarrow j, z) + U_i^X (t, x, j))$$

where  $\beta$  is the parameter set,  $x(i \rightarrow j)$  is the network changes that would occur if the connection between individual  $i$  and individual  $j$  in the network were changed,  $z$  are the individual attributes within the network, and  $U$  is an independent random component. For a given actor  $i$ , the objective function is maximized over all potential alters  $j$ .

In psychological counseling change estimation, the student  $i$  might change psychological counseling use based on the objective function for the parameterized psychological counseling use outcome and a random influence. For a given actor  $i$ , the probability of a change in counseling is given by:

$$p(z_i) = f_i^Z(\beta, x, z(i)) + U_i^Z(t, z, i)$$

where  $\beta$  is the parameter set for psychological counseling use,  $x$  is the current state of network ties,  $z(i)$  is psychological counseling use after the potential micro-step change, and  $U$  is a random independent component.

The analysis uses the statistical program RSIENA (Ripley et al., 2011), originally designed by Snijders and van Duijn (Snijders & Van Duijn, 1997) and programmed by Ruth Ripley and Kristis Boitmanis.

*Model Specification.* The stochastic actor-based model consists of two parts: friendship connection change (i.e., selection effects) and psychological counseling use change (i.e., influence effects) (see Supplement Table 1). The friendship change part of the model (i.e., selection effects) includes: (1) the effect of psychological counseling use on adolescents naming others as friends; (2) the effect of psychological counseling use on the probability of being named as a friend by others; and (3) the effect of similarity in psychological counseling use on friendship selection.

Furthermore, the friendship change part of the model includes structural network effects on friendships: (1) reciprocal friendship nominations (*reciprocity*); (2) the tendency for friends of friends to be friends (*transitive triplets*); and (3) closure in three-person friendships (*3-cycles*). Individual control variables include age, gender, race/ethnicity, scholastic aptitude, alcohol use, and depression. Individual characteristics were included in the model as baseline covariates of the likelihood of friendship ties and were not modeled to change over time.

The psychological counseling change part of the model (i.e., influence effects) evaluates how the number of friendship nominations that an adolescent receives impacts adolescent psychological counseling use. The psychological counseling change model controls for linear trends in psychological counseling use over time as well as age, gender, race/ethnicity, alcohol use, depression score, self-rated physical health, sensation seeking, 3-step reach and local density. Social networks tend to display “three degrees of influence,” such that behaviors within them spread beyond the closest social ties to one- or two-step removed social connections (Christakis & Fowler, 2013). An adolescent’s 3-step reach is a count of the number of school classmates who can be reached by three or fewer steps via friendship ties (Valente, 1995). Local density is calculated as the density of connections within the 3-step reach network.

Finally, we employ the Snijders-Baerveldt meta-analysis test (Snijders & Baerveldt, 2003) to test overall significance of the primary and control variables aggregated across schools. The Snijders-Baerveldt test considers the studied schools to be a sample of a population of schools and makes inference about parameters across all schools, taking into account the variability associated with sampling of schools, which adds to the width of the confidence intervals.

## Results

The sample consisted of 2,264 adolescents in grades 7 through 11 at Wave I of the Add Health survey (Table 1). Half (49%) of the respondents were minorities, with 18% Hispanic and 16% African American. Respondents to Wave II included 2,044 adolescents, 90.3 percent of the Wave I sample. There were no significant differences between respondents and non-respondents in age, grade, gender, race/ethnicity, scholastic aptitude, or use of psychological counseling.

Table 2 provides unadjusted psychological counseling use at Wave I by individual characteristics. Overall, 8.7% of study subjects had received psychological counseling in the past year. In unadjusted univariate analyses, psychological counseling was more common among females (11% vs. 7%), non-Hispanic whites (11% vs. 6 %) and among students who had consumed alcohol in the past year (12% vs. 5% for abstainers). 21% of the students with modified CES-D scores of 24 or higher had received psychological counseling in the past year. The mean CES-D score for the study sample did not change significantly from Wave I to Wave II (11.9 vs 11.8, respectively).

Figure 1 displays the range, 25th percentile, and 75th percentile for  $\beta$  parameter estimates of friendship and psychological counseling use change aggregated across the nine schools during a one-year follow-up. Statistically significant dynamics for friendship selection included psychological counseling users sending more friendship nominations. Friendship nominations were associated with similarities in age, gender, race, scholastic aptitude, and alcohol use. Individuals meeting the criteria for depression sent fewer nominations and received fewer nominations. Statistically significant factors for psychological counseling use (i.e., influence) were female gender, depression, and alcohol use.

The top portion of Table 3 presents the stochastic actor-based model results for *friendship change* from Wave I to Wave II. After adjusting for social networks, depression severity, alcohol use and demographic characteristics, students receiving psychological counseling in the past year named more classmates as friends at Wave II ( $\beta=0.50$ ,  $p=0.008$ ). An adolescent receiving psychological counseling was 65% more likely (Odds Ratio=1.65, 95% CI: 1.25-2.17) to nominate another student as a friend than an adolescent who did not receive psychological counseling, all else being equal. Use of psychological counseling was not associated with the number of friendship nominations received ( $\beta=-0.08$ ,  $p=0.569$ ). In addition, friendship selection was not significantly associated with similarity in psychological counseling use ( $\beta=0.32$ ,  $p=0.069$ ).

Adolescents in more interconnected social networks generated more friendship connections. Social network structural characteristics of *outdegree* ( $\beta=-3.14$ ,  $p<0.001$ ), a required structural parameter, *reciprocity* ( $\beta=2.44$ ,  $p<0.001$ ), *transitive triplets* ( $\beta=0.84$ ,  $p<0.001$ ), and *3-cycles* ( $\beta=-$

**Table 1: Descriptive Statistics of Add Health Sample, Wave I, 1995 (N=2,264)**

<i>Characteristic</i>		
<i>Demographics</i>		
Male (%)		51.2
Age, mean (sd) (years)		15.8 (1.3)
Age, range (years)		12-18
Grade Level (%)		
	7th grade	6.7
	8th grade	6.8
	9th grade	16.2
	10th grade	35.8
	11th grade	34.5
Race (%)		
	Non-Hispanic white	50.5
	Black	16.3
	White Hispanic	18.5
	Other	14.8
<i>Individual Characteristics</i>		
Depression (modified CES-D score), mean (sd)		11.9 (7.5)
Self-rated physical health (%)		
	Excellent	25.7
	Very good	39.6
	Good	26.7
	Fair	7.7
	Poor	0.5
Frequency of alcohol consumption, past 12 months (%)		
	None	49.6
	1-2 times	18.3
	3-12 times	14.2
	More than monthly, less than weekly	8.3
	Weekly or more often	9.6
Add Health Picture Vocabulary Test, mean (sd)		99.1 (13.2)
Bike/skate/car/boat racing frequency (%)		
	Never	45.4
	Once or twice	23.7
	Once a month or less	7
	Two or three times a month	6.5
	Weekly or more often	17.4
Mother's education (%)		
	Less than high school	20.5
	High school graduate	45
	Some college	12.6
	Graduated college	21.8

**Table 2: Wave I Psychological Counseling Use by Individual Characteristics (N=2,264)**

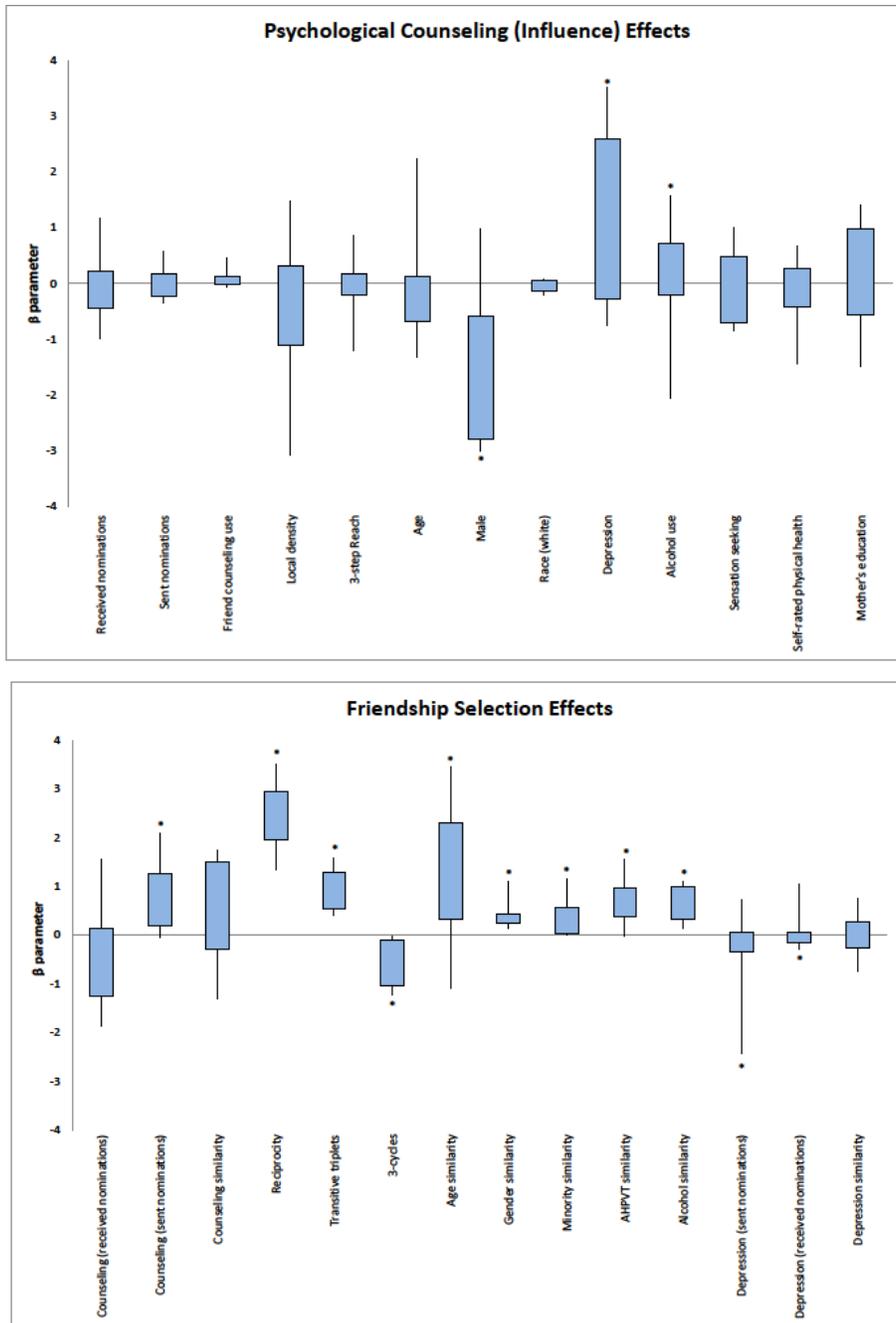
<b>Individual Characteristic at Wave I</b>		<b>n per category</b>	<b>Psychological counseling use within category in past year at Wave I (% of n)</b>	
All Subjects		2,264	8.7	
Gender	Male	1,159	6.9	$\chi^2=9.63^{**}$
	Female	1,105	10.6	
Age	12-13 years	153	5.9	$\chi^2=3.80$
	14-15 years	647	10.2	
	16-17 years	1,339	8.4	
	18-19 years	125	7.3	
Race	Non-Hispanic white	1,144	11.3	$\chi^2=20.81^{***}$
	Black	368	7.4	
	White Hispanic	418	5.7	
	Other	334	5.4	
Modified CES-D depression score	0-23	2,096	7.7	$\chi^2=34.06^{***}$
	24 or more	168	21	
Self-rated physical health	Excellent	580	7.8	$\chi^2=7.76$
	Very good	897	7.4	
	Good	604	10.8	
	Fair/Poor	183	11.5	
Frequency of alcohol consumption, past 12 months	None	1,138	5.3	$\chi^2=36.64^{***}$
	1-2 times	410	11.2	
	3-12 times	316	11.1	
	More than monthly, less than weekly	185	14.1	
	Weekly or more often	215	14	
Bike/skate/car/boat racing frequency	Never	1,028	8.4	
	Once or twice	536	8.3	

	Once a month or less	158	9.1	
	Two or three times a month	148	13.3	
	Weekly or more often	394	8.4	$\chi^2=3.32$
Mother's education	Less than high school	464	8.8	
	High school graduate	1,019	8.4	
	Some college	287	9.8	
	Graduated college	494	8.5	$\chi^2=0.55$
Friendship nominations received	0-1	491	8.3	
	2-3	668	9	
	5-6	601	8.5	
	7+	504	8.4	$\chi^2=0.20$
Friendship nominations sent	0-1	496	7.4	
	2-4	669	8	
	5-6	482	12.1	
	7+	617	7.4	$\chi^2=8.08^*$
3-step friendship reach	0-14	583	7.4	
	15-42	559	6.9	
	43-76	559	9.1	
	77+	563	11	$\chi^2=6.15$
Local friendship density	0- 0.20	563	10.1	
	0.21-0.29	546	9.9	
	0.30-0.39	590	7.3	
	0.40-1.00	565	7.3	$\chi^2=4.15$

\* $p<0.05$ , \*\* $p<0.01$ , \*\*\* $p<0.001$

0.46,  $p=0.010$ ) contributed to greater friendship formation. Friendship nominations showed a strong tendency towards being reciprocal. The positive transitive triplet effect together with the negative 3-cycle effect provides evidence of a social hierarchy in the school friendship networks.

Similar to previous research (Brendgen, Vitaro, Turgeon, & Poulin, 2002), adolescents with higher depression scores nominated fewer classmates as friends ( $\beta=-0.21$ ,  $p=0.041$ ) and received fewer friendship nominations from the overall school body ( $\beta=-0.08$ ,  $p=0.040$ ). There was no



Legend: Boxplots (Minimum, Maximum, 25th and 75th percentiles) for stochastic actor-based modeling selection and influence effect  $\beta$  parameter estimates in Add Health ( $n = 2,264$ ). Significant coefficients ( $p < 0.05$ ) are labeled with an asterisk (\*). For selection effects, coefficients correspond to the log-odds of a friendship tie being present vs. absent if the selection criterion is met. For influence effects, coefficients correspond to log-odds of psychological counseling use given a one-unit increase in the independent variable.

**Figure 1: Stochastic actor-based modeling  $\beta$  parameter estimates**

**Table 3: Parameter Estimates for Actor-Based Model of Friendship Network and Psychological Counseling<sup>a</sup>**

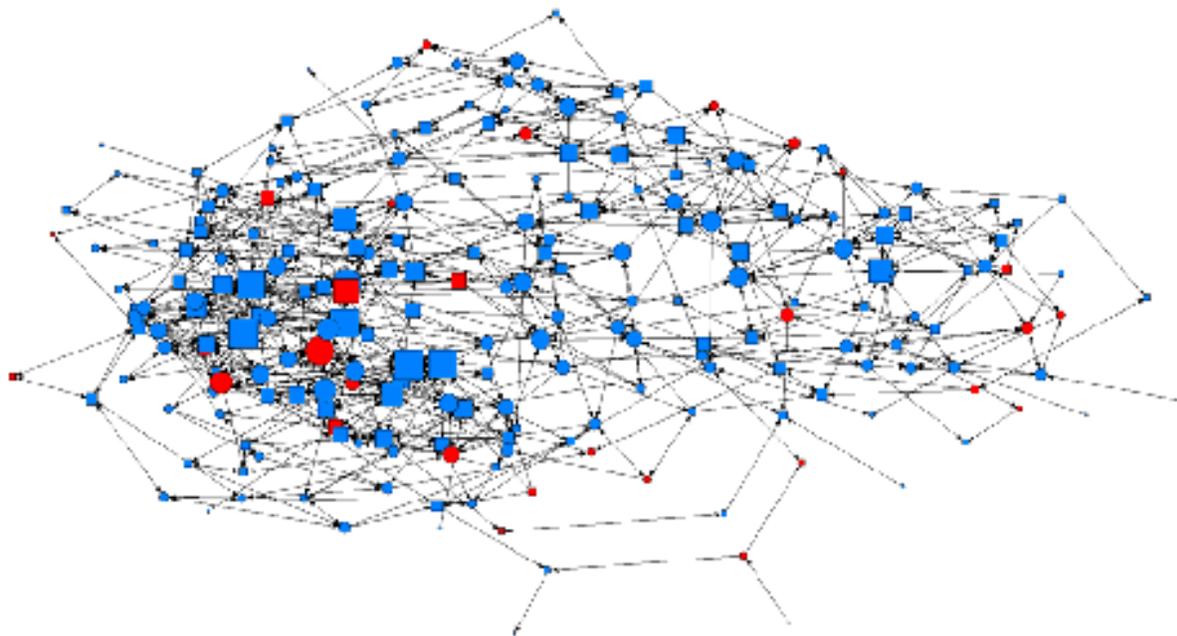
<b>Variable</b>	<b>Est. <i>b</i></b>	<b>SE</b>	<b>t-ratio</b>
<b><u>Friendship evolution</u></b>			
Psychological counseling effect on nominations sent	0.50**	0.14	3.57
Psychological counseling effect on nominations received	-0.08	0.13	-0.62
Psychological counseling similarity	0.32	0.15	2.13
Outdegree	-3.14***	0.34	-9.24
Reciprocity	2.44***	0.2	12.19
Transitive triplets	0.84***	0.09	9.33
3-cycles	-0.46*	0.15	-3.07
Age similarity	1.19*	0.42	2.83
Same gender	0.34***	0.04	8.52
Same race/ethnicity	0.39**	0.13	2.98
AHPVT similarity	0.65***	0.1	6.46
Alcohol use similarity	0.66***	0.08	8.24
Depression effect on nominations sent	-0.21*	0.09	-2.31
Depression effect on nominations received	-0.08*	0.04	-2.21
Depression similarity	0.14	0.13	1.07
<b><u>Psychological counseling evolution</u></b>			
Tendency (linear)	-3.35***	0.42	-7.96
Friendship nominations received	0.13	0.07	1.83
Friendship nominations sent	0.03	0.12	0.21
Psychological counseling use by friends	0.02	0.1	0.18
Local density	-0.11	0.36	-0.31
3-step reach	0	0.08	-0.04
Age	-0.1	0.19	-0.53
Gender (male)	-0.88*	0.24	-3.61
Race (white)	0.03	0.07	0.41
Depression	1.34*	0.45	2.94
Alcohol use	0.37*	0.13	2.85
Sensation seeking	0.18	0.09	2.02
Self-rated physical health	0.02	0.12	0.15
Mother's education	0.05	0.18	0.29

<sup>a</sup>Est. *b* = estimate of unstandardized regression coefficient

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

tendency towards friendship formation among those with similar depression scores ( $\beta=0.13$ ,  $p=0.286$ ).

In addition, as reported in other studies (de la Haye et al., 2011; Kiuru et al., 2010; Mercken et al., 2012), students were more likely to choose friends of similar age ( $\beta=1.19$ ,  $p=0.017$ ), gender ( $\beta=0.34$ ,  $p < 0.001$ ), race/ethnicity ( $\beta=0.39$ ,  $p=0.004$ ), scholastic aptitude ( $\beta=0.65$ ,  $p < 0.001$ ), and frequency of alcohol use ( $\beta=0.66$ ,  $p < 0.001$ ).



Legend: Friendship network of a single school in the Add Health study at Wave I. Friendship nominations denoted by arrow connections. Nodes sized by in-degree. Node shape (gender): square=boy; circle=girl. Node color (received psychological counseling): red=received counseling; blue=did not receive counseling.

**Figure 2: Help-seeking behavior in a single school**

The second part of Table 3 provides factors which affected use of psychological counseling. The number of friendship nominations an adolescent received or sent was not associated with increased psychological counseling use ( $\beta=0.13, p=0.088$ ;  $\beta=0.03, p=0.832$ ). Adolescents whose friends received psychological counseling were as likely to use psychological counseling as those whose friends did not receive any psychological counseling ( $\beta=0.02, p=0.745$ ). Females ( $\beta=0.87, p=0.019$ ), adolescent alcohol drinkers ( $\beta=0.35, p=0.043$ ), and adolescents who had higher depression scores, were more likely to receive psychological counseling ( $\beta=1.34, p=0.018$ ).

Figure 2 provides a visual representation of the help-seeking behavior at Wave I of one of the schools in the study. In this school, boys are represented as squares and girls as circles. Students who had received psychological counseling are colored red. Students who did not receive counseling are colored blue. The nodes are sized according to the number of incoming friendship nominations. As seen in the figure, girls were more likely to have received counseling than boys. There was no significant difference in friendship nominations based on receiving counseling. In addition, the students who received counseling were not significantly clustered together or isolated from the other students.

## Discussion

The main goal of this investigation is to investigate the co-dependence between adolescent friendships and help-seeking behavior while accounting for social selection and influence effects

in the same model. Specifically, the study evaluates: (1) how adolescent use of psychological services relates to friendship formation and maintenance in peer social networks; and (2) how friends and friendship network structure influence the uptake of help-seeking behaviors. Our results suggest that selection effects may be more prominent than influence effects in the relationship between the use of psychological counseling and adolescent friendship formation. Adolescents increase their number of friendship nominations sent and remain steady in the number of nominations received following psychological counseling. On the other hand, the study findings offer little support to the theory that friends or friendship group structures influence the receipt of psychological counseling. Our study is the first to employ stochastic actor-based modeling of friendship formation and help-seeking behavior in a sample of U.S. middle and high school students.

Our findings show that receiving adolescent psychological counseling in the past year resulted in a 65% increase in an adolescent's naming classmates as friends compared to otherwise similar adolescents who did not seek psychological help. It is encouraging that adolescent users of psychological counseling are actively engaging with their peers and are seeking out social support to lessen the burden of psychological distress. Our data points to the benefits associated with the use of adolescent psychological services, and advocates for availability of wide-spread screening and early detection and treatment of mental ill-health among U.S. adolescents.

In addition, our results show that after adjusting for covariates and selection and influence effects, help-seeking behavior did not contribute to a loss of friends (i.e., no difference in being named by classmates as a friend) at rates higher than exhibited by adolescents with no psychological services use. To reconcile our findings with studies on stigma reported by users of psychological counseling (Chandra & Minkovitz, 2007; Moses, 2010), it is possible that the perception of peer rejection associated with psychological counseling is associated with adolescents' individual characteristics which inhibit friendship formation (e.g. poor social skills), and not with negative peer reactions to psychological counseling services per se. Future research may wish to explore this issue further.

Furthermore, adolescents who resided in more interconnected peer social networks (i.e., networks with a greater tendency for friends of friends to be named friends) made more friends. An adolescent in need of psychological counseling would be twice as likely to be named as a friend in a more interconnected peer social network than an otherwise identical adolescent in a less closely knit peer group. In more interconnected networks, adolescents with mental health needs may come into more social contact with peers, which may help "break down barriers" and promote better mental health (Brendgen, Vitaro, Doyle, Markiewicz, & Bukowski, 2002; Estroff, Penn, & Toporek, 2004; Martin, Pescosolido, Olafsdottir, & McLeod, 2007). Our results argue for group-wide structural social peer effects that may mitigate the affliction of adolescent mental health illness.

The presence of social network structural effects on friendship formation lends support to interventions targeting greater interconnectedness of adolescent peer groups as a way to attenuate the experience of adolescent mental illness by harnessing peer social support. Educational interventions may focus on developing better social skills among all adolescents as a way to promote peer group interconnectedness, and, thus, improving the social functioning of

adolescents with psychological counseling needs. Our results lend credence to recent efforts to teach social skills in primary and secondary education (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), which may enhance mental health and social well-being for vulnerable adolescents in need of psychological counseling.

The study has a number of strengths. Our investigation is the first to employ stochastic actor-based modeling for disentangling peer selection and influence effects on psychological counseling in a sample of U.S. middle and high school students. The analysis examined a large sample of U.S. adolescents across a variety of school sizes and settings. It included a great variety of control variables for individual characteristics and controls for selection and influence effects in the same model.

The study results should be viewed in light of its potential limitations. First, adolescents' friendship nominations were limited to 10 friends, which may bias the friendship formation parameters in the model. However, studies show that students report having an average of four friends (Burk, Steglich, & Snijders, 2007). Second, the analysis focused on the social connections within a school and may not have captured all peers in the adolescent social network. Students who had friends outside of school may have been misrepresented in the analysis and the inclusion of those alters could possibly have shaped the findings. It is possible that non-school based friendships may be an important link to adolescents' seeking help for depressive symptoms. However, school-based networks may be most pertinent for intervention efforts. Third, schools with low network stability were excluded from the analysis. The study results may only apply to school settings where friendships are durable. Fourth, psychological counseling was self-reported with a single question. However, a similar outcome measure of psychological counseling has been commonly employed in other studies of mental health utilization (Pirkis et al., 2003). Finally, the analysis uses the Add Health data set which was initiated in 1995. There may be substantive differences in how participation in mental health services is viewed now as compared to how it may have been viewed 20 years ago. However, the disparity between the need for mental health services in adolescence and the receipt of counseling and other mental health treatments among adolescents appears to be consistent since the initiation of the Add Health study (Kataoka et al., 2002; Cama et al., 2017).

## **Conclusion**

Our findings argue for improved social functioning of adolescent psychological counseling users. The results point to the necessity of wide-spread screening, early detection, and treatment of mental ill-health among U.S. adolescents. Effective policy can support evidence-based interventions, modern training programs, and tangible strategies for improving both social skills and adolescent mental health. Group interventions targeting building social skills to enhance peer group social network interconnectivity may promote better social functioning for adolescents in need of psychological counseling. Our results may be of interest to policymakers, public health professionals, educators, parents, and community leaders who focus on improving adolescent mental health.

## References

- Boardman, J. D. (2006). Self-rated health among US adolescents. *Journal of Adolescent Health, 38*(4), 401-408. doi: DOI 10.1016/j.jadohealth.2005.01.006
- Brendgen, M., Vitaro, F., Doyle, A. B., Markiewicz, D., & Bukowski, W. M. (2002). Same-sex peer relations and romantic relationships during early adolescence: Interactive links to emotional, behavioral, and academic adjustment. *Merrill-Palmer Quarterly-Journal of Developmental Psychology, 48*(1), 77-103. doi: DOI 10.1353/mpq.2002.0001
- Brendgen, M., Vitaro, F., Turgeon, L., & Poulin, F. (2002). Assessing aggressive and depressed children's social relations with classmates and friends: A matter of perspective. *Journal of Abnormal Child Psychology, 30*(6), 609-624. doi: Doi 10.1023/A:1020863730902
- Brooks, T. L., Harris, S. K., Thrall, J. S., & Woods, E. R. (2002). Association of adolescent risk behaviors with mental health symptoms in high school students. *Journal of Adolescent Health, 31*(3), 240-246. doi: Pii S1054-139x(02)00385-3  
Doi 10.1016/S1054-139x(02)00385-3
- Burk, W. J., Steglich, C. E. G., & Snijders, A. B. (2007). Beyond dyadic interdependence: Actor-oriented models for co-evolving social networks and individual behaviors. *International Journal of Behavioral Development, 31*(4), 397-404. doi: Doi 10.1177/0165025407077762
- Cama S., Malowney M., Smith A. J. B., Spottswood M., Cheng E., Ostrowsky L., Rengifo J., Boyd J. W. (2017). Availability of Outpatient Mental Health Care by Pediatricians and Child Psychiatrists in Five U.S. Cities. *International Journal of Health Services, 47*(4):621-635. doi: 10.1177/0020731417707492
- Chandra, A., & Minkovitz, C. S. (2007). Factors that influence mental health stigma among 8th grade adolescents. *Journal of Youth and Adolescence, 36*(6), 763-774. doi: DOI 10.1007/s10964-006-9091-0
- Christakis, N. A., & Fowler, J. H. (2013). Social contagion theory: examining dynamic social networks and human behavior. *Statistics in Medicine, 32*(4), 556-577. doi: 10.1002/sim.5408
- de la Haye, K., Robins, G., Mohr, P., & Wilson, C. (2011). Homophily and Contagion as Explanations for Weight Similarities Among Adolescent Friends. *Journal of Adolescent Health, 49*(4), 421-427. doi: DOI 10.1016/j.jadohealth.2011.02.008
- DuRant, R. H., Altman, D., Wolfson, M., Barkin, S., Kreiter, S., & Krowchuk, D. (2000). Exposure to violence and victimization, depression, substance use, and the use of violence by young adolescents. *Journal of Pediatrics, 137*(5), 707-713. doi: DOI 10.1067/mpd.2000.109146
- Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The Impact of Enhancing Students' Social and Emotional Learning: A Meta-Analysis of School-Based Universal Interventions. *Child Development, 82*(1), 405-432. doi: DOI 10.1111/j.1467-8624.2010.01564.x
- Essau, C. A. (2005). Frequency and patterns of mental health services utilization among adolescents with anxiety and depressive disorders. *Depression and Anxiety, 22*(3), 130-137. doi: Doi 10.1002/Da.20115
- Estroff, S. E., Penn, D. L., & Toporek, J. R. (2004). From stigma to discrimination: An analysis of community efforts to reduce the negative consequences of having a psychiatric disorder and label. *Schizophrenia Bulletin, 30*(3), 493-509.

- Evans, D. L., & Annenberg Foundation Trust at Sunnylands. (2005). *Treating and preventing adolescent mental health disorders : what we know and what we don't know : a research agenda for improving the mental health of our youth*. New York: Oxford University Press.
- Gulliver, A., Griffiths, K. M., & Christensen, H. (2010). Perceived barriers and facilitators to mental health help-seeking in young people: a systematic review. *BMC Psychiatry, 10*. doi: Artn 113 Doi 10.1186/1471-244x-10-113
- Harris, K. M., Halpern, C. T., Whitsel, E., Hussey, J., Tabor, J., Entzel, P., & Udry, J. R. (2012). National longitudinal study of adolescent health: Research design. Retrieved December 12, 2012, from <http://www.cpc.unc.edu/projects/addhealth/design>
- Hoagwood, K., Burns, B. J., Kiser, L., Ringeisen, H., & Schoenwald, S. K. (2001). Evidence-based practice in child and adolescent mental health services. *Psychiatric Services, 52*(9), 1179-1189. doi: DOI 10.1176/appi.ps.52.9.1179
- Ialongo, N. S., Werthamer, L., & Kellam, S. G. (1999). Proximal impact of two first-grade preventive interventions on the early risk behaviors for later substance abuse, depression, and antisocial behavior. *American Journal of Community Psychology, 27*(5), 599-641. doi: Doi 10.1023/A:1022137920532
- Kataoka, S. H., Zhang, L., & Wells, K. B. (2002). Unmet need for mental health care among US children: Variation by ethnicity and insurance status. *American Journal of Psychiatry, 159*(9), 1548-1555. doi: DOI 10.1176/appi.ajp.159.9.1548
- Kiuru, N., Burk, W. J., Laursen, B., Nurmi, J. E., & Salmela-Aro, K. (2012). Is Depression Contagious? A Test of Alternative Peer Socialization Mechanisms of Depressive Symptoms in Adolescent Peer Networks. *Journal of Adolescent Health, 50*(3), 250-255. doi: DOI 10.1016/j.jadohealth.2011.06.013
- Kiuru, N., Burk, W. J., Laursen, B., Salmela-Aro, K., & Nurmi, J. E. (2010). Pressure to drink but not to smoke: disentangling selection and socialization in adolescent peer networks and peer groups. *Journal of Adolescence, 33*(6), 801-812. doi: 10.1016/j.adolescence.2010.07.006
- Lehrer J. A., Buka S., Gortmaker S., Shrier L. A. (2006). Depressive symptomatology as a predictor of exposure to intimate partner violence among US female adolescents and young adults. *Archives of Pediatric and Adolescent Medicine, 160*: 270-276.
- Lewis, J. (2006). Doing it in the dirt: High sensation seeking motocross racers. *Annals of Leisure Research, 9*(1-2), 110-132.
- Lindsey, M. A., Joe, S., & Nebbitt, V. (2010). Family Matters: The Role of Mental Health Stigma and Social Support on Depressive Symptoms and Subsequent Help Seeking Among African American Boys. *Journal of Black Psychology, 36*(4), 458-482. doi: Doi 10.1177/0095798409355796
- Martin, J. K., Pescosolido, B. A., Olafsdottir, S., & McLeod, J. D. (2007). The construction of fear: Americans' preferences for social distance from children and adolescents with mental health problems. *Journal of Health and Social Behavior, 48*(1), 50-67.
- McKay, M. M., & Bannon, W. M. (2004). Engaging families in child mental health services. *Child and Adolescent Psychiatric Clinics of North America, 13*(4), 905-+. doi: DOI 10.1016/j.chc.2004.04.001
- Mercken, L., Steglich, C., Knibbe, R., & De Vries, H. (2012). Dynamics of friendship networks and alcohol use in early and mid-adolescence. *Journal of Studies on Alcohol and Drugs, 73*(1), 99-110.

- Mercken, L., Steglich, C., Sinclair, P., Holliday, J., & Moore, L. (2012). A Longitudinal Social Network Analysis of Peer Influence, Peer Selection, and Smoking Behavior Among Adolescents in British Schools. *Health Psychology, 31*(4), 450-459. doi: Doi 10.1037/A0026876
- Mercken, L., Sleddens, E. F., de Vries, H., & Steglich, C. E. (2013). Choosing adolescent smokers as friends: the role of parenting and parental smoking. *Journal of Adolescence, 36*(2):383-92. doi: 10.1016/j.adolescence.2012.12.004
- Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L. H., . . . Swendsen, J. (2010). Lifetime Prevalence of Mental Disorders in U.S. Adolescents: Results from the National Comorbidity Survey Replication-Adolescent Supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry, 49*(10), 980-989. doi: DOI 10.1016/j.jaac.2010.05.017
- Moody, J., Feinberg, M. E., Osgood, D. W., & Gest, S. D. (2010). Mining the Network: Peers and Adolescent Health. *Journal of Adolescent Health, 47*(4), 324-326. doi: DOI 10.1016/j.jadohealth.2010.07.027
- Moses, T. (2010). Being treated differently: Stigma experiences with family, peers, and school staff among adolescents with mental health disorders. *Social Science & Medicine, 70*(7), 985-993. doi: DOI 10.1016/j.socscimed.2009.12.022
- Nguyen T., Davis K. (2017). The state of mental health in America 2017 [Internet] Alexandria, VA: Mental Health America. [cited 2019 Feb 3]. Available from: [www.mentalhealthamerica.net/sites/default/files/2017%20MH%20in%20America%20Full.pdf](http://www.mentalhealthamerica.net/sites/default/files/2017%20MH%20in%20America%20Full.pdf).
- Paxton, R. J., Valois, R. F., Watkins, K. W., Huebner, E. S., & Drane, J. W. (2007). Associations Between Depressed Mood and Clusters of Health Risk Behaviors. *American Journal of Health Behavior, 31*(3), 272-283. DOI 10.5993/AJHB.31.3.5
- Pescosolido, B. A., Perry, B. L., Martin, J. K., McLeod, J. D., & Jensen, P. S. (2007). Stigmatizing attitudes and beliefs about treatment and psychiatric medications for children with mental illness. *Psychiatric Services, 58*(5), 613-618. doi: DOI 10.1176/appi.ps.58.5.613
- Pirkis, J. E., Irwin, C. E., Brindis, C. D., Sawyer, M. G., Friestad, C., Biehl, M., & Patton, G. C. (2003). Receipt of psychological or emotional counseling by suicidal adolescents. *Pediatrics, 111*(4). doi: ARTN e388 DOI 10.1542/peds.111.4.e388
- Prinstein, M. J. (2007). Moderators of peer contagion: A longitudinal examination of depression socialization between adolescents and their best friends. *Journal of Clinical Child and Adolescent Psychology, 36*(2), 159-170.
- Radloff, L. S. (1991). The Use of the Center for Epidemiologic Studies Depression Scale in Adolescents and Young-Adults. *Journal of Youth and Adolescence, 20*(2), 149-166. doi: Doi 10.1007/Bf01537606
- Real, R., & Vargas, J. M. (1996). The probabilistic basis of Jaccard's index of similarity. *Systematic Biology, 45*(3), 380-385.
- Ripley, R. M, Snijders, T. A. B, & Preciado, P. (2011). Manual for RSiena 4.0 (version May 1, 2011 ed.). Oxford: University of Oxford, Department of Statistics; Nuffield College.
- Roberts, R. E., Lewinsohn, P. M., & Seeley, J. R. (1991). Screening for Adolescent Depression - a Comparison of Depression Scales. *Journal of the American Academy of Child and Adolescent Psychiatry, 30*(1), 58-66. doi: Doi 10.1097/00004583-199101000-00009

- Schaefer, D. R., Kornienko, O., & Fox, A. M. (2011). Misery Does Not Love Company: Network Selection Mechanisms and Depression Homophily. *American Sociological Review*, 76(5), 764-785. doi: Doi 10.1177/0003122411420813
- Shalizi, C. R., & Thomas, A. C. (2011). Homophily and Contagion Are Generically Confounded in Observational Social Network Studies. *Sociological Methods & Research*, 40(2), 211-239. doi: Doi 10.1177/0049124111404820
- Shoham D.A., Tong L., Lamberson P.J., Auchincloss A.H., Zhang J., Dugas L., Kaufman J.S., Cooper R.S., Luke A. (2012). An actor-based model of social network influence on adolescent body size, screen time, and playing sports. *PLoS One* 7(6):e39795. doi: 10.1371/journal.pone.0039795
- Snijders, T. A. B., & Van Duijn, M. A. J. (1997). Simulation of statistical inference in dynamic network models. In R. Conte, R. Hegselmann & P. Terna (Eds.), *Simulating Social Phenomena* (pp. 493-512). Berlin: Springer.
- Snijders, T. A. B., & Baerveldt, C. (2003). A multilevel network study of the effects of delinquent behavior on friendship evolution. *Journal of Mathematical Sociology*, 27(2-3), 123-151.
- Snijders, T. A. B., van de Bunt, G. G., & Steglich, C. E. G. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks*, 32(1), 44-60. doi: DOI 10.1016/j.socnet.2009.02.004
- Tolan, P. H., & Dodge, K. A. (2005). Children's Mental Health as a Primary Care and Concern: A System for Comprehensive Support and Service. *American Psychologist*, 60(6), 601-614. DOI 10.1037/0003-066X.60.6.601
- Valente, T. W. (1995). *Network models of the diffusion of innovations*. Cresskill, N.J.: Hampton Press.
- Van Zalk, M. H. W., Kerr, M., Branje, S. J. T., Stattin, H., & Meeus, W. H. J. (2010). It Takes Three: Selection, Influence, and De-Selection Processes of Depression in Adolescent Friendship Networks. *Developmental Psychology*, 46(4), 927-938. doi: Doi 10.1037/A0019661