# Associations Among Household Chaos, School Belonging and Risk Behaviors in Adolescents

Erin Delker[1,2] · Patricia East[1] · Estela Blanco[1] · Victoria Wu[1] · Pamela Encina[3] · Betsy Lozoff[4,5] · Jorge Delva[6] · Sheila Gahagan[1,7]

## Abstract

We examined the associations between adolescent risk behaviors and household chaos, and whether associations varied by adolescents' sense of school belonging. We collected data from 801 Chilean adolescents from working-class families (*M* age 16.2 years). Approximately, one-quarter of participants reported past-month cigarette use, and 8% and 9% reported past-month binge drinking and marijuana use, respectively. More than half of youth reported having sex (52%), 23% of youth reported having unprotected sex at their last encounter, and 14% reported having multiple sex partners. Within the past year, 16%, 36%, and 23% reported carrying a weapon, physically attacking someone, and threatening to physically hurt someone, respectively. Greater household chaos was related to increased odds of each risk behavior except unprotected sex. These associations did not vary significantly by level of school belonging. Results are compared to previously reported results using a U.S., largely Latinx sample in attempts to replicate findings across culture and context.

## Introduction

Adolescence is a crucial developmental period during which health behaviors are established (Seiffge-Krenke, 1998). Engaging in health risk behaviors during adolescence can have long-lasting consequences for subsequent morbidity and mortality. Adolescent risk behaviors, such as alcohol, tobacco and other drug use, sexual behaviors that contribute to risk of HIV, STDs and unintended pregnancy, and

✉ Sheila Gahagan
  sgahagan@ucsd.edu

Extended author information available on the last page of the article

aggression have been prioritized by the Centers for Disease Control and Prevention (2018) for intervention and public health policy efforts.

Guided by developmental-ecological models of health (Bronfenbrenner, 1989), researchers have increasingly studied adolescent risk behaviors across multiple levels of the environment (Espelage, 2014; Millstein & Igra, 1995). Most proximal to the individual is the family and home environment. Household chaos, or overstimulation due to unpredictability or a lack of routine, instability, and physical crowding or noise, has been singled out as an important aspect of the home environment (Evans & Wachs, 2010)). Several studies have measured household chaos using the Confusion, Hubbub, and Order Scale (CHAOS; Matheny, Wachs, Ludwig & Phillips, 1995), which asks participants to rate 15 different statements based on how much they feel each describes their own home. Some items focus on the physical space in the home (e.g., "the atmosphere in our home is clean," "We can usually find things when we need them") and other items focus on chaos due to interpersonal relationships (e.g.,. "I often get drawn into other people's arguments at home," "At home we can talk to each other without being interrupted" [reversed], "it's a real zoo in our home"). Taken together, these items measure the construct of household chaos, where higher scores indicate lack of order and routine in the home. Household chaos has been associated with children's emotional and behavioral problems (Coldwell, Pike, & Dunn, 2006; Deater-Deckard et al., 2009; Dush, Schmeer, & Taylor, 2013; Fiese & Winter, 2010), poor self-control (Valiente, Lemery-Chalfant, & Reiser, 2007; Vernon-Feagans, Willoughby, & Garrett-Peters, 2016), attention problems (Shamama-tus-Sabah & Gilani, 2011), and low school achievement (Hanscombe, Haworth, Davis, Jaffee, & Plomin, 2011). Elevated household chaos, as measured by the CHAOS scale, has also been associated with increased risk behaviors in adolescents (Chatterjee, Gillman, & Wong, 2015). In their sample of 929 predominately Latinx students studied between 2007 and 2010 in Los Angeles, California, Chatterjee et al. (2015) found that high levels of household chaos related to an increased likelihood of substance use, smoking, drinking, and fighting. They also found support for school engagement as a mediator of the relationship between household chaos and youths' risk behaviors.

Indeed, school belonging has been widely discussed as an important factor in healthy youth development (Catalano, Oesterle, Fleming, & Hawkins, 2004; Pittman & Richmond, 2007; Shochet, Dadds, Ham, & Montague, 2006). Based on the need-to-belong theory, which emphasizes the fundamental need of humans to belong and feel connected to others (Baumeister, 2012), school belonging encompasses the extent to which students feel accepted, respected, included, engaged and supported by others in the school context (Anderman & Freeman, 2004; Libbey, 2004). Adolescents who report a strong sense of school belonging are less likely to engage in substance use and delinquent behaviors and more likely to show positive academic achievement (Bond et al., 2007; Meisel & Colder, 2017; Schaps & Solomon, 2003). One explanation for these findings, based on social control theory (Hirschi, 1969), is that students become committed to the values endorsed within the school and develop bonds to individuals who promote positive social values (Anderman & Freeman, 2004). Once established, these factors exert controls on behavior and inhibit deviant behaviors (Meisel & Colder, 2017; Schaps & Solomon,

2003). Several studies have conceptualized school belonging as a mediator between negative environmental influences and health (Reid, 2006; Schaps & Solomon, 2003; Seidler & Ritchie, 2018), though school belonging can also be conceptualized as an effect modifier or buffering variable. A feeling of belonging and engagement with others at school may compensate for a frenzied, chaotic, home environment. The supportive influence of school belonging can help youth develop self-control and healthy decision-making, which are compromised by overstimulation and over-arousal within chaotic homes (Holmes, Brieant, Kahn, Deater-Deckard, & Kim-Spoon, 2019). Thus, the well-studied relationship between school belonging and low risk behavior, coupled with the vast amount of time adolescents spend in school, suggest that a strong sense of school belonging could function as a protective factor buffering against risk behaviors in the presence of a chaotic home environment.

The primary aims of our study were to examine the associations between household chaos and adolescent risk behaviors, and to test for effect modification of these associations by youths' feelings of school belonging. We hypothesized that individuals reporting more household chaos will have increased odds of engaging in risk behaviors, and that a strong sense of school belonging will attenuate these associations. A secondary goal was to compare our results to those of Chatterjee et al. (2015), extending their findings based on a U.S. sample of predominantly Latinx students to our sample of Chilean youth. Replicating prior results across different cultures and contexts can provide insights into the reliability and robustness of associations. Additionally, replicating a previously reported result using a different sample and culture strengthens the generalization of the findings (Tortolero & Li, 2012).

## Methods

### Sample and Study Design

We collected data from 801 Chilean adolescents (*M* age 16.2 years, *SD* = 0.2, range 14–17; 50% male) who participated in a randomized-controlled iron deficiency preventive trial in infancy with longitudinal follow-up into adolescence (2008–2011; Doom et al., 2018; East et al., 2018). The infancy preventive trial involved 1657 children from low- to middle-income working-class communities, of whom 1115 participated at adolescence. Our analytic sample involves the 801 youth who had complete data on adolescent risk behaviors. All youth were of mixed European, Spanish, and Amerindian descent, the predominant racial/ethnic group in Chile (Barandiarán, 2012). The adolescent assessments were conducted in Spanish by clinical psychologists in private examination rooms at the Institute for Nutrition and Food Technology at the University of Chile. The study was approved by the Institutional Review Boards at the participating universities in the U.S. and Chile and was performed in accordance with the ethical standards as stated in Helsinki Declaration and its amendments. Informed written parental consent and child assent were obtained from all participants.

## Study Measures

The primary independent variable of interest was Chaos in the adolescent's household, measured by youth report on the Chaos, Hubbub, and Order Scale (CHAOS; Matheny et al., 1995). The CHAOS questionnaire has 15 true/false statements designed to measure confusion, noise, and lack of routine in the home environment (e.g., "we almost always seem rushed," "you can't hear yourself think in our home," "There is often a fuss going on at our home," "It's a real zoo in our home"). Items were aggregated to create a summary score, such that higher scores reflect a more chaotic home environment. The scale has been validated against direct observation in children and adolescent samples, and with Latinx samples (Haack, Gerdes, & Schneider, & Hurtado, 2011; Matheny et al., 1995). The scale has high internal consistency (Cronbach's $\alpha = 0.79$) and 12-month test–retest stability ($r = 0.72$; Matheny et al., 1995). The Cronbach's alpha coefficient within our study sample was 0.76.

The Risk behaviors studied included self-reported past-month Binge drinking, Cigarette use, and Marijuana use. Adolescents were asked "Have you ever smoked cigarettes?" "Have you ever drunk alcohol?" and "Have you ever used marijuana?" Adolescents who reported any prior use were asked a series of follow-up questions about frequency and quantity of use. These questionnaire items were adapted from items used in the U.S. Monitoring the Future Study (Johnston, O'Malley, & Bachman, 2001). We classified binge drinking as at least 4 or 5 alcoholic drinks on one occasion for females and males, respectively (Johnston et al., 2001). We classified individuals as cigarette users if they reported smoking more than one cigarette in the past month. We classified individuals as marijuana users if they reported using marijuana at least once in the past month.

Youth also reported on their Sexual behavior, indicating whether they had ever had sexual relations, and if so, were asked to report the number of sexual partners and whether they used "something to prevent pregnancy or sexually transmitted diseases the last time" they had sexual intercourse. Youths' Aggressive behavior was assessed using three items from the Youth Self-Report of the Child Behavior Checklist (Achenbach, 1991), which asked if they had "ever belonged to a gang," "ever carried a weapon such as a gun, razor, or big knife for protection," and "ever physically attacked someone, or threatened to hurt someone" (each coded as: no = 0, yes = 1).

The hypothesized effect modifier, School belonging, was measured with an 8-item questionnaire adapted from the Monitoring the Future Study (Johnston et al., 2001). Participants responded to questions such as, "I feel like I am part of my school," "I feel close to others at my school," "I feel safe at my school," and "I feel proud of my school." Response options were: (1) not at all true, (2) not very true, (3) sort of true, and (4) very true. The Cronbach's alpha coefficient within our sample was 0.80. Responses were summed across items, such that higher scores reflect a stronger sense of school belonging (possible range: 8–32). The full list of items is available upon request.

Potential confounding variables were selected a priori based on review of the literature (see Table 1). Variables included participants' sex and age at

**Table 1** Sample characteristics, Santiago longitudinal study (N=801)

|  | % (n) or M ± SD |
|---|---|
| Sex (male), % (n) | 49.3 (395) |
| Age, years | 16.2 ± 0.2 |
| Socioeconomic status[a] | 27.6 ± 6.4 |
| Maternal education, years | 9.5 ± 2.7 |
| Father's education, years | 9.8 ± 2.8 |
| Maternal CES-D score | 16.1 ± 4.8 |
| HOME supportive environment | 30.1 ± 4.8 |
| Household chaos | 4.1 ± 3.2 |
| School belonging | 27.0 ± 3.3 |
| Past 30d cigarette use, % (n) | 23.7 (190) |
| Past 30d binge drinking, % (n)[b] | 7.5 (60) |
| Past 30d marijuana use, % (n) | 8.6 (69) |
| Ever had sex, % (n) | 52.3 (419) |
| Multiple sex partners, % (n) | 22.7 (182) |
| Unprotected sex, % (n) | 13.7 (110) |
| Ever in a gang, % (n) | 4.9 (38) |
| Ever carried a weapon, % (n) | 15.5 (122) |
| Ever physically attacked someone, % (n) | 35.5 (284) |
| Ever threatened to hurt someone, % (n) | 22.7 (182) |

See Measures for description of coding. HOME = Home Observation for Measurement of the Environment Inventory

[a]Socioeconomic status measured with the Graffar Index, with higher scores indicating greater disadvantage. CES-D = Centers for Epidemiologic Studies Depression Scale: higher scores indicate more frequent depressive symptoms. School belonging scale adapted from Monitoring the Future Study: higher scores indicate stronger feelings of belonging

[b]Binge drinking involved drinking at least 4 (females) or 5 (males) alcoholic drinks on one occasion. Note that the following categorical variables contain missing values and have been excluded from percentage calculations: ever in a gang (n=28 missing), Ever physically attacked someone (n=12 missing), ever threatened to hurt someone (n=12 missing), and, ever carried a weapon (n=12 missing). The following continuous variables contain missing values: Graffar (n=2 missing), maternal education (n=1 missing), father education (n=2 missing), maternal depression (n=227 missing), home score (n=2 missing), school belonging (n=30 missing)

assessment, maternal education, maternal depressive symptoms (Radloff, 1977), the emotional and material support provided in the home environment (Caldwell & Bradley, 2003), and family socioeconomic position (Graffar, 1956). We describe maternal depressive symptoms in the sample, measured with the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), but do not include it as a covariate in analyses due to a large amount of missing data. Other

covariates that were measured in infancy, rather than in adolescence, were used to maximize sample size for analyses.

## Data Analysis

All data management and analyses were conducted using SAS 9.4 software (SAS Institute, Cary, NC). We first described the frequencies of categorical, and means and standard deviations of continuous, study variables for the full sample (see Table 1). Next, we modeled the probability of each Risk behavior as a function of Household chaos, a continuous variable, and covariates using SAS PROC GENMOD. To assess the nonlinear effect of chaos on odds of each Risk behavior, we used restricted cubic splines with knots placed at 50th, 75th, and 90th percentile of chaos score. From this model, we estimated odds ratios comparing the following chaos scores: 2 versus 0, 8 versus 0, and 12 versus 0. These points were selected to represent low, medium, and high levels of chaos. The analyses were carried out using a published SAS macro (Desquilbet & Mariotti, 2010).

To assess whether School belonging modified the relation between Household chaos and youth Risk behavior, we introduced a Chaos X School belonging interaction term into the multivariable models and tested for its significance. Thus, we tested for the presence of interaction on the multiplicative scale. School belonging was entered as a continuous variable into the interaction term. For ease in interpretation, we then categorized School belonging using a median split to stratify analyses and compare effect estimates across high and low levels of the moderator.

## Results

Table 1 includes summary statistics for demographic characteristics, Household chaos and School belonging variables, and prevalence of adolescent Risk behaviors. In brief, the sample was 50% males and approximately 16 years of age at date of study participation. The range of Household chaos scores was 0 to 14, with 9.2% (74) of the sample reporting no household chaos (score=0). The average chaos score was 4.1 (SD=3.2) and the distribution was skewed to the right (see Table 1).

## Substance Use

Overall, 23.7% of youth reported past-month Cigarette use, 7.5% reported past-month Binge drinking, and 8.6% reported past-month Marijuana use (see Table 1). In multivariable analyses, the Household chaos score was significantly associated with each of the three substance use behaviors (see Table 2). We found no evidence from the restricted cubic spline models to suggest that the relationships were non-linear. Instead, increasing Household chaos score was associated with increasing odds of substance use in a graded fashion. Estimates for high levels of Household chaos (12) compared to no chaos (0) were of the greatest magnitude, though these estimates were imprecise with wide confidence intervals. (see Table 2).

**Table 2** Odds ratios and 95% confidence intervals from non-linear models examining associations between Household chaos scores and youth Risk behavior

|  | Binge drinking Past 30 days | Cigarette use Past 30 days | Marijuana use Past 30 days |
|---|---|---|---|
| Household chaos Score |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | **1.6 (1.1, 2.2)** | **1.5 (1.2, 1.8)** | 1.3 (0.9, 1.8) |
| 8 | **4.1 (1.7, 10.2)** | **3.4 (2.0, 5.8)** | **3.0 (1.3, 6.8)** |
| 12 | **4.8 (1.8, 13.2)** | **4.1 (2.2, 7.9)** | **5.5 (2.3, 13.3)** |
| Overall p | <0.01 | <0.01 | <0.01 |
| Non-linear p | 0.26 | 0.20 | 0.89 |
| Low = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.6 (1.1, 2.4) | **1.4 (1.1, 1.8)** | **1.5 (1.1, 2.2)** |
| 8 | 4.1 (1.2, 14.7) | **3.2 (1.5, 7.0)** | **4.4 (1.5, 13.0)** |
| 12 | 2.6 (0.6, 10.2) | **3.0 (1.3, 7.3)** | **4.9 (1.6, 15.2)** |
| High = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.4 (0.8, 2.6) | 1.4 (0.9, 2.0) | 0.7 (0.4, 1.4) |
| 8 | 4.1 (1.1, 15.5) | **3.3 (1.6, 7.0)** | 1.2 (0.3, 4.2) |
| 12 | 8.7 (1.8, 41.1) | **5.6 (2.0, 15.2)** | **4.8 (1.1, 20.5)** |
| Test for interaction p | 0.22 | 0.06 | 0.12 |

Models adjusted for youth sex, age at evaluation, mothers' education, and support in the HOME environment. Bolded values indicate statistical significance at $p < 0.05$ in comparing the three chaos scores (2, 8, 12) to the no chaos score (0). Household chaos scores were derived by restricted spline model

## Sexual Risk Behaviors

Overall, 52.2% of youth reported ever having sex. Of those, 43.4% reported having more than one lifetime sex partner, and 26.3% reported using no protection the last time they had sex (see Table 1). Household chaos was significantly related to odds of ever having sex and having multiple sex partners (see Table 3).

## Aggressive Behaviors

Regarding Aggressive behavior, 4.9% of youth reported ever being involved in a gang, and 15.4%, 35.4%, and 22.7% reported carrying a weapon, physically attacking someone, or threatening to hurt someone, respectively (see Table 1). (Gang involvement was not analyzed further due to the small number of participants involved in a gang.) Youths' Aggressive behaviors varied significantly by level of Household chaos. Those reporting low (2) Household chaos were more likely to have carried a weapon, to have threatened to harm someone in the past year, and

**Table 3** Odds ratios and 95% confidence intervals from non-linear models examining associations between Household chaos scores and youth Sexual behavior

|  | Ever had sex | Multiple sex partners | Unprotected sex |
|---|---|---|---|
| Household Chaos Score |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.2 (0.9, 1.4) | **1.2 (0.9, 1.5)** | 1.2 (0.9, 1.5) |
| 8 | **1.8 (1.2, 2.7)** | **1.9 (1.1, 3.2)** | 1.7 (0.9, 3.3) |
| 12 | **2.0 (1.1, 3.6)** | **2.4 (1.2, 4.7)** | 1.9 (0.9, 4.2) |
| Overall *p* | 0.02 | 0.03 | 0.18 |
| Non-linear *p* | 0.56 | 0.75 | 0.60 |
| Low = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.3 (1.0, 1.6) | 1.2 (0.9, 1.6) | **1.4 (1.0, 1.9)** |
| 8 | 2.1 (1.1, 4.1) | 1.7 (0.8, 3.8) | **2.6 (1.1, 6.4)** |
| 12 | 2.0 (0.9, 4.5) | 1.5 (0.5, 3.8) | 1.4 (0.5, 4.4) |
| High = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.1 (0.9, 1.5) | 1.2 (0.8, 1.6) | 0.9 (0.6, 1.3) |
| 8 | 1.6 (0.9, 2.8) | **2.3 (1.1, 4.8)** | 1.1 (0.4, 2.6) |
| 12 | 1.8 (0.7, 4.5) | **4.2 (1.5, 11.9)** | 2.1 (0.6, 7.2) |
| Test for interaction *p* | 0.70 | 0.08 | 0.78 |

Models adjusted for youth sex, age at evaluation, mothers' education, and the HOME environment. Bolded values indicate statistical significance at *p* value < 0.05 in comparing the three chaos scores (2, 8, 12) to the no chaos score (0). Household chaos scores were derived by restricted spline model

to have physically attacked someone compared to those reporting no chaos (see Table 4). The magnitude of these effect estimates increased with more household chaos.

## Moderating Effect of School Belonging

Regarding the moderating effect of School belonging, there were no significant (at alpha = 0.05) interactions between Household chaos and School belonging for any outcome. The interaction between School belonging and Household chaos for Cigarette use (*p* = 0.06) and Multiple sex partners (*p* = 0.08) approached significance. For both outcomes the effect of high levels of Household chaos (12) was stronger among participants reporting high levels of School belonging, which was counter to the direction of our hypothesis.

## Comparison With Results by Chatterjee et al. (2015)

Three of the risk behaviors studied here overlapped with those studied by Chatterjee et al.: smoking in the past 30 days, marijuana use in the past 30 days, and no contraception used at last sexual encounter. (Several risk behaviors were

**Table 4** Odds ratios and 95% confidence intervals from non-linear models examining associations between Household chaos scores and Aggressive behavior

|  | Carried a weapon | Physically attacked someone | Threaten hurt someone |
|---|---|---|---|
| Chaos Score |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | **1.3 (1.0, 1.7)** | **1.3 (1.0, 1.5)** | **1.4 (1.1, 1.7)** |
| 8 | **2.5 (1.4, 4.8)** | **2.2 (1.4, 3.5)** | **3.1 (1.8, 5.4)** |
| 12 | **3.5 (1.6, 7.6)** | **2.5 (1.3, 4.8)** | **4.0 (2.0, 8.0)** |
| Overall $p$ | <0.01 | <0.01 | <0.01 |
| Non-linear $p$ | 0.69 | 0.41 | 0.34 |
| Low = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | **1.4 (1.0, 1.8)** | **1.3 (1.0, 1.6)** | 1.1 (0.9, 1.5) |
| 8 | **2.9 (1.2, 6.9)** | **2.1 (1.1, 4.3)** | 1.8 (0.8, 4.1) |
| 12 | **2.8 (1.0, 7.7)** | 1.8 (0.7, 4.2) | **3.3 (1.3, 8.3)** |
| High = School belonging |  |  |  |
| 0 | Ref | Ref | Ref |
| 2 | 1.1 (0.7, 1.7) | 1.2 (0.9, 1.6) | **1.7 (1.2, 2.5)** |
| 8 | 2.1 (0.8, 5.2) | **2.1 (1.1, 4.1)** | **4.5 (2.0, 9.9)** |
| 12 | **4.0 (1.1, 13.7)** | **3.3 (1.3, 8.7)** | **4.8 (1.6, 14.4)** |
| Test for interaction $p$ | 0.20 | 0.36 | 0.20 |

Models adjusted for youth sex, age at evaluation, mothers' education, and the HOME environment. Bolded values indicate statistical significance at $p < 0.05$ in comparing the three chaos scores (2, 8, 12) to the no chaos score (0). Household chaos scores were derived by restricted spline model

not worded identically between the two studies, and some referred to different time periods during which the risk behavior could have occurred.) The percentage of youth who smoked cigarettes was higher among the Chilean sample (23.7%) than in the Chatterjee et al. sample (9.4%). However, more youth in the Chatterjee et al. sample reported using marijuana than in the Chilean sample (20.5% vs. 8.6%). The percentages of youth who did not use any contraception at their last sexual encounter were similar between the samples (13.7% in our sample, and 11.7% in the Chatterjee et al. sample). Thus, despite sociodemographic differences between the samples, the overall level of risk behaviors appears comparable.

## Discussion

In this cross-sectional study of low-to-middle-income adolescents living in Santiago, Chile, participants living in more chaotic households had greater odds of reporting several adolescent risk behaviors, including cigarette use, binge drinking, marijuana use, ever having sexual intercourse, having multiple sex partners, carrying a weapon, physically attacking someone, and threatening to hurt someone.

These findings were independent of the adolescents' sex and age, mothers' educational level, and stimulation in the home in infancy. It is noteworthy that the odds of all substances studied (cigarettes, alcohol, marijuana) were increased even at low levels of chaos. The size of these effects doubled as chaos increased to moderate and high levels. This trend possibly reflects a self-medicating phenomenon, such that adolescents choose to use substances to escape a chaotic home environment (Coldwell et al., 2006; Evans & Wachs, 2010). This seems plausible given that lack of routine, structure, and predictability in the home are known to relate to psychological distress and socioemotional struggles (Evans, 2001; Fiese & Winter, 2010). It is also possible that relations between home chaos and youth risk behaviors reflect deficits in youths' self-regulatory abilities (Valiente et al., 2007; Vernon-Feagans et al., 2016) or poor parental oversight or supervision (Coldwell et al., 2006; Dush et al., 2013). These potential mechanisms should be explored in future research.

Findings related to the moderating effect of school belonging indicated that strong feelings of school belonging did not attenuate the associations between household chaos and specific youth risk behaviors. Our interaction terms were not statistically significant and the directions of stratified effects were inconsistent. Thus, the findings from this study did not support a buffering hypothesis. Other constructs relating to school belonging, such as school bonding—a broader construct encompassing school belonging as well as perceptions of fair treatment of students and involvement in academic activities—should be investigated in future research.

Our results are consistent with findings by Chatterjee et al. (2015), who studied a similar-sized sample of low-income, predominantly Latinx adolescents in Los Angeles. That study found that youths living in the most chaotic homes were approximately three times as likely to have smoked cigarettes and drunk alcohol in the past 30 days, as compared to those living in households with no chaos (Chatterjee et al., 2015). We found additional associations between household chaos and past-month marijuana use, risky sex behaviors (ever had sex, multiple sex partners), as well as aggressive behavior, such as carrying a weapon or threatening to physically attack someone. Overall, this study extends the findings by Chatterjee et al., replicating an observed association between household chaos and adolescent risk behavior. Notably, it contributes to the limited research on social factors relating to adolescent risk behaviors in a non-U.S. Latinx sample (Tortolero & Li, 2012).

The comparison between our study results and those by the Chatterjee et al. (2015) study is strengthened by a consideration of each study's sample characteristics and measures. Primary differences between the samples, though, may be best considered in the broader socio-cultural context. Specifically, our sample of Chilean youth were from low- to middle-income or working-class families. Participants in our study were of mixed European, Spanish, and Amerindian descent. In contrast, the sample studied by Chatterjee et al. (2015) involved low-income, predominately Latinx urban teens residing in high-risk neighborhoods in Los Angeles, suggesting racial/ethnic and socioeconomic minority status. Scholars have pointed to socioeconomic status mismatch between students and the broader socioeconomic context as a critical factor in demographic marginalization and socioemotional distress (Crosnoe, 2009). Being a racial/ethnic minority within the school context also has been widely shown

to lead to feelings of marginalization, socioemotional struggles, and engagement in risk behaviors (Benner & Graham, 2011; Brenner & Wang, 2015). Additionally, most participants in the Chatterjee study were native Spanish speakers (61%) or first-generation U.S.-born children (72%), suggesting that acculturation factors may also be playing a role in escalating youths' risk behaviors (Lara, Gamboa, Kahramanian, Morales, & Bautista, 2012). Given these differences, the participants in the Chatterjee sample may be exposed to different risk factors that increase their likelihood of adopting unhealthy behaviors and decrease their feelings of belonging in the school context.

Our findings should be interpreted considering some limitations. With cross-sectional analyses such as ours, temporality cannot be established. Although we consider that household chaos may lead to youths' risky behavior, longitudinal data are needed to examine the temporal associations between these factors. Risk behaviors were assessed by youth self-report, which may lead to under-reporting on sensitive items such as drug use and sexual activity. Also, two of the risk factors, binge drinking and marijuana use, were infrequent (prevalence < 10%); thus, analyses of these outcomes yielded less precise results reflected by wide confidence intervals surrounding effect estimates. Unmeasured confounding is also possible. Specifically, our analysis did not include data on parental substance use and parental aggressive behaviors, two likely confounding factors. In addition, we were unable to consider as a covariate maternal depression due to missing data for that variable. Importantly, participants may experience chaotic home environments for many different reasons (i.e., parent working multiple jobs, low socioeconomic conditions, poor parental physical or mental health). Based on the data presented in this study, we cannot draw conclusions as to *why* any given participant's household chaos score may be high. That needs to be clarified by further research and will be important to inform specific interventions.

Despite these limitations, our study has several strengths. It involves a relatively large sample of non-U.S. youth and assessed many critical youth risk behaviors known to be linked to subsequent morbidity and mortality. Our results largely replicate those found among a Southern California sample, despite cultural differences in the samples. Study findings highlight the importance of household chaos for adolescent risk behaviors and past research suggests its damaging effects on young children's adjustment (Evans & Wachs, 2010; Jaffe, Hanscombe, Haworth, Davis, & Plomin, 2012). Thus, screening and early identification of children showing signs of problem, disruptive behavior and who lack structure and routine at home are critical first steps in addressing children's outcomes.

## Compliance With Ethical Standards

# References

Achenbach, T. M. (1991). *Manual for the youth self-report and 1991 profile.* Department of Psychiatry, University of Vermont Department of Psychiatry, Burlington.

Anderman, L. H., & Freeman, T. M. (2004). Students' sense of belonging in school. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement. Motivating students, improving schools: The legacy of Carol Midgley* (Vol. 13, pp. 27–63). Greenwich, CT: Elsevier.

Barandiarán, J. (2012). Researching race in Chile. *Latin American Research Review, 47*(1), 161–176. https://doi.org/10.1353/lar.2012.0007.

Baumeister, R. F. (2012). Need-to-belong theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (Vol. 2, pp. 121–140). Thousand Oaks, CA: Sage.

Benner, A. D., & Graham, S. (2011). Latino adolescents' experiences of discrimination across the first 2 years of high school: Correlates and influences on educational outcomes. *Child Development, 82*(2), 508–519. https://doi.org/10.1111/j.1467-8624.2010.01524.x.

Benner, A. D., & Wang, Y. (2015). Adolescent substance use: The role of demographic marginalization and socioemotional distress. *Developmental Psychology, 51*(8), 1086–1097. https://doi.org/10.1037/dev0000026.

Bond, L., Butler, H., Thomas, L., Carlin, J., Glover, S., Bowes, G., et al. (2007). Social and school connectedness in early secondary school as predictors of late teenage substance use, mental health, and academic outcomes. *Journal of Adolescent Health, 40*(4), 357-e9. https://doi.org/10.1016/j.jadohealth.2006.10.013.

Bronfenbrenner, U. (1989). Ecological systems theory. In R. Vasta (Ed.), *Annals of child development: Six theories of child development—Revised formulations and current issues* (pp. 187–249). London: JAI Press.

Caldwell, B., & Bradley, R. (2003). *The home observation for measurement of the environment: Administration manual.* Family & Human Dynamics Research Institute, Arizona State University, Tempe, AZ. https://thesanfordschool.asu.edu/home-inventory.

Catalano, R. F., Oesterle, S., Fleming, C. B., & Hawkins, J. D. (2004). The importance of bonding to school for healthy development: Findings from the Social Development Research Group. *Journal of School Health, 74*(7), 252–261. https://doi.org/10.1111/j.1746-1561.2004.tb08281.x.

Centers for Disease Control and Prevention. (2018). *Youth risk behavior survey: Data summary and trends report 2007–2017.* https://www.cdc.gov/healthyyouth/data/yrbs/pdf-/trendsreport.pdf.

Chatterjee, A., Gillman, M. W., & Wong, M. D. (2015). Chaos, Hubbub, and Order Scale and health risk behaviors in adolescents in Los Angeles. *The Journal of Pediatrics, 167*(6), 1415–1421. https://doi.org/10.1016/j.jpeds.2015.08.043.

Coldwell, J., Pike, A., & Dunn, J. (2006). Household chaos–links with parenting and child behaviour. *Journal of Child Psychology and Psychiatry, 47*(11), 1116–1122. https://doi.org/10.1111/j.1469-7610.2006.01655.x.

Crosnoe, R. (2009). Low-income students and the socioeconomic composition of public high schools. *American Sociological Review, 74*(5), 709–730. https://doi.org/10.1177/000312240907400502.

Deater-Deckard, K., Mullineaux, P. Y., Beekman, C., Petrill, S. A., Schatschneider, C., & Thompson, L. A. (2009). Conduct problems, IQ, and household chaos: A longitudinal multi-informant study. *Journal of Child Psychology and Psychiatry, 50*(10), 1301–1308. https://doi.org/10.1111/j.1469-7610.2009.02108.x.

Desquilbet, L., & Mariotti, F. (2010). Dose-response analyses using restricted cubic spline functions in public health research. *Statistics in Medicine, 29*(9), 1037–1057. https://doi.org/10.1002/sim.3841.

Doom, J. R., Richards, B., Caballero, G., Delva, J., Gahagan, S., & Lozoff, B. (2018). Infant iron deficiency and iron supplementation predict adolescent internalizing, externalizing, and social problems. *Journal of Pediatrics, 195,* 199–205. https://doi.org/10.1016/j.jpeds.2017.12.008.

Dush, C. M. K., Schmeer, K. K., & Taylor, M. (2013). Chaos as a social determinant of child health: Reciprocal associations? *Social Science and Medicine, 95,* 69–76. https://doi.org/10.1016/j.socscimed.2013.01.038.

East, P., Delker, E., Lozoff, B., Delva, J., Castillo, M., & Gahagan, S. (2018). Associations among infant iron deficiency, childhood emotion and attention regulation, and adolescent problem behaviors. *Child Development, 89*(2), 583–608. https://doi.org/10.1111/cdev.12765.

Espelage, D. (2014). Ecological theory: Preventing youth bullying, aggression and victimization. *Theory into Practice, 53*(4), 257–264.

Evans, G. W. (2001). Environmental stress and health. In A. Baum, T. E. Revenson, & J. E. Singer (Eds.), *Handbook of health psychology* (pp. 365–385). Mahwah, NJ: Erlbaum.

Evans, G. W., & Wachs, T. D. (Eds.). (2010). *Chaos and its influence on children's development: An ecological perspective*. Washington, DC: American Psychological Association. https://doi.org/10.1037/12057-004.

Fiese, B. H., & Winter, M. A. (2010). The dynamics of family chaos and its relation to children's socioemotional well-being. In G. W. Evans & T. D. Wachs (Eds.), *Chaos and its influence on children's development: An ecological perspective* (pp. 49–66). Washington, DC: American Psychological Association. https://doi.org/10.1037/12057-004.

Graffar, M. (1956). A method for social classification of samples of the population. *Courrier, 6*(8), 455–459.

Haack, L. M., Gerdes, A. C., Schneider, B. W., & Hurtado, G. D. (2011). Advancing our knowledge of ADHD in Latino children: Psychometric and cultural properties of Spanish-versions of parental/family functioning measures. *Journal of Abnormal Child Psychology, 39*(1), 33–43. https://doi.org/10.1007/s10802-010-9441-y.

Hanscombe, K. B., Haworth, C. M., Davis, O. S., Jaffee, S. R., & Plomin, R. (2011). Chaotic homes and school achievement: A twin study. *Journal of Child Psychology and Psychiatry, 52*(11), 1212–1220. https://doi.org/10.1111/j.1469-7610.2011.02421.x.

Hirschi, T. (1969). *Causes of delinquency*. Berkeley, CA: University of California Press.

Holmes, C., Brieant, A., Kahn, R., Deater-Deckard, K., & Kim-Spoon, J. (2019). Structural home environment effects on developmental trajectories of self-control and adolescent risk taking. *Journal of Youth and Adolescence, 48*(1), 43–55. https://doi.org/10.1007/s10964-018-0921-7.

Jaffe, S. R., Hanscombe, K. B., Haworth, C. M., Davis, O. S., & Plomin, R. (2012). Chaotic homes and children's disruptive behavior: A longitudinal cross-lagged twin study. *Psychological Science, 23*(6), 643–650. https://doi.org/10.1177/0956797611431693.

Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (2001). *The monitoring the future national survey results on adolescent drug use: Overview of key findings*, 2000 (pp. 1–60). NIH Publication No. 01-4923: 1-60. Bethesda, MD: National Institute on Drug Abuse.

Lara, M., Gamboa, C., Kahramanian, M. I., Morales, L. S., & Bautista, D. E. H. (2012). *Acculturation and Latino health in the United States. Race, Ethnicity, and Health: A Public Health Reader*, p. 215

Libbey, H. P. (2004). Measuring student relationships to school: Attachment, bonding, connectedness, and engagement. *Journal of School Health, 74*(7), 274–283. https://doi.org/10.1111/j.1746-1561.2004.tb08284.x.

Matheny, A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology, 16*(3), 429–444. https://doi.org/10.1016/0193-3973(95)90028-4.

Meisel, S. N., & Colder, C. R. (2017). Social goals impact adolescent substance use through influencing adolescents' connectedness to their schools. *Journal of Youth and Adolescence, 46*(9), 2015–2027. https://doi.org/10.1007/s10964-017-0655-y.

Millstein, S., & Igra, V. (1995). Theoretical models of adolescent risk-taking behavior. In J. L. Wallander & L. J. Siegel (Eds.), *Adolescent health problems: Behavioral perspectives* (pp. 52–71). New York: Guilford.

Pittman, L. D., & Richmond, A. (2007). Academic and psychological functioning in late adolescence: The importance of school belonging. *The Journal of Experimental Education, 75*(4), 270–290. https://doi.org/10.3200/JEXE.75.4.270-292.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401. https://doi.org/10.1177/014662167700100306.

Reid, R. J. (2006). School climate and adolescent drug use: Mediating effects of violence victimization in the urban high school context. *Journal of Primary Prevention, 27*(3), 281–292. https://doi.org/10.1007/s10935-006-0035-y.

Schaps, E., & Solomon, D. (2003). The role of the school's social environment in preventing student drug use. *Journal of Primary Prevention, 23*(3), 299–328. https://doi.org/10.1023/A:1021393724832.

Seidler, A. L., & Ritchie, S. J. (2018). The association between socioeconomic status and cognitive development in children is partly mediated by a chaotic home atmosphere. *Journal of Cognition and Development, 19*(5), 486–508. https://doi.org/10.1080/15248372.2018.1515077.

Seiffge-Krenke, I. (1998). *Adolescents' health: A developmental perspective* (p. 1998). Mahway, NJ: Lawrence Erlbaum Associates, Inc.

Shamama-tus-Sabah, S., & Gilani, N. (2011). Household chaos, attention and school problems in primary school children. *Journal of Behavioural Sciences*, *21*(1), 68–79.

Shochet, I. M., Dadds, M. R., Ham, D., & Montague, R. (2006). School connectedness is an underemphasized parameter in adolescent mental health: Results of a community prediction study. *Journal of Clinical Child & Adolescent Psychology, 35*(2), 170–179. https://doi.org/10.1207/s15374424jccp3502_1.

Tortolero, S. R., & Li, D. H. (2012). New and Re-new: Expanding prevention science within child and adolescent health. *Journal of Primary Prevention, 33,* 1–2. https://doi.org/10.1007/s10935-012-0265-0.

Valiente, C., Lemery-Chalfant, K., & Reiser, M. (2007). Pathways to problem behaviors: Chaotic homes, parent and child effortful control, and parenting. *Social Development, 16*(2), 249–267. https://doi.org/10.1111/j.1467-9507.2007.00383.x.

Vernon-Feagans, L., Willoughby, M., & Garrett-Peters, P. (2016). Predictors of behavioral regulation in kindergarten: Household chaos, parenting, and early executive functions. *Developmental Psychology, 52*(3), 430–441. https://doi.org/10.1037/dev0000087.

**Publisher's Note**  Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## Affiliations

**Erin Delker[1,2]** · **Patricia East[1]** · **Estela Blanco[1]** · **Victoria Wu[1]** · **Pamela Encina[3]** · **Betsy Lozoff[4,5]** · **Jorge Delva[6]** · **Sheila Gahagan[1,7]**

[1]  Division of Child Development and Community Health, Department of Pediatrics, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0927, USA

[2]  Epidemiology, San Diego State University/University of California at San Diego Joint Doctoral Program, 4305 University Avenue, San Diego, CA 92105, USA

[3]  Institute of Nutrition and Food Technology, University of Chile, Av. El Líbano 5524, Santiago, Chile

[4]  Center for Human Growth and Development, University of Michigan, 300 N. Ingalls Bldg. 1063NE, Ann Arbor, MI 48109, USA

[5]  Department of Pediatrics and Communicable Diseases, Development, University of Michigan, 300 N. Ingalls Bldg. 1063NE, Ann Arbor, MI 48109, USA

[6]  School of Social Work, Boston University, 264 Bay State Rd, Boston, MA 02215, USA

[7]  Division of Child Development and Community Health, MPH Department of Pediatrics, University of California, San Diego, 4305 University Avenue, Suite 590, San Diego, CA, USA