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Analysis of Adolescent Drinking Behavior Based on Social Network

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Abstract

Alcohol consumption among adolescents can be very harmful to growth and development, mental health, and educational growth. Therefore, the problem of adolescent drinking has been of great concern to the world. Based on social network analysis, this paper explores the pathways of influence from the perspective of adolescent friendship relationships to improve the current situation of adolescent drinking, reduce the harmful effects of alcohol consumption on adolescents, and provide related suggestions.

Keywords

Adolescents; Drinking behavior; Social networks.

1. Introduction

Adolescence is an important stage in the development of the human mind and body, it is the most characteristic critical period in the development of the individual, and the cultivation of the mind and education in adolescence have far-reaching significance for the development of people throughout their lives. However, adolescence is also an important transitional period in the life of a person's physical and mental development towards maturity. As adolescents enter puberty, their bodies develop and their minds change dramatically. It is a time of gradual experience from ignorance to maturity, and therefore adolescence is also the most unstable period of life. People in adolescence usually do not have a stable sense of self and cannot make an objective and correct evaluation of events. Therefore, during this period, adolescents are easily influenced by others and cannot correctly and quickly clarify right and wrong and control themselves rationally, and may eventually go astray due to misjudgment and blind herd behavior. In today's world, where drinking is a social behavior widely accepted and promoted by society, this mindset largely influences the drinking behavior of adolescents.

It is a growing public health problem in many countries that alcohol use from a young age. World Health Organization report shows that 28% of teenagers in Europe will have tried alcohol by the age of 13. As teenagers get older, the number of those who regularly drink alcohol increases as well as the quantity and variety of drinks consumed [1]. It is harmful to the health of children and teenagers to start alcohol consumption early in life. Alcohol consumption has a negative impact on both physical and mental health in young people and it is difficult for them to quit drinking which often leads to serious addiction [2]. In order to develop an effective prevention program, identifying the factors associated with adolescent drinking is the important first step. Researchers have found that social influences have been playing a key role in adolescent drinking [3,4]. Peer relationships play an important role in adolescents' lives and form the social context of adolescent development. Children and adolescents are particularly vulnerable to peer influence because of the extreme importance of peers at this stage of development. Moreover, peer influence is stronger in adolescence than in adulthood due to deficits in mental capacity. Peer interactions may foster healthy or unhealthy behavior

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development, including alcohol use. Some research shows that the tendency to be influenced by peers does not remain constant over time: it is higher during early and middle adolescence than during preadolescence or late adolescence [5]. Some authors also showed that these age patterns demonstrate gender differences and analyses within gender subgroups indicate that the deviance of males was more strongly affected by the actions of friends than was the deviance of females [6]. Adolescents' alcohol consumption is closely associated with the drinking behavior of their peers. It may thus be concluded that peer influence exerts a role in explaining the willingness to drink alcohol. Furthermore, there are also other aspects of this process: peer norms, direct and indirect influences, popularity, and friendship effects. The similarity in drinking behavior patterns may arise from two different processes: the influence of peers on a person's behavior or the preference of a person to associate with similar others. In order to evaluate peer influence, it is necessary to disentangle it from social homophily, or the tendency to play with people with similar behavior.

2. Data Source And Pre-Process

The data sets consist of information about 10 classes of first-year students in secondary schools (aged 12-13). The data sets include the networks of friendship nominations over the four semesters, sex information of students, and attitudes towards alcohol consumption over time. Students who were structurally absent or did not respond to any of the information were excluded from the analysis. The final data contained 10 classes with an average of 23.2 students per class.

3. Theoretical Analysis and Research Hypothesis

3.1. Analysis Method

The stochastic actor-oriented model (SAOM) is a statistical model to investigate the evolution of social networks between two or more discrete time points[7]. It provides methodological solutions to one of the major challenges of investigating the evolution of social networks, namely that its members select their network partners while simultaneously being influenced by them [8]. Stochastic actor-based models are models for network dynamics that can represent a wide variety of influences on network change, allow to estimate parameters expressing such influences, and test corresponding hypotheses. The nodes in the network represent social actors, and the collection of ties represents a social relation. SAOMs model the interdependency of choices in a social network by simulating a sequence of decisions in which individuals (also called "actors") shape the evolution of the network. In addition, the network itself and the social relationships that people maintain can affect other individuals' choices as well. The SAOM models should satisfy the following assumptions: Time *t* is continuous. While the parameter estimation assumes that data is observed at two or more discrete points in time (*network panel wave*), the model assumes that between the observed data collection periods, unobserved mini-steps are happening.

The goal of the simulation procedure is to arrive at simulated networks that resemble the empirically observed network as closely as possible in terms of the network statistics that are spelled out in the model specification. The person sending the tie (*ego*) decides if he/she wants to be connected to another person (*alter*). This excludes any relationships that are based on negotiations. Network formation is thus *actor-based*. At any moment in time, only one outgoing tie can change. Hence, *ties change one by one*. This makes the network easier to model.

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3.2. Hypothesis & Effects

3.2.1. H1: Adolescents of the same sex are more likely to become friends.

"egoX" and "altX" are the effects of gender on the tendency to send friendship ties and to receive friendship ties and "sameX" is the effect of the tendency for ties to form between students of the same gender.

The `egoX`, is defined by the actor's outdegree weighted by its covariate value. When significant, it expresses which class of actors starts interactions more rapidly. For a significant statistic, the interpretation will be that females contact others more rapidly than males if it is positive, and vice versa if the statistic is negative.

The `altX`, is defined by the sum of the covariates over all actors with whom the actor of interest has an interaction. When significant, it expresses which class of actors receives interactions from others more rapidly. For a significant statistic, the interpretation will be that females are contacted by others more rapidly than males if it is positive, and vice versa if the statistic is negative.

The `sameX`, is defined by the number of interactions of the actor of interest to all other actors who have exactly the same value of covariate. When significant, it expresses how likely the actor of interest is to interact with others who share the same covariate value. A positive statistic will thus express homophily (i.e., actors interact more often with others who have the same covariate value).

3.2.2. H2: Adolescents with a similar drinking attitude are more likely to become friends.

"egoX" and "altX" are the effects of being similar attitudes toward alcohol consumption on the tendency to send friendship ties and to receive friendship ties, and the effect of the tendency for ties to form between students of the similar attitude ("simX").

For a significant statistic of "egoX", the interpretation will be that students with a higher attitude toward alcohol consumption contact others more rapidly than students with a lower attitude toward alcohol consumption if it is positive, and vice versa if the statistic is negative.

For a significant statistic "altX", the interpretation will be that students with a higher attitude toward alcohol consumption are contacted by others more rapidly than students with a lower attitude toward alcohol consumption if it is positive, and vice versa if the statistic is negative.

The "simX", is defined by the sum of centered similarity scores between with whom the actor of interest and the other actors to whom he is tied. When significant, it expresses how likely the actor of interest is to interact with others who have a similar covariate value.

The average similarity effect ("avSim"), is defined by the average of centered similarity scores between i and the other actors j to whom he is tied. When significant, it expresses tied actors have an average similarity.

3.2.3. H3: A friend of a pupil's friend also tends to be a friend of this pupil.

The triadic effect of the contribution of the number of indirect ties between two friends and measured by geometrically weighted edgewise shared partners with forwarding direction ("gwespFF").

3.2.4. H4: Adolescents with high reciprocity will send more outgoing links.

"reciAct" is a reciprocal degree-related activity effect defined by the degree of i multiplied by i's reciprocal degree.

3.2.5. H5: Adolescents with higher popularity will receive more incoming links.

"inPopSqr**"** and **"**outPopSqr**"** are the in-degree related popularity square root effect and out-degree related popularity square root effect in the network. The out-degree related activity

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(sqrt) effect ("outActSqr"), represents the extent to which a currently high outdegree actor promotes the further creation and maintenance of outgoing ties of the actor.

4. Results

4.1. Descriptive Statistics of the Data

Overall, male students are more than female students in the 10 classes. In most subgroups of class and gender combinations, the average attitude towards alcohol was between "drinking is stupid" and "drinking doesn't matter" and male students had a more positive attitude toward drinking than female students. Over 20 unique combinations of class and gender, 12 of them had an increasingly positive attitude towards alcohol consumption in May/June 2004 compared to their attitude in August/September 2003. This is consistent with studies of other researchers, see Table 1.

Table 1. Descriptive statistics of gender and attitude towards alcohol consumption over time

Numble	Female (N, %)	Average attitude towards alcohol consumption (Wave V)	Average attitude towards alcohol consumption (Wave Y)	Male (N, %)	Average attitude towards alcohol consumption (Wave V)	Average attitude towards alcohol consumption (Wave Y)
Class 1	10 (41.7%)	2.400	2.700	14 (58.3%)	2.714	2.357
Class 2	9 (37.5%)	2.111	2.111	15 (62.5%)	2.333	3.067
Class 3	13 (52.0%)	2.538	2.769	12 (48.0%)	2.417	2.667
Class 4	11 (45.8%)	2.273	2.182	13 (54.2%)	2.846	2.846
Class 5	8 (42.1%)	2.250	3.125	11 (57.9%)	1.636	2.091
Class 6	13 (48.1%)	2.385	2.692	14 (51.9%)	2.500	2.643
Class 7	9 (39.1%)	2.667	2.143	14 (60.9%)	2.111	2.286
Class 8	6 (27.3%)	1.667	1.813	16 (72.7%)	2.000	1.563
Class 9	9 (40.9%)	2.222	2.222	13 (59.1%)	2.308	1.692
Class 10	13 (59.1%)	2.462	2.769	9 (40.9%)	1.889	2.778

Table 2. Descriptive statistics of network

	Average degrees over all waves	Mean structural dissimilarity values	Similarity values on attitude towards alcohol consumption	Similarity values on sex
Class 1	3.438	0.2470	0.6850	0.4928
Class 2	3.604	0.2660	0.6966	0.5109
Class 3	3.11	0.2132	0.7189	0.4800
Class 4	3.219	0.2414	0.7062	0.4819
Class 5	3.697	0.3204	0.7135	0.4854
Class 6	4.111	0.2730	0.6607	0.4815
Class 7	2.946	0.2310	0.7003	0.5020
Class 8	3.375	0.2758	0.5505	0.5844
Class 9	2.841	0.2271	0.7122	0.4935
Class 10	2.48	0.2085	0.7612	0.4935

The descriptive statistics of the network do not indicate a significant difference between classes. Class 10 has the lowest average degrees over all waves and Class 6 has the highest average degrees over all waves. In most classes, mean structural dissimilarity is under 0.3 but in class 5

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that is 0.3204. Values of similarity values on attitude towards alcohol consumption are around 0.7 and values of similarity values on sex are around 0.5, both suggesting there is no big difference in similarities between classes, see Table 2.

4.2. Model

Table 3 provides the summary of the model where the rates at each period are omitted. The column "Convergence t-ratio" is an indicator of convergence and all these values are lower in absolute value than 0.1. The value "Overall maximum convergence ratio" is another indicator of convergence. For adequate convergence, this value should be less than 0.25. In this model, the overall maximum convergence ratio is 0.2333.

Table 3. Summary of model

	Estimate	SE	Convergence t-ratio	Est. p-Value
outdegree (density)	-1.4315	0.2415	0.0173	0.000
reciprocity	2.829	0.149	0.0036	0.000
GWESP I -> K -> J (69)	1.885	0.083	-0.0012	0.000
indegree - popularity (sqrt)	-0.664	0.0988	0.0154	0.000
outdegree - popularity (sqrt)	-0.6244	0.0838	0.0198	0.000
outdegree - activity (sqrt)	0.305	0.068	0.0118	0.000
rec.degree^(1/1) - activity	-0.2591	0.0296	0.0017	0.000
alcatt alter	-0.0002	0.0362	-0.0021	0.995
alcatt ego	0.0027	0.0358	-0.0144	0.941
alcatt similarity	0.1598	0.2012	-0.0157	0.427
sex alter	-0.1953	0.0831	0.0561	0.019
sex ego	0.2103	0.0824	0.051	0.011
same sex	0.7301	0.0824	0.0094	0.000
alcatt linear shape	-0.1282	0.0473	0.0155	0.007
alcatt quadratic shape	0.0163	0.0414	-0.0232	0.693
alcatt average similarity	1.3379	0.5084	0.0251	0.008

For H1, through the sex ego effect, female students initiated interactions with others significantly more than male students. Through the sex alter effect, male individuals received interactions with others more frequently than female. Through the same effect, sex expresses homophily that students interact more often with others who have the same sex.

For H2, the alter effect, ego effect, and similarity effect of alcohol attitude are insignificant. However, the average similarity (avSim) effect on alcohol attitude is significant so that tied students have strong similar alcohol attitudes.

For H3, reciprocity is significant and positive, reciprocity is the tendency of individuals to form mutual connections with each other. Transitivity is significant and positive, transitivity is the triadic effect of the contribution of the number of indirect ties between two friends.

For H4, the reciprocal degree-related activity effect is significant and negative. Therefore, students with higher degrees multiplied by reciprocal degrees will less likely to send more outgoing links.

For H5, indegree - popularity (sqrt) and outdegree - popularity (sqrt) are both significant and negative, so adolescents with high popularity will get fewer incoming links for friendship.

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Popularity effects, activity effects, and density effects are significant, suggesting the activity of an individual has a positive effect on friendship, and popularity and density have a negative effect.

4.3. Goodness of Fit

The goodness of fit for the outdegree distribution is reasonably well with a p-value of 0.142 greater than 0.05, see Figure 1.

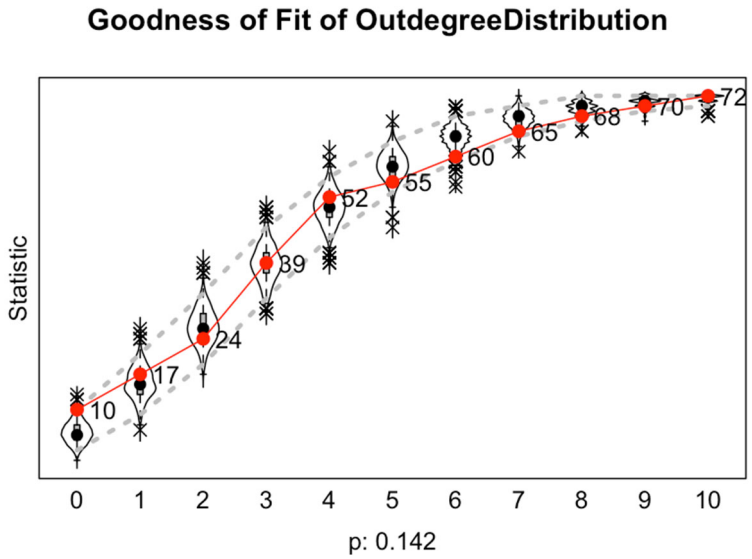

Figure 1. Goodness of fit of the outdegree distribution

The goodness of fit for the outdegree distribution is reasonably well with a p-value of 0.459 greater than 0.05, see Figure 2.

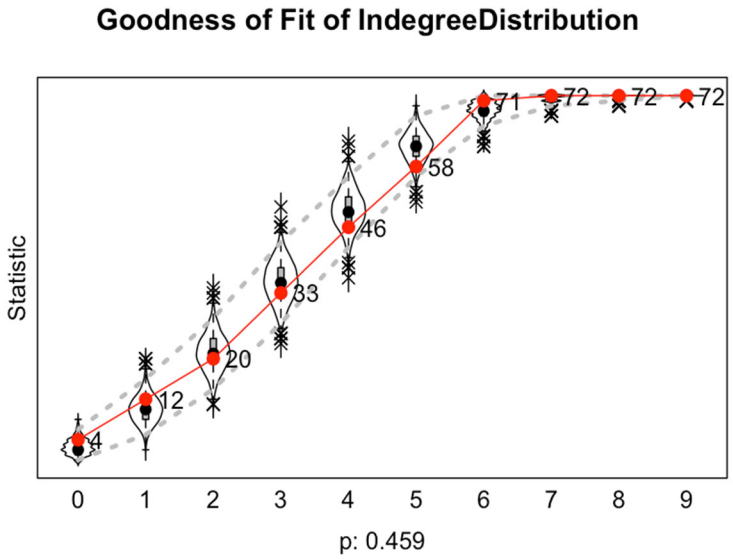

Figure 2. Goodness of fit of the indegree distribution

The goodness of fit for the outdegree distribution is reasonably well with a p-value of 0.883 greater than 0.05, see Figure 3.

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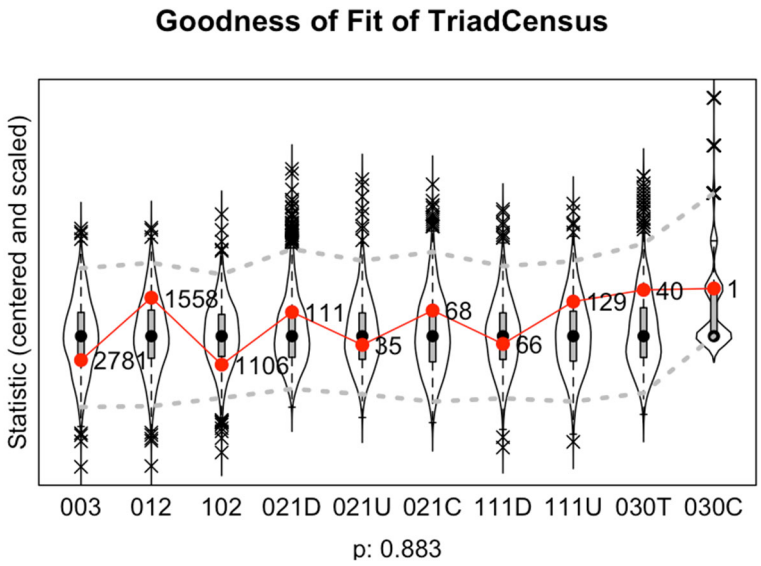

Figure 3. Goodness of fit of the triad census

5. Discussion

The results showed that a sufficient fit was obtained using a multi-group model. The goodness of fit for the outdegree, indegree distribution, and triad census are reasonably well.

For the hypothesis in the model, hypothesis 1 is consistent with the conclusion. Sex express homophily that students interact more often with others who have the same sex. Male students received interactions with others more frequently than females and female students initiated interactions with others significantly more than male students.

For the hypothesis in the model, hypothesis 2 is not consistent with the conclusion. It is unable to find significance in all effects of alcohol attitude. However, the average similarity effect on alcohol attitude is significant so that tied students have strong similar alcohol attitudes.

For the hypothesis in the model, hypothesis 3 is consistent with the conclusion. Reciprocity and transitivity are always significant. The triadic effect of the contribution of the number of indirect ties between two friends is significant.

For the hypothesis in the model, the conclusion is contrary to hypothesis 4, in common sense, if a person has a higher reciprocity value, then he is more likely to send out more friendship links. However, according to the data results, in this model, people with higher reciprocity values will less likely to send more outgoing links.

For the hypothesis in the model, the conclusion is contrary to hypothesis 5, in common sense, if a person with higher popularity (high in-degree and high outdegree) will receive more incoming links for friendship. However, according to the data results, in this model, high square root weighted in-degree and out-degree will get fewer incoming links.

6. Conclusion

Adolescence is an important period of physical and mental development. Drinking alcohol can seriously damage the physical and mental development of adolescents. In addition, teenagers have a certain degree of curiosity about many things, but they lack the correct understanding and self-control of unknown things in this period. Therefore, it is very important to understand the methods to control the drinking behavior of adolescents in order to reduce the harm of drinking to adolescents.

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Adolescents are more inclined to interact with people of the same gender. Therefore, adolescents are more likely to be influenced by others of the same gender in same-gender relationships. The results of the study indicate that male adolescents generally have higher drinking behaviors than females. Therefore, the control of adolescent drinking behavior should be more focused on male adolescents.

In a relational group, adolescents have similar drinking attitudes. Therefore, the drinking behavior and drinking attitudes of peers also influence the drinking behavior of adolescents. If adolescents inadvertently associate with friends who have bad behaviors and make friendships with these people to form friendships, then adolescents can easily go astray. Therefore, the education sector should educate teenagers to be careful in choosing their peers, not to be easily influenced by others, and to stick to their beliefs.

The results of the study showed that adolescents with high drinking behavior were socially adaptive, they were popular and had a high degree of reciprocity. This shows that moderate drinking as a social tool can enhance the interpersonal skills of adolescents and that adolescents do not have a high level of rejection of others' drinking behavior. Therefore, relevant authorities can educate adolescents to establish correct values so that adolescents are clearly aware of the dangers associated with alcohol consumption.

In addition to providing a good educational environment for adolescents and correcting misconceptions about drinking behavior, the authorities should also pay close attention to adolescents' social adjustment reactions, help adolescents establish a correct concept of friendship, improve their self-confidence, and create different social activities for adolescents to develop their social communication skills.

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