Associations Between Sugar-Sweetened Beverage Consumption and Fast Food Restaurant Frequency among Adolescents and their Friends

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Overview

- Social network research
- Methods and Findings
- Next steps
part I: social network research in nutrition
Think back: who did you spend the most time with?
social influences change over time
Social network research
social networks
social network research
What is the evidence among youth?
Peer effects in adolescent overweight

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ABSTRACT

This study is the first to estimate peer effects for adolescent weight. We use data from the National Longitudinal Study of Adolescent Health (Add Health) and define peer groups using nominated friends within schools. Endogenous peer groups are accounted for using a combination of school fixed effects, instrumental variables, and alternative definitions of peers (i.e., grade-level peers). Mean peer weight is correlated with adolescent weight, even after controlling endogenous peer groups. The impact of peer weight is larger among females and adolescents with high body mass index. The results are consistent with social multipliers for adolescent overweight policies.

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1. Introduction

The prevalence of overweight in children, the term used to define childhood obesity, has increased dramatically over the last 40 years. The prevalence of overweight among children and adolescents was four times higher in 2002 than in the 1960s (16% vs. 4%) (Hedley et al., 2004). As a result, interest in identifying the causes of this trend and policies for reducing childhood overweight is growing.

Research on the determinants of childhood overweight has focused on parental influences, the role of food prices, the built environment, and school nutrition policies (Koplan et al., 2005). One area that has not received much attention to date is the role of peers in determining adolescent weight. The existing literature on peer effects suggests that peers influence
Obesity-related behaviors in adolescent friendship networks

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ABSTRACT

This study examines obesity-related behaviors within adolescent friendship networks, because adolescent peers have been identified as being important determinants of many health behaviors. We applied ERGM selection models for single network observations to determine if close adolescent friends engage in similar behaviors and to explore associations between behavior and popularity. Same-sex friends were found to be similar on measures of organized physical activity in two out of three school-based friendship networks. Female friends were found to engage in similar screen-based behaviors, and male friends tended to be similar in their consumption of high-calorie foods. Popularity (receiving ties) was also associated with some behaviors, although these effects were gender specific and differed across networks.

The proportion of children who are overweight or obese is estimated to be between 20\% and 25\% in Australia (Olds et al., 2004). The prevalence of childhood obesity in many other affluent countries is equally high and, as in Australia, has risen dramatically over the past couple of decades (WHO, 2003). The economic and societal costs of this ‘epidemic’ are predicted to be immense because obese children have an increased risk for a number of medical conditions. Research has also provided evidence that obesity may have long-term effects on physical and cognitive development. Research suggests that a strong relationship between screen time, physical activity, and propensity for obesity; children who watch more television are less likely to do vigorous physical activity and are

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Research report

Peer influence on snacking behavior in adolescence

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ABSTRACT

To examine the association of adolescents’ snack and soft drink consumption with friendship group snack and soft drink consumption, availability of snacks and soft drinks at school, and personal characteristics, snack and soft drink consumption was assessed in 749 adolescents (398 girls, 351 boys, age 12.4–17.6 years), and their friends, and snack and soft drink availability at schools was measured. In regression analysis, consumption by friends, snack and soft drink availability within school, and personal characteristics (age, gender, education level, body mass index) were examined as determinants of snack and drink consumption. Snack and soft drink consumption was higher in boys, soft drink consumption was higher in lower educated adolescents, and snack consumption was higher in adolescents with a lower body weight. Peer group snack and soft drink consumption were associated with individual intake, particularly when availability in the canteen and vending machines was high. The association between individual and peer snack consumption was strong in boys, adolescents with a lower education level, and adolescents with lower body weights. Our study shows that individual snack and soft drink consumption is associated with specific combinations of consumption by peers, availability at school, and personal characteristics.

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Introduction

‘obesogenic’ environment (D. A. Cohen, 2008; Kipke et al., 2007; Martens van Assema & Bruin 2005; Zenk & Powell 2008) Schools
Weight-Related Behavior among Adolescents: The Role of Peer Effects

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Abstract

Purpose: To investigate whether social interactions in friendship networks influence the following weight-related behaviors of adolescents: exercising regularly, playing an active sport, hours of TV/video viewing, sleeping six or fewer hours, eating breakfast on weekdays, frequency of eating at fast food restaurants, eating five servings of fruits/vegetables daily, and consuming calorie-dense snacks.

Method: Data from a nationally representative sample of adolescents are used to examine the association between peer and individual weight-related behaviors. Evidence from multivariate regression analysis controlling for an extensive list of individual-and family-level factors as well as school-level unobserved heterogeneity is obtained.

Results: We find a significant positive association between individuals’ and friends’ behaviors in terms of sports, exercise and fast food consumption. The estimated associations are robust to controls for individual- and family-level factors, unobserved heterogeneity at the school level and our attempts to account for non-random peer selection.

Conclusions: The social transmission of weight-related behaviors is a viable explanation for the spread of obesity in friendship networks documented in recent research. Traditional weight reduction interventions may be fruitfully complemented with strategies that focus on harnessing peer support to modify behaviors.


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part II: methods and findings
PROJECT EAT
2793 Participants

20 Middle and High Schools
<table>
<thead>
<tr>
<th>Sample demographics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> (years) <em>(Mean ± SD)</em></td>
<td>14.2±1.9</td>
</tr>
<tr>
<td><strong>School level %</strong>(n)</td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>52.5 (1100)</td>
</tr>
<tr>
<td>High school</td>
<td>47.5 (997)</td>
</tr>
<tr>
<td><strong>Gender %</strong>(n)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47.5 (971)</td>
</tr>
<tr>
<td>Female</td>
<td>53.7 (1128)</td>
</tr>
<tr>
<td><strong>Race/ethnicity group %</strong>(n)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>20.2 (423)</td>
</tr>
<tr>
<td>African American/Black</td>
<td>26.6 (557)</td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>17.7 (370)</td>
</tr>
<tr>
<td>Asian American</td>
<td>19.4 (405)</td>
</tr>
<tr>
<td>Native American</td>
<td>4.1 (85)</td>
</tr>
<tr>
<td>Mixed/Other</td>
<td>12.0 (251)</td>
</tr>
<tr>
<td><strong>US-born Status %</strong>(n)</td>
<td></td>
</tr>
<tr>
<td>US-born</td>
<td>83.2 (1742)</td>
</tr>
<tr>
<td>Foreign-born</td>
<td>16.8 (352)</td>
</tr>
<tr>
<td><strong>Socioeconomic Status %</strong>(n)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>29.6 (468)</td>
</tr>
<tr>
<td>Low-middle</td>
<td>25.5 (236)</td>
</tr>
<tr>
<td>Middle</td>
<td>34.8 (183)</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>6.9 (140)</td>
</tr>
<tr>
<td>High</td>
<td>3.2 (72)</td>
</tr>
</tbody>
</table>
Theoretical Framework

Factors of the Social Ecological Model

Key: Indicates reciprocal determinism among factors

Theoretical relationship between interpersonal factors and adolescent outcomes

Friend interpersonal factors
- Friend sugar-sweetened beverage intake
- Friend fast food restaurant use

Adolescent outcomes
- Sugar-sweetened beverage intake
- Fast food restaurant use

Socio-demographic factors; modifiers
Survey tools & measures

• Project EAT-2010 student survey

• Youth/Adolescent Food Frequency Questionnaire (YAQ)

• Friend nomination survey
Unhealthy Eating Behavior Measures

• Regular and diet soda (YAQ)
  • Past year consumption → Weekly servings

• Sports and energy drinks (Student survey)
  • Past year consumption of “sports drinks such as Gatorade, Powerade, etc” and “energy drinks such as Red Bull, Full Throttle, Rockstar, etc”
  → Weekly servings

• Fast food (Student survey)
  • Monthly frequency → Weekly visits
    • Traditional “burger-and-fries”
    • Mexican fast food restaurant
    • Fried chicken
    • Sandwich or sub shop
    • Pizza place
Friend nomination

- Female best friend
- Female friend
- Male best friend
- Male friend
- Male friend

Image of a building and a person smiling.
2. Think of your three best FEMALE FRIENDS and your three best MALE FRIENDS. Look at the list of students in your school and write the code numbers for these friends on the lines. Please do NOT write names on the survey.

- If one of your friends is your boyfriend or girlfriend, circle their number.
- If one of your three best friends is NOT on the list, write “9999” for them on the line.
- Please fill all the lines even if you don’t have three female and three male friends. On any blank line, write “0000”.

**Female Friends**

1 (closest friend)

2

3

**Male Friends**

1 (closest friend)

2

3
Friends nominated: $5.2 \pm 1.3$
Friends included: $2.1 \pm 1.7$
With at least 1 friend: $77\%$

School Saturation and Friend Nomination
Sensitivity analyses:

Friend inclusion criteria

1. Complete friends: all nominated friends (n=251)
2. Almost complete friends: n-1 friends (n=585)
3. Sufficient friends: ≥ 50% friends (n=1655)
4. Any friend: ≥ one friend (n=2126)
# Frequency of unhealthy eating behaviors

<table>
<thead>
<tr>
<th>Eating behavior</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular soda intake (servings/week)</td>
<td>2.5 ±3.6</td>
</tr>
<tr>
<td>Diet soda intake (servings/week)</td>
<td>0.7±2.0</td>
</tr>
<tr>
<td>Sports drink intake (servings/week)</td>
<td>1.9±3.1</td>
</tr>
<tr>
<td>Energy drink intake (servings/week)</td>
<td>0.7±2.0</td>
</tr>
<tr>
<td>All fast food restaurant use (times/week)</td>
<td>3.7± 4.3</td>
</tr>
<tr>
<td>Burger and fries fast food restaurant use (times/week)</td>
<td>0.9± 1.1</td>
</tr>
<tr>
<td>Mexican fast food restaurant use (times/week)</td>
<td>0.5±1.0</td>
</tr>
<tr>
<td>Fried chicken fast food restaurant use (times/week)</td>
<td>0.6±1.3</td>
</tr>
<tr>
<td>Sandwich fast food restaurant use (times/week)</td>
<td>0.7 ±1.2</td>
</tr>
<tr>
<td>Pizza fast food restaurant use (times/week)</td>
<td>0.9 ±1.3</td>
</tr>
</tbody>
</table>
## Linear associations in friends’ sugar sweetened beverage intake

<table>
<thead>
<tr>
<th>Friend group</th>
<th>Regular soda $\beta$</th>
<th>Diet soda $\beta$</th>
<th>Sports drinks $\beta$</th>
<th>Energy drinks $\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friend group</td>
<td>0.13</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Best friends</td>
<td>0.07</td>
<td>0.01</td>
<td>0.03</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Key: = significant findings
Linear associations in best friends’ fast food restaurant use, modified by school level

* Significant interaction by school level
Linear associations in friend groups’ fast food restaurant use, **not modified by school level**

![Bar chart showing linear associations in fast food restaurant use among middle and high school students, with significant associations marked by asterisks.](chart.png)
• Significant associations with adolescents’ and friends’ *healthy eating behaviors* (Bruening, 2012)

• Increased odds of *extreme weight control behaviors* (Eisenberg, 2012)

• Screen time and physical activity associated among friends, differences by gender (Sirard, 2013)
Strengths and limitations

**Strengths**

- Direct measures of friends’ weight status and behaviors
- Replicated findings in an open network design
- Large socioeconomically, racially/ethnic diverse sample
- Examined healthy eating behaviors
- Compared associations between friend groups to best friends

**Limitations**

- Cross-sectional: cannot differentiate between influence and selection
- No data on persistence or strength of relational ties
- Open network design
- Self-reported dietary data
- Unmeasured confounding
Practice implications

• Create interventions targeted to youth and friends
  • Use friend groups as peer models
  • Use best friends as social support

• Provide social experiences for youth and friends to interact and support each other for healthy eating

• Consider the developmental differences in youth

• Institute policies limiting exposure to unhealthy foods
Research implications

• Are associations due to friendship influence or friendship selection?

• What multi-level interactions are involved?

• Are there longitudinal effects from friends on weight and eating behaviors?

• What are young people’s perceptions about how friends impact these behaviors?

• How can we harness findings to engage friends in nutrition interventions for youth?
selection vs. influence
Social contagion theory: examining dynamic social networks and human behavior

Nicholas A. Christakis and James H. Fowler

Here, we review the research we have conducted on social contagion. We describe the methods we have employed (and the assumptions they have entailed) to examine several datasets with complementary strengths and weaknesses, including the Framingham Heart Study, the National Longitudinal Study of Adolescent Health, and other observational and experimental datasets that we and others have collected. We describe the regularities that led us to propose that human social networks may exhibit a “three degrees of influence” property, and we review statistical approaches we have used to characterize interpersonal influence with respect to phenomena as diverse as obesity, smoking, cooperation, and happiness. We do not claim that this work is the final word, but we do believe that it provides some novel, informative, and stimulating evidence regarding social contagion in longitudinally followed networks. Along with other scholars, we are working to develop new methods for identifying causal effects using social network data, and we believe that this area is ripe for statistical development as current methods have known and often unavoidable limitations. Copyright © 2012 John Wiley & Sons, Ltd.

Keywords: social networks; contagion; human behavior; homophily; causal inference

1. Introduction

In 2007, we became aware of the existence of a source of raw data that had not previously been used for...
Adolescent Friendships, BMI, and Physical Activity: Untangling Selection and Influence Through Longitudinal Social Network Analysis

Sandra D. Simpkins, David R. Schaefer, Chara D. Price, and Andrea E. Vest
Arizona State University

Bioecological theory suggests that adolescents’ health is a result of selection and socialization processes occurring between adolescents and their microsettings. This study examines the association between adolescents’ friends and health using a social network model and data from the National Longitudinal Study of Adolescent Health (N = 1,896, mean age = 15.97 years). Results indicated evidence of friend influence on BMI and physical activity. Friendships were more likely among adolescents who engaged in greater physical activity and who were similar to one another in BMI and physical activity. These effects emerged after controlling for alternative friend selection factors, such as endogenous social network processes and propinquity through courses and activities. Some selection effects were moderated by gender, popularity, and reciprocity.

Adolescent obesity and physical activity (PA) levels are rising public health concerns around the world (Spruijt-Metz, 2011). Over the last 30 years in the United States, the rate of adolescent obesity has nearly tripled and only around one third of high school students meet the recommended level of physical activity (Child Trends, 2010). Adolescents who are overweight tend to be physically inactive, and are more likely to experience chronic physical health problems, lower economic success, and negative psychological outcomes compared with their peers (e.g., Puhl & Latner, 2007). In light of these trends, U.S. government agencies and social science researchers have turned their attention to food intake and physical activity in young people. A central question in this area is: Do friends influence the health behavior of adolescents? Friends are an important component of adolescent health (e.g., Duncan, Duncan, Strycker, & Chaumeton, 2007). According to bioecological theory, adolescent development is driven by the bidirectional processes of selecting microsettings and the influence of those microsettings on adolescents (Bronfenbrenner & Morris, 2006). Indeed, selection and influence comprise the backbone of theories explaining peer homophily (Kandel, 1978). When applied to adolescents’ health, these theories assert that adolescents’ friendships develop based on adolescents’ attributes, their health, and endogenous social network processes. In return, adolescents’ health is affected by individual-level factors...
part III: next steps
why college freshmen?
devilSPARC by the numbers

1400 Participants

3 Dormitories

8 Waves

128 Assessments
• Eating behaviors
• Physical activity behaviors
• Sedentary behaviors
• Stress
• Weight
friends matter
Citations


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