Residential Relocation and the Risk of Attempted Suicide in Adolescents

David B. Sommer

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Chapel Hill

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Abstract

Objective: To examine whether frequency of residential relocation was associated with increased risk of attempted suicide in a large, nationally representative sample of adolescents (ages 12 to 17).

Method: Data on over 19,000 adolescents from the 2000 National Household Survey on Drug Abuse (NHSDA) were analyzed. Logistic regression was performed to determine the odds ratio for attempted suicide comparing adolescents in three categories of relocation frequency with adolescents who did not move during the preceding five years. Analyses were stratified on demographic characteristics to test for effect modification. Demographic control variables were then added to the regression model to generate adjusted odds ratios.

Results: Compared to adolescents reporting no moves in the preceding five years, crude odds ratios (and 95% confidence intervals) for a suicide attempt among adolescents by number of moves in the last five years were: 1.23 (0.97-1.57) for one move, 1.53 (1.22-1.91) for two or three moves, and 3.11 (2.32-4.16) for four or more moves. Odds ratios did not change substantially when adjusted for sex, age, race/ethnicity, family income, family structure, and population density.

Conclusions: A dose-response relationship was observed between frequency of relocation and risk of attempted suicide. A history of frequent relocation may be

ii

a clinically useful marker to assist school and medical professionals in identifying at-risk adolescents for further evaluation.

Table of Contents

	Page
List of Tables	v
List of Figures	vi
Introduction	1
Materials and Methods	11
Results	17
Discussion	20
References	27
Tables	29
Figure	34
Acknowledgements	35

List of Tables

		Page
1.	Frequency of Residential Relocation by Demographic Characteristics	29
2.	Suicidality by Demographic Characteristics	30
3.	Crude Association Between Frequency of Relocation and Suicidality	31
4.	Stratified Odds Ratios for Suicide Attempt by Frequency of Relocation	32
5.	Adjusted Odds Ratios for Suicide Attempt by Frequency of Relocation	33

List of Figures

1.	Adjusted Odds Ratios for Suicide Attempt by Frequency	34
	of Relocation	

Page

Introduction

Although a rare event, suicide among American adolescents aged 12 to 17 years was the second leading cause of death in this population during the year 2000 with 1044 deaths recorded in the National Center for Health Statistic's Vital Statistics System.¹ Rates of suicide among young adults have nearly tripled between 1952 and 1996.² Among adolescents, suicidal ideation and attempted suicide are much more common than completed suicide. Data from the 2000 Youth Risk Behavior Study indicate that, during the preceding year, 19% of high school students "seriously considered attempting suicide" and 8.8% did attempt suicide.³ The prevention of adolescent suicide is a difficult undertaking given the high prevalence of suicidal ideation, the relative rarity of completed suicide, and the large proportion of individuals with identified risk factors who do not commit suicide.⁴ Nonetheless, the Surgeon General's Call to Action to Prevent Suicide² urges a concerted effort in the public health community to develop effective prevention strategies. The report emphasizes that an evidence-based public health approach to prevention requires a better understanding of the risk and protective factors related to suicide and suicidal behavior in specific populations. This paper aims to enhance the epidemiologic research base by examining the contribution of residential relocation to the risk of attempted suicide in American adolescents.

Attempted suicide is an imperfect predictor of completed suicide in adolescents. Suicide attempts are 100 times more frequent than completed suicides, and females are more likely to attempt suicide, while males are more likely to commit suicide. A previous suicide attempt is, however, the most

important correlate for completed suicide in adolescents.⁵ Furthermore, the relatively high prevalence of attempted suicide means that sufficient numbers of cases will be present in a large nationally representative sample to make meaningful statistical inferences about associated factors. Retrospective case-control designs with proxy informants must be used when examining completed suicides, increasing the possibility of selection and informant biases. Therefore, attempted suicide is accepted as a valid proxy, and several epidemiologic studies have used attempted suicide as the dependent variable to examine risk factors for suicidality.⁶

Identified risk and protective factors for adolescent suicide are numerous. In 2000, Beautrais conducted an extensive literature review on risk factors for suicide and attempted suicide in adolescents and young adults for the National Health and Medical Research Council of Australia.⁷ She classified risk factors for which empiric support existed into five categories: 1) socioeconomic disadvantage, 2) childhood and family adversity (parental psychopathology, marital dysfunction, child abuse), 3) individual vulnerabilities (genetic predisposition, personality characteristics), 4) mental disorders, and 5) exposure to stressors (interpersonal losses, legal or disciplinary problems). A more recent review of risk factors for suicidal behavior in youth was conducted by Gould, Greenberg, Velting, and Shaffer at Columbia University.⁸ Their compiled list of risk factors did not differ substantially from that of Beautrais, although Gould et al. placed a greater emphasis on the importance of psychopathology. Depression, in particular, stands out as an important risk factor. Other mental disorders

associated with adolescent suicidality include substance abuse, anxiety disorders, and psychotic disorders.^{8,4,7,9}

Many studies identifying risk factors are of poor methodologic quality owing to the use of convenience samples, the lack of non-suicidal comparison subjects, failure to account for confounding variables, and the lack of longitudinal observation.⁷ A rigorous analysis was performed on a nationally representative sample of 13,110 American students in grades 7 through 12 using the 1995 National Longitudinal Study of Adolescent Health (Add Health),⁵ identified as the most important risk factors for attempted suicide: a previous suicide attempt, suicidal behavior in a friend, somatic symptoms, history of mental health treatment (the study did not assess specific diagnoses), same-sex attraction, school problems, violence victimization, violence perpetration, alcohol use, and illicit drug use. The most important protective factors were parent-family connectedness and emotional well-being. All analyses controlled for age, family structure, and welfare status and were stratified by race/ethnicity and sex. The effect of relocation on suicidality was not examined in the Add Health study, nor was relocation mentioned as a risk factor in either of the major reviews by Beautrais⁷ and Gould et al.⁸

However, residential relocation has been implicated as a risk factor for adolescent suicidality in at least two case-control studies. In a study of 129 serious suicide attempts among individuals aged less than 25 years living in Christchurch, New Zealand between 1991 and 1994 compared with 153 community controls, change of residence within the last 6 months was associated

with increased odds of suicide attempt (OR 2.2, 95% CI 1.3-3.6).⁶ In a study of 153 nearly-lethal suicide attempts among residents of Houston, TX aged 15 to 34 years between 1992 and 1994 compared to 513 community controls, Potter et al. found that the risk of suicide attempt was increased if the subject had moved during the past 12 months (crude OR 3.1, 95%CI 2.2-4.5).¹⁰ When they controlled for age, sex, the presence of depression, and alcoholism, the adjusted odds ratio was 2.1 (95%CI 1.4-3.3.) Furthermore, they found that the risk increased with the number of moves during the last 12 months. For subjects who had moved one, two, or three or more times, the adjusted odds ratios were 1.5, 1.7, and 6.2 verses not moving at all. Thus, frequent residential relocation may be a qualitatively different and stronger risk factor than the occurrence of any relocation.

While these studies suggest that residential relocation is associated with an increased risk of a suicide attempt in adolescents, they are limited in three important ways. First, they include subjects aged 18 to 34 years. In fact, persons over 17 years old comprised the majority of cases in both studies. The typical life circumstances of persons aged 12 to 17 years and persons aged 18 to 34 years are sufficiently different that they warrant separate consideration. Second, they both focused upon a single metropolitan area. A geographically diverse sample would allow for more confident generalization of findings to broader populations. Finally, the case-control design imparts bias because subjects are selected based upon an outcome of interest. The use of a random population sample would eliminate this bias.

To describe a theoretical causal model for the association between relocation and suicidality, Potter et al.¹⁰ rely on the century-old model of Emile Durkheim, who described egoistic and anomic suicide. They hypothesize that moving forces an individual to become more isolated and self-reliant, while creating a void of social regulation, thus increasing the risk for both egoistic an anomic suicide. Decreased social support and increased subjective isolation are recognized as important effects of residential relocation and may increase the risk of suicidality. Current etiologic explanations of suicidal behavior, however, focus mainly on psychopathology. Over 90% of adolescents who commit suicide suffered from an associated psychiatric disorder at the time of death.⁹ In her review of the literature on risk and protective factors.⁷ Beautrais synthesized current theories to create a causal model in which psychiatric morbidity interacts with environmental factors to cause suicidal behavior. Therefore, the most plausible causal model, stated in contemporary language, is that moving is an environmental stressor that creates or exacerbates psychopathology and thus increases risk for suicidal behavior.

Evidence suggests that moving does, in a broad sense, adversely affect adolescents' psychological well-being and/or development. Epidemiologic studies on this subject date back to at least 1942, when Tietze, Lemkau, and Cooper analyzed the 1936 Mental Hygiene Study in Eastern Baltimore and found that, controlling for age, ethnicity, and relief status, the proportion of children with "behavioral problems" (broadly defined to include all serious psychopathology) was inversely related to the number of years in current

residence.¹¹ More recently, Wood et al examined data for 9,915 children aged 6 to 17 years from the 1988 National Household Interview Survey and found that frequent movers (defined as the top decile when subjects were ordered by moves per year over the course of their lifetime) were significantly more likely than non-movers to have four or more behavioral problems. (OR 1.77, 95%CI 1.37-2.29).¹² Brown and Orthner surveyed 720 adolescents aged 12-14 years in 5 geographically and socioeconomicly diverse middle schools in the United States and found that life satisfaction significantly decreased with increased frequency and recency of moves.¹³

While the evidence supporting some adverse psychological effects of moving is strong, evidence linking relocation with depression, the form of pathology most strongly associated with suicidality is weaker. Brown and Orthner, also assessed depression in their subjects, but failed to find a significant difference between movers and non-movers. Hendershott studied a sample of 205 middle school students in the Southwestern United States and found a significant but small (OR 1.16) increase in the prevalence of depression among students who had moved during the preceding year.¹⁴

The theoretical literature on the effects of residential mobility on youth offers more insight as to the role relocation may play in causing or enhancing psychopathology. In a review of the literature, Scanlon and Devine¹⁵ discuss two mechanisms by which moving may decrease psychological well-being. The first is the creation of psychological stress by thinking about, planning for, and carrying out the move itself. For adolescents, the stress of a move may be

accentuated because they typically have little input as to the planning and timing of the move. The second mechanism is a loss of social capital incurred as a result of changing location. Social capital describes an individual's power derived from social relationships both within and outside of the family unit. Moving puts stress on family relationships, disrupting intrafamily social capital and also severs important ties to friends, other families, teachers, administrators and neighbors. Strong social capital can be a protective factor against depression,¹⁴ and loss of important social connections may place the adolescent at greater risk for psychological pathology. One empiric study in adolescents lends support to the social capital hypothesis. In a prospective comparison of 36 movers and 37 nonmovers, Vernberg found that mobile adolescents had fewer contacts with friends and reported less intimacy with their best friend.¹⁶

While most of the theoretical literature focuses upon the effect of a single move, Humke and Schaefer hypothesize that the more life stresses a young person experiences, including relocation, the higher that individual's risk of psychological maladjustment will be.¹⁷ Therefore, the total number or frequency of moves may be a more important predictor of psychopathology (and hence suicidality) than would be a dichotomous classification (moved versus didn't move).

While a crude association between the frequency of relocation and the risk of suicidality would represent clinically useful information, several demographic variables may modify or confound the effect of relocation and thus should be examined in an adjusted analysis. These variables include gender, age,

race/ethnicity, family structure, family income, and population density (rural vs. urban). An effect modifier would be a variable associated with a differential effect of relocation on the risk of suicidality. In other words, if adolescents were stratified by an effect-modifying demographic characteristic, the relationship between relocation and suicidality would be different in different strata. A confounding variable, on the other hand, would be a characteristic associated with a differential rate of relocation, and a differential risk of suicidality, but not a differential effect of relocation on the risk of suicidality. Therefore, the relationship between relocation and attempted suicide would be exaggerated or diminished if group membership were not accounted for in an analysis. In other words, if adolescents were stratified by a confounding demographic characteristic, the relationship between relocation and suicidality would be similar across strata but significantly different than the relationship described in the unstratified analysis.

Whether moving will affect the risk of suicidality differently for females than for males is unclear. The literature on differential effects of moving by gender has been inconsistent and contradictory.¹⁵ Females attempt suicide at much higher rates than males.⁴ However, it is unlikely that males and females move at different rates. Therefore, gender will not likely be an important confounder. The relationship of age to relocation and suicidality is similar to that of gender. Older adolescents attempt suicide with greater frequency; ⁷ however, it is unlikely that age will affect the likelihood of relocation.

Race/ethnicity may potentially be a confounder or an effect modifier. In previous studies, African-Americans have had greater rates of relocation than other groups.^{17,18} Also, relocation may, on average, represent a different experience for African-Americans than for other groups.¹⁸ In prior studies, African-Americans had lower rates of attempted suicide, while Hispanics had higher rates of attempted suicide than non-Hispanic whites.⁵ The literature on relocation in adolescents does not address the possible differential effect of relocation on Hispanic adolescents.

The number of parents in an adolescent's household and whether those parents are biological, step, foster, or adoptive, may be associated with differential effects of relocation on psychological well-being. A study on the effect of relocation on "school life" (a construct involving behavioral and academic components) found that living with both biological parents was a protective factor against the adverse effects of relocation.¹⁹ Children in single parent households have been shown to move more frequently than children in two parent households.¹² Thus, family structure may be both a confounder and an effect modifier.

Several studies have found frequent relocation to be more common among persons with low income.^{15,20} Low family income has also been associated with increased rates of suicide attempts.⁷ Therefore, family income may be an important confounder. Scanlon and Devine¹⁵ also imply that moving may be a more stressful experience for low-income adolescents, so family income may be an important effect modifier as well.

Finally, living in a rural area has been implicated as a risk factor for suicidality.⁷ While it is unclear whether persons in rural areas relocate more or less frequently than persons in non-rural areas, this possibility and the possibility that living in a rural area modifies the effect of relocation on suicidality merit investigation.

Given the strong theoretical link between relocation and psychological distress in adolescents, as well as the empiric link between psychopathology and suicidality, an association between relocation and suicide attempts in adolescents seems plausible. The positive results of the two case-control studies cited above suggest the presence of this association. However, there have been no population-based investigations of this association. I hypothesize that, in a large, nationally representative, sample of 12 to 17 year olds, a positive association will exist between recent residential relocation and the risk of a suicide attempt. Furthermore, I hypothesize that the risk of a suicide attempt will increase as the number of recent past moves increases and that this association will persist after important confounding demographic variables have been controlled for in a regression model.

Materials and Methods

The National Household Survey on Drug Abuse (NHSDA) is a nationwide personal interview survey conducted on a year-round basis by Research Triangle Institute (Research Triangle Park, North Carolina) for the Substance Abuse and Mental Health Services Administration (SAMHSA). (The name of this project changed in 2002, and it is currently called the National Survey on Drug Use and Health [NSDUH].) While the primary aim of the study is to obtain data on the prevalence and correlates of drug use in the United States, the 2000 administration contained questions about residential relocation and suicidality as well as several demographic factors and thus was selected as the data source for my study. The study population is a random sample of the civilian, noninstitutionalized population of the United States aged 12 and older. The details of the sampling design are described elsewhere.²¹ In 2000, 71,764 persons in total completed the computer-assisted interview (CAI). The weighted response rate for the CAI was 74%.

Before making the NHSDA data publicly available, SAMHSA processed the data in multiple ways to ensure confidentiality of the respondents. First, demographic variables were recoded so that an individual respondent could not be identified with any combination of variables. Second, a randomly selected subset of the 71,764 records in the full data set was dropped. This left 58,680 records, of which 19,430 are for 12-17 year-olds. The analytic weights were reassigned after the first subsample. Therefore, these 19,430 records were weighted to represent the entire 12 to 17 year-old non-institutionalized population of the United States.

Finally, a smaller random subsample of records was selected and responses for certain variables were swapped between donor and recipient records selected for their overall similarity. The resultant data set comprises the Public Use File (PUF) for the 2000 NHSDA, which is maintained by the Inter-University Consortium for Political and Social Research (IUCPSR) as part of the Substance Abuse and Mental Health Data Archive (SAMHDA). The codebook²¹ for the dataset provides several comparisons of population prevalence estimates made using the PUF and the original full unaltered data set. For comparisons in which at least 60 respondents per cell are represented in the PUF, the differences in prevalence estimates made using the two data sets are minimal.

The 2000 NHSDA was an in-home interview and utilized two different interviewing modalities. The majority of the survey was performed using an audio computer-assisted self-interview (ACASI). Respondents listened to prerecorded audio files of questions through headphones and entered responses on a computer keyboard. The interviewer did not have access to the respondent's answers. This design was intended to allow the greatest degree of privacy for respondents. Demographic information was obtained using a computer-assisted personal interview (CAPI), in which the interviewer asked questions aloud to the respondent and entered answers on the computer for the respondent.

The presence and informed consent of a parent or guardian was required to begin an interview with a 12-17 year-old respondent unless that respondent was legally emancipated or living in a college dormitory. Adolescent respondents were also required to give informed consent prior to the interview. While all

other survey questions used in this study were addressed only to the respondent, information about family income was also asked of the respondent's parent or guardian who consented to the interview.

The sequence of questions and the wording of individual questions for the 2000 NHSDA are contained in the codebook and questionnaire, both of which are available on-line.²¹ The questions of primary interest for this study were "How many times have you moved in the past 5 years?"; "During the past 12 months, has there been a time when you thought seriously about killing yourself?"; and "During the past 12 months, have you tried to kill yourself?". The two questions about suicidality were asked as part of the depression section of the DISC Predictive Scales (DPS), a psychological screening instrument that was administered in its entirety to all adolescent respondents of the 2000 NHSDA. The section consisted of four gate questions (including suicidal ideation) and three follow-up questions (including suicide attempt). A positive response to any of the four gate questions led to the three follow-up questions being asked of the respondent. Therefore, while the question about suicidal ideation was asked to every respondent, the question about suicide attempt was only addressed to 66% of the respondents due to the skip logic described above.

Using the on-line data analysis system (DAS) at SAMDA, I downloaded a subset of the PUF containing all 19,430 adolescent records and all variables potentially of interest to this study. Definition statements for Stata were generated by the DAS. All subsequent manipulations of the data and analyses were performed using Stata, version 7.0. (Stata Corporation, College Station, TX).

The survey module commands in Stata utilize variables for the analytic weight, sampling stratum, and sampling cluster of each record in all calculations to produce accurate population estimates of parameters and their variance.

Since the outcome of primary interest was attempted suicide, and the suicide attempt question was only addressed to 66% of respondents, I classified respondents as having made a suicide attempt only if they answered positively both the question about suicidal ideation and the question about suicide attempt. This eliminated the bias induced by the skip logic of the DPS since every respondent who answered positively the question about suicidal ideation was subsequently asked the question about suicide attempt. This decision excluded 96 individuals who answered negatively the question about suicidal ideation and positively the question about suicidal ideation and positively the question about suicide attempt. A sensitivity analysis was performed to examine the effect of this decision on study findings.

In categorizing the number of moves in the past 5 years, I attempted to approximate Wood et al.'s¹² category of the top 10% of movers. Therefore, I created the top category of persons who reported four or more moves (6.6% of the population). Rather than simply compare this group to the non-movers, I coded the persons who had moved at least once but less than four times into two roughly equal-sized categories (one move and two or three moves) so that I could better describe the dose-response relationship between relocation and suicidality.

I recoded the respondents' ages into three groups (12 to 13, 14 to 15, and 16 to 17), and condensed race/ethnicity into four categories (White, non-Hispanic; Black, non-Hispanic, Hispanic; and other) in order to maintain adequate cell sizes

for each category of relocation frequency and suicidality within each demographic category.

Annual family income was categorized in the PUF by multiples of \$10,000 up to \$50,000 (with the highest category being \$75,000 and over). I condensed the family incomes below \$20,000 (a level which contains all families under the federal poverty line)²² into a single category. I retained the top category and created intermediate categories in the way that provided the most even distribution of respondents across categories. This resulted in a four-level categorization of family income (0 - 19,999; 20,000 - 49,999; 50,000 - 74,999; and 75,000 and over).

A household composition module on the NHSDA determined whether the respondent's mother and/or father were living with the respondent. Individuals were considered parents by the NHSDA whether they were biological, step, adoptive, or foster parents. I could not, therefore differentiate among these categories. I therefore treated family structure as a two level variable: living with a mother and a father (regardless of type), and any other arrangement.

Population density was coded in three levels in the PUF: not in metropolitan statistical area (MSA), in MSA with fewer than 1,000,000 people, and in MSA with over 1,000,000 people. Because large MSA's contain both densely urban and suburban areas, I was unable to differentiate between these environments. I did, however, assume that if a respondent was not in an MSA (an area with at least 50,000 people) that the respondent lived in a rural environment.

I therefore created a two level variable to differentiate rural versus non-rural settings.

I began analysis by determining the number of respondents (and the associated estimated population proportion) in each category of relocation frequency and suicidality both for the entire sample and for each demographic category. I then performed logistic regression with suicidality as the dependent variable and appropriate dummy variables for frequency of relocation as the only independent variables in order to determine the crude odds of a suicide attempt for adolescents in each category of relocation frequency compared to adolescents reporting no relocation. I then repeated this regression on subpopulations defined by each of the demographic categories described above to check for effect modification. A variable was considered a significant effect modifier if the confidence interval for any stratified odds ratio did not overlap with the confidence interval of the corresponding crude odds ratio. I then iterated the original logistic regression with each demographic variable as the only control to assess for confounding. I considered a confounder to be important if the difference between the crude and adjusted odds ratios were greater than 5 % at any frequency of relocation. I then produced two sets of adjusted odds ratios. The first set adjusted only for demographic variables determined to be important confounders, while the second set adjusted for all demographic variables. Finally, I performed a sensitivity analysis recoding the 96 respondents with ambiguous suicidality status as suicidal.

Results

Of the 19,430 available records, 19,009 had complete information for both suicidality and frequency of relocation and were thus usable for analysis. Among these respondents, 751 (4.0%) reported both suicidal ideation and a suicide attempt in the past 12 months. These 751 respondents constituted the "cases" for all regression analyses, while the remaining 18,258 respondents comprised the "controls." The estimated population prevalence of at least one suicide attempt in the preceding 12 months was 4.0% (standard error 0.17%). The estimated percentages of the population reporting zero, one, two or three, and four or more moves during the last five years were 50.6%, 23.6%, 19.2%, and 6.6% respectively.

The demographic characteristics of the subpopulations reporting each category of relocation frequency are reported in table 1. Design-based Pearson tests indicate significant heterogeneity in all demographic domains except gender (P < 0.01 to compensate for multiple comparisons). Differences are only substantial (variation of more than 20%) and consistent, however, within race/ethnicity, family income, and family structure. Notable findings include the over representation of African-Americans and Hispanics among all non-zero frequencies of relocation, an inverse relationship between family income and frequency of relocation, and a decreasing proportion of two-parent households with increasing frequency of relocation.

The demographic characteristics of respondents who reported a suicide attempt are compared with those who did not in table 2. Design-based Pearson

tests indicate significant heterogeneity in sex, age, family income, and family structure. Females attempted suicide at a rate 2.3 times that of males. Both 14 to 15 year-olds and 15 to 16 year-olds attempted suicide at nearly double the rate of 12 to 13 year-olds, though there was little difference between the two older groups. Family income was negatively related to the rate of suicide attempts with families earning under \$50,000 over-represented among attempters, and those earning over \$50,000 under-represented among attempters. Respondents in twoparent households were less likely to attempt suicide.

The crude association between frequency of relocation and suicidality is presented in table 3. The crude odds ratios and 95% confidence intervals for attempted suicide having moved one, two or three, or four or more times during the last five years compared to the referent group of non-movers are 1.23 (0.97-1.57), 1.53 (1.22-1.91), and 3.11 (2.32-4.16) respectively.

In table 4, the odds ratios for attempted suicide having moved one, two or three, or four or more times during the last five years compared to the referent group of non-movers are presented for members of the subpopulation defined by each demographic characteristic. The 95% confidence intervals for all odds ratios in table 4 overlap with the confidence intervals for the crude odds, indicating no significant effect modification.

The results of regressions controlling for demographic variables are presented in table 5. All results are qualitatively similar to the crude association and are presented in figure 1. Among control variables, only family income and family structure result in a change of more than 5% in the relative odds of a

suicide attempt at any frequency of relocation. When only these variables are controlled for, the adjusted odds ratios and their 95% confidence intervals for attempted suicide having moved one, two or three, or four or more times are 1.20 (0.94-1.52), 1.41 (1.13-1.77), and 2.80 (2.06-3.81). When all demographic variables (sex, age, race/ethnicity, family income, family structure, and population density) are controlled for, the adjusted odds ratios and their 95% confidence intervals for attempted suicide having moved one, two or three, or four or more times are 1.27 (0.99-1.62), 1.47 (1.16-1.85), and 2.85 (2.09-3.89). These fully adjusted odds ratios are represented graphically in figure 1.

The sensitivity analysis recoding the 96 respondents with ambiguous suicidality status as suicide attempters revealed no significant difference in crude or adjusted odds ratios for suicide attempts by frequency of relocation. The adjusted odds ratios and 95% confidence intervals with all demographic controls were 1.26 (1.00-1.58), 1.47 (1.18-1.82), and 2.92 (2.20-3.88).

Discussion

This is the first population-based study to examine the association between residential relocation and suicidality in adolescents. The principal finding of this study is that adolescents (ages 12 to 17) who have moved two or more times in the last five years are at a significantly increased risk of attempting suicide when compared to adolescents who have not changed residence during the last five years. The increase in risk is particularly notable for adolescents who have moved four or more times. These highly mobile adolescents have odds of a suicide attempt that are two to four times those of adolescents reporting no residential relocation. The relationship between frequency of relocation and the risk for suicide attempt remains qualitatively unchanged when several demographic characteristics are incorporated into the model as controls.

Three features of the study may limit the validity of the findings. First, because respondents on the NHSDA self-report suicide attempts, the attempts reported are likely to include many which are not life-threatening. Some researchers argue that life-threatening suicide attempts are a much more relevant clinical endpoint than self-defined suicide attempts.^{6,10} Nonetheless, in order to classify an attempt as serious or life-threatening, documented interaction with medical personnel is required. The many suicide attempts that do not result in medical attention, are still important indicators of psychopathology and are still considered an important risk factor for eventual suicide completion.^{7,8} Furthermore, self-report of a suicide attempt can be assessed in a national sample

without concerns about differences in definition applied in geographic regions or at specific institutions.

Second, respondents' recall and report of relocation history and the occurrence of a suicide attempt may be somewhat unreliable. It is unlikely that report of relocation frequency was subject to classic recall bias (i.e. persons who attempted suicide being more likely to report a high number of moves) because the questions about suicidality and relocation were asked in different sections of the interview, and moving is not commonly thought of as predisposing an individual to attempt suicide. Nonetheless, it is possible that adolescents who attempted suicide, were more acutely aware of and likely to report stressful past experiences (including relocation) than were adolescents who did not attempt suicide. If this were true, the magnitude of the effect of relocation on the odds of attempted suicide would be artificially exaggerated. The reliability of adolescents' self report of suicide attempt on the NHSDA is uncertain. However, the design of the interview was such that incentives for respondents to not report an actual suicide attempt or to falsely report an attempt (such as getting a reaction out of the interviewer) were substantially mitigated. The prevalence of an attempt in the preceding 12 months estimated from this study (4.0 %) is consistent with the same prevalence estimated from the Add Health study (3.6 %).⁵ Both of these figures are lower, however, than the 8.8% estimated on the 2001 National Youth Risk Behavior Survey (YRBS).³

Third, the conclusion that relocation is associated with an increased risk for attempted suicide is only clinically useful if the moves in question occur

before the suicide attempt. Unfortunately, given the cross-sectional nature of the NHSDA and the time frames outlined in the questions about relocation history and suicidality, it is impossible to know for certain whether any or all of the moves reported by individuals who attempted suicide occurred before the suicide attempt. While important to recognize, this problem is unlikely to seriously limit the validity of the primary findings. If the precise dates of reported moves and suicide attempts were evenly distributed over the five-year and one-year time frames in question, then 90% of reported moves would predate a reported suicide attempt. Even if not temporally causal, the number of moves remains clinically useful as a screening tool for suicidal risk.

The etiology of adolescent suicide is complex,⁷ and the finding of an association between relocation and suicide attempts in this study does not represent evidence of causality. While some theoretical literature cited in the introduction to this report describes possible mechanisms by which moving could increase an individual's risk for attempted suicide, it is impossible to establish causality from this cross-sectional data.²³ Additionally, several factors that have been documented as strongly related to the risk of suicide attempt in adolescents (e.g. family dysfunction, history of abuse, family history of suicide attempt)^{7,8} could not be adequately examined in this study.

Evidence of causality, however, is not necessary for the association between relocation and attempted suicide to be clinically important and useful. Based on this study, a history of frequent residential relocation in an adolescent is a valid risk marker for suicidal behavior. I do not use the term "risk factor" as

this term is often interpreted as implying a causal relationship. There may indeed be nothing causal about the link between residential relocation and suicidality in adolescents. For instance, if severe family dysfunction caused families to move frequently and also augmented adolescents' risk for attempted suicide, then family dysfunction could completely account for the observed association between frequent moves and a higher risk for attempted suicide. Clearly, the family dysfunction is causal in this case rather than the relocation itself. Nonetheless, a history of frequent relocation would still be a valid marker for risk, because an adolescent with this history would more likely suffer from family dysfunction.

A history of frequent relocation is a clinically useful risk marker because this information is easily obtained without a formal psychosocial evaluation and is frequently available to professionals working with adolescents. While a report of four or more moves in the preceding five years is neither a highly sensitive (16 % of suicide attempters reported four or more moves) nor highly specific (9% of adolescents reporting four or more moves attempted suicide) predictor of a suicide attempt, the increase in relative odds is substantial. Therefore, a history of frequent relocation in an adolescent should raise a professional's index of suspicion for psychopathology or other well-defined risk factors for suicidality.

Most forms of psychopathology associated with suicidality can be effectively treated or ameliorated with psychotherapeutic and/or pharmacologic intervention.⁹ In theory, if histories of frequent relocation in some adolescents prompt assessments that lead to the diagnosis and treatment of some mental

disorders, which might have otherwise gone untreated, then the use of frequent relocation as a marker for risk could lead to a reduced risk of suicide on a population level. Whether or not inclusion of relocation history as a risk marker actually enhances the effectiveness of screening programs is a question that warrants further investigation.

Two environments in which a history of frequent relocation may be useful as a risk marker are schools and primary care medical settings. Although the efficacy of school-based depression screening programs in reducing rates of adolescent suicide has not been proven, the screening approach -- identifying atrisk students for further evaluation and possible intervention -- holds promise for the prevention of adolescent suicide. Nonetheless, most school administrators are reluctant to implement school-wide screening programs.⁸ Scholars in the educational field have suggested that multi-faceted programs, involving contact with both peers and professionals, be implemented in schools to welcome new students and mitigate the well-documented adverse effects of relocation on psychological well-being and academic performance.²⁴ It is conceivable that screening programs for suicide risk could be built into such welcoming programs and thus be more effectively targeted at a high-risk population.

A history of frequent relocation may also be a useful risk marker for suicidality in the primary care medical setting. In their review of promising preventive interventions, Gould et al.⁸ stress the importance of educational and training programs for primary care physicians who treat adolescents. Many adolescents visit the doctor in the month prior to a suicide attempt, yet only about

half of adolescents are screened for depression in this setting. Incorporation of a history of frequent relocation as a risk marker into educational materials provided to primary care physicians may help increase the proportion of adolescents screened for suicidality.

While regressions analyses stratified on demographic subgroups were performed to test for effect modification, the lack of significant differences between groups is largely attributable to inadequate power to detect subgroup differences. Furthermore, the stratified analyses must be interpreted with caution given the small cell sizes. Nonetheless, three non-significant trends merit attention. The data suggest that frequent relocation (four of more moves) has a stronger effect on older adolescents than it does on younger adolescents. Hispanic ethnicity is possibly protective against the effect of relocation on suicidality. Finally, frequent relocation appears to more strongly affect rural adolescents. Further investigation may be warranted to determine if true differences in effect exist for Hispanic adolescents and rural adolescents. However, these differences, if real, do not importantly alter the principal findings of this study, and speculation as to reasons for these differences is beyond the scope of this report.

Suicide among adolescents ages 12 to 17 remains a serious problem in America and a difficult case for prevention. The formulation of effective preventive interventions requires a solid understanding of the epidemiology of suicide and suicidal behavior in this population. This study enhances that understanding by presenting substantial evidence for an association between

frequent residential relocation and suicide attempts. While such an association had been suggested previously, residential relocation is not commonly listed as a marker for risk in epidemiologic reviews. Hopefully, this report will lead to systematic evaluation of the clinical utility of relocation history as a predictor of risk in future investigations. In the meantime, the knowledge that frequent relocation is associated with increased risk for suicide may help primary care and school professionals to better identify adolescents at risk.

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Table 1: Frequency of Residential Relocation by Demographic Characteristics

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)

		Number of Moves in Past 5 Years										
	Total Po	Total Population Zero		ro	Or	One Two			or Three Four or M		Significance of Heterogeneity	
	n	%	n	%	n	%	n	%	n	%		
Overali	19430		9733	50.6	4501	23.6	3664	19.2	1264	6.6		
Sex											Sex	
Male	9856	51.2	4925	50.4	2325	24.2	1862	19.0	606	6.3	P = 0.151	
Female	9574	48.8	4808	50.9	2176	22.9	1802	19.3	658	7.0		
Age											Age	
12 to 13	6584	33.0	3080	47.5	1648	25.7	1283	19.9	440	6.9	P < 0.001	
14 to 15	6702	34.6	3384	51.2	1558	23.5	1228	18.5	459	6.8		
16 to 17	6144	32.4	3269	53.2	1295	21.5	1153	19.1	365	6.2		
Race/Ethinicity											Race/Ethinicity	
White, non-hispar	nic 12958	65.5	7112	55.6	2876	22.2	2073	16.0	779	6.1	P < 0.001	
Black/AA, non-Hi	spanic 2631	14.3	1030	39.1	671	27.1	671	26.0	197	7.9		
Hispanic	2695	14.2	1092	42.3	667	24.4	649	25.0	226	8.3		
Other	1146	6.0	499	42.6	287	28.1	271	23.6	62	5.8		
Family Income											Family Income	
\$0 to \$19,999	3444	17,9	1211	35.9	794	24.5	936	27.7	422	11.9	P < 0.001	
\$20,000 to \$49,9	99 7768	39.1	3669	47.6	1811	23.3	1602	21.2	566	7.8		
\$50,000 to \$74,9	99 3971	20.6	2289	57.8	902	23.0	587	15.1	156	4.2		
\$75,000 and over	4247	22.4	2564	60.8	994	23.9	539	12.6	120	2.7		
Family Structure											Family Structure	
Two Parent Hous	ehold 13653	71.1	7627	56.2	3122	23.3	2124	15.7	631	4.9		
Other	5777	28.9	2106	36.9	1379	24.4	1540	27.7	633	11.0		
Population Density											Population Density	
not in MSA	5129	77.0	2652	52.5	1088	21.3	942	18.5	377	7.8	P < 0.001	
in MSA	14301	23.1	7081	50.1	3413	24.3	2722	19.3	887	6.3		

The individual cell numbers do not necessarily sum to the population total for each characteristic since some records contain bad/missing data. The percentages are population estimates computed using analytic weights for each record. The P values are derived from the design-based Pearson statistic. Notes:

Table 2: Suicidality by Demographic Characteristics

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)

	Total Pop	ulation	Did Not Sui	Attempt cide	Attempte	d Suicide	Significance of Heterogeneity	
	n	%	n	%	n	%		
Overall	19430		18487	96.0	756	4.0		
Sex							Sex	
Male	9856	51.2	9544	97.7	209	2.3	P < 0.001	
Female	9574	48.8	8943	94.3	547	5.7		
Age							Age	
12 to 13	6584	33.0	6333	97.4	168	2.6	P < 0.001	
14 to 15	6702	34.6	6329	95.4	309	4.6		
16 to 17	6144	32.4	5825	95.3	279	4.7		
Race/Ethinicity							Race/Ethinicity	
White, non-hispanic	12958	65.5	12332	96.0	510	4.0	P = 0.059	
Black/AA, non-Hispanic	2631	14.3	2523	97.0	82	3.0		
Hispanic	2695	14.2	2547	95.3	121	4.7		
Other	1146	6.0	1085	95.2	43	4.8		
amily Income							Family Income	
\$0 to \$19,999	3444	17.9	3232	95.2	173	4.8	P = 0.002	
\$20,000 to \$49,999	7768	39.1	7374	95.6	319	4.4		
\$50,000 to \$74,999	3971	20.6	3795	96.4	139	3.6		
\$75,000 and over	4247	22.4	4086	97.0	125	3.0		
Family Structure							Family Structure	
Two Parent Household	13653	71.1	13064	96.5	467	3.5	P < 0,001	
Other	5777	28.9	5423	94.9	289	5.1		
Population Density								
not in MSA	5129	77.0	4849	95.4	233	4.6	Population Densi	
in MSA	14301	23.1	13638	96.2	523	3.8	P = 0.044	

Notes: The individual cell numbers do not necessarily sum to the population total for each characteristic since some records contain bad/missing data. The percentages are population estimates computed using analytic weights for each record. The P values are derived from the design-based Pearson statistic. Table 3: Crude Association Between Frequency of Relocation and Suicidality

n	%	n	%	
			,0	Udds Ratio (95% CI)
9363	96.85	293	3.15	1 (referent group)
4297	96.14	174	3.86	1.23 (0.97 - 1.57)
3457	95.27	176	4.73	1.53 (1.22 - 1.91)
1141	90.82	108	9.18	3.11 (2.32 - 4.16)
	9363 4297 3457 1141	936396.85429796.14345795.27114190.82	936396.85293429796.14174345795.27176114190.82108	936396.852933.15429796.141743.86345795.271764.73114190.821089.18

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)

Notes: Percentages are population estimates calculated using analytic weights for each record. Confidence intervals were obtained from the variance estimates obtained in a design-based logistic regression.

Table 4: Stratified Odds Ratios for Suicide Attempt by Frequency of Relocation (compared to adolescents reporting no moves in last five years)

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)

	Number of Moves in Last Five Years											
		One			Tw	o or Thr	ee		Foi	ur or Mo	re	
	n _{cases}	OR	95%	CI	n _{cases}	OR	95%	сі	n _{cases}	OR	95%	CI
Overall	174	1.23	0.97	1.57	176	1.53	1.22	1.91	108	3.11	2.32	4.16
Sex												
Male	53	1.19	0.79	1.80	48	1.32	0.86	2.02	26	3.14	1.83	5.38
Female	121	1.29	0,96	1.72	128	1.63	1.25	2.11	82	3.06	2.16	4.32
Age												
12 to 13	45	1.32	0.85	2.05	35	1.48	0.88	2.50	20	2.27	1.31	3.95
14 to 15	74	1.40	0.97	2.00	77	1.74	1.24	2.44	44	3.01	1.95	4.66
16 to 17	55	1.10	0.73	1.65	64	1.42	0.99	2.04	44	4.02	2.44	6.62
Race/Ethinicity												
White, non-hispanic	115	1.24	0.94	1.65	106	1.78	1.34	2.37	74	3.68	2.67	5.07
Black/AA, non-Hispanic	21	1.80	0.91	3.57	25	1.57	0.72	3.44	13	3.74	1.66	8.42
Hispanic	32	1.14	0.67	1.93	31	1.20	0.69	2.11	14	1.24	0.61	2.52
Other	6	0.76	0.23	2.46	14	0.82	0.30	2.20	7	4.00	0.92	17.40
Family Income												
\$0 to \$19,999	32	0.90	0.54	1.50	45	1.18	0.75	1.86	44	2.78	1.72	4.49
\$20,000 to \$49,000	78	1.39	0.96	2.00	78	1.41	0.99	2.00	47	2.99	1.87	4.80
\$50,000 to \$75,000	32	0.95	0.58	1.54	26	1.39	0.80	2.40	9	1.58	0.67	3.70
over \$75,000	32	1.50	0.83	2.69	27	2.27	1.41	3.66	8	4.25	1.83	9.88
Family Structure												
Two Parent Household	110	1.21	0,90	1,61	92	1.46	1.08	1.97	50	3.43	2.22	5.29
Other	64	1.18	0.78	1.76	84	1.38	0.96	1.98	58	2.34	1.57	3.49
Population Density												
not in MSA	46	1.18	0.76	1.83	58	2.18	1.45	3.27	65	4.67	2.76	7.92
in MSA	128	1.25	0.95	1.65	118	1.34	1.04	1.74	43	2.56	1.80	3.64

Table 5: Adjusted Odds Ratios for Suicide Attempt by Frequency of Relocation (compared to adolescents reporting no moves in last five years)

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)

		Number of Moves in Last Five Years								
		One			Tw	o or Th	ree	Fo	ore	
Control Variables	OR	95% CI			OR	95% Cl		OR	95%	6 CI
No Contols	1.23	0.97	1.57		1.53	1.22	1.91	3.11	2.32	4.16
Sex	1.26	0.98	1.60		1.53	1.22	1.91	3.09	2.30	4.14
Age	1.27	1.00	1.62		1.56	1.24	1.94	3.18	2.37	4.26
Race/Ethnicity	1.25	0.98	1.59		1.55	1.23	1.94	3.14	2.34	4.22
Family Income	1.21	0.95	1.55		1.46	1.16	1.82	2.91	2.16	3.92
Family Structure	1.20	0.95	1.54		1.44	1.15	1.81	2.89	2.13	3.94
Population Density	1.24	0.98	1.58		1.53	1.23	1.91	3.09	2.31	4.13
Family Income, Family Structure	1.20	0.94	1.52		1.41	1.13	1.77	2.80	2.06	3.81
All Variables	1.27	0.99	1.62		1.47	1.16	1.85	2.85	2.09	3.88

Figure 1: Adjusted Odds Ratios for Suicide Attempt by Frequency of Relocation (compared to adolescents reporting no moves in last five years)

Data Source: Adolescents (ages 12 to 17) on the 2000 National Household Survey on Drug Abuse (NHSDA)



Notes: Odds ratios for suicide attempt from multivariable logistic regression controlling for the sex, age, race/ethnicity, family income, family structure, and area population density of respondents. Bars indicate 95% confidence intervals.

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