

MISSINGNESS IN LONGITUDINAL RESEARCH:
ATTRITION ANALYSIS AND IMPUTATION APPROACHES IN
A SCHOOL-BASED, LONGITUDINAL STUDY OF YOUNG ADOLESCENTS

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA BY

SCOTT BUTLER HARPIN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

RENEE E. SIEVING, ADVISOR

July 2010

Acknowledgements

I first thank the members of my preliminary exam committees not on my dissertation committee. Dr. Joe Gaugler gave birth to the idea of a robust attrition analysis and Dr. Cheryl Robertson gave me thoughtful advice about my dissertation work at a critical time in my work.

My dissertation committee: Drs. Michael Oakes, Wendy Looman, Debbie Bernat, Lyn Bearinger, and Renee Sieving. It has been an incredible process walking with all of you from conceptualization through final project. Thank you for your patience, your contributions and your inspiration. You have all taken time out of your impressive careers to advise and guide me throughout this research and writing; I am grateful.

To Drs. Rachel Widome and Kari Kugler, former and current post-doc trainees in our interdisciplinary training program. You each took time to help me understand aspects of my dissertation research that were unclear to me when I began this project. Thanks for the advice and encouragement along the way. I look forward to many years of work with you in the future!

To Michael Resnick and Lyn Bearinger: for the past decade you have been my mentors and my friends. You've both been there for my highs and for my lows. Mary and I appreciate your support and time spent together.

Renee Sieving, you have been an amazing advisor, mentor and friend! I aspire to have a professional life as yours. Adolescents are truly in good hands with people like

you in their lives. Thank you for trusting me to be a part of the Lead Peace Demonstration Study and to observe/be a part of your academic career these past years.

Dr. Barb McMorris has been a great partner for much of the methodology work, variable set-up, model-building and overall moral support. Thank you, Barb, for your gentle education and teamwork!

The Lead Peace team, Lead Peace schools, teachers and students were all wonderful to work with these past years. I was a stranger to the schools and the students when I first walked in the front door to volunteer with this project 4 years ago, and I left our final data collection a fixture of the project. We have wonderful young adolescents and public schools in north Minneapolis and I thank them for their time, respect and cooperation.

Finally, the biggest thanks is for my love, Mary. I started my doctoral education a month after we started our journey together. Lydia (and Emilee!) entered our lives concurrent with the first steps of this dissertation project. You have been an incredible support these past four years; I am so very lucky to have you in my life!

This dissertation and my entire doctoral preparation would not have been possible without generous support from Dr. Lyn Bearinger, the Center for Adolescent Nursing and the CDC T01 training grant (T01-DP000112). I have been given every opportunity in my academic career because of Federal Trainee support. Thanks to the Maternal-Child Health Bureau and the Center for Disease Control and Prevention for recognizing the need for and funding adolescent health leadership. Completing this dissertation is but a first step in a long career to improve the lives of young people and families.

Dedication

This dissertation, and indeed, my higher education, is dedicated to my mom, Connie Harpin, and my dad, the late John Harpin. In a sublime and very humble way, you raised the three of us kids to be the best we can be. Our home was always full of love and encouragement that we aspire to great things. I love you both.

Dad, I wish you were here to share this achievement.

Abstract

Participant attrition and missing data are omnipresent validity threats in longitudinal research. Study attrition is especially concerning in longitudinal studies with vulnerable populations, such as students in public schools located within poor urban communities where residential mobility is often a fact of life.

The current study is a secondary data analysis of the Lead Peace demonstration study. "Lead Peace" is a middle school service learning program of the Minneapolis Public School District. Student outcomes associated with Lead Peace program involvement are being evaluated by the University of Minnesota Prevention Research Center with a cohort of middle school students followed over three years beginning in the 2006-2007 school year. This evaluation included student surveys administered at four points: the beginning of 6th grade (T1), the end of 6th/beginning of 7th grade (T2), the end of 7th grade (T3), and the end of 8th grade (T4). The current study utilized data from T2, T3 and T4 surveys.

The purpose of this study was two-fold: 1) to compare sub-samples of young adolescents completing surveys at one or more of three time points, and 2) to test methods for handling missing data in longitudinal studies. The primary aim was to examine similarities and differences between students who completed surveys at T2, T3 and T4 and those who did not complete surveys at one or two of these data collection points. The secondary aim was to contrast estimates from multivariate models predicting youth violence involvement using three different datasets, one that included all students present for all surveys (complete-cases) and two that included imputed data from those missing at time points T3 and T4.

The primary aim was addressed through a series of comparison tests contrasting a group of students who completed all three surveys with groups who in-migrated and groups who out-migrated during the study period. Groups were compared on variables including gender, ethnicity, number of years living in one's neighborhood, number of schools in current school year, substance use, a variety of pro-social connectedness factors, bullying and violence involvement. The study's secondary aim was addressed by creating three different longitudinal datasets, one that includes all students present for all surveys (complete-case analysis) and two that include imputed data for those students missing at time points T3 and T4. Two types of data imputation, regression-imputation and multiple imputation, were used to create a second and third dataset. Comparisons were made of point estimates, standardized beta values, and standard errors generated by each dataset for a longitudinal regression model of relationships between T2 youth violence involvement, T3 neighborhood connectedness measures, and T4 youth violence involvement.

Findings related to primary aim suggested that out-migrating and in-migrating groups of students were similar to those who started and stayed the duration of the Lead Peace study. Students who entered the study at T3 tended to have increased levels of disruptive behavior in their first year, but became more similar to the group of students present the entire time in the second year of surveys. Students who joined Lead Peace for only the T4 data collection point exhibited the greatest number of different characteristics across comparisons from those who were present at all time points.

Data imputation models performed as hypothesized, with each having merits and drawbacks. In each dataset, T2 violence involvement predicted T4 violence involvement at statistically significant levels ($p = 0.00$ in each multivariate model). T3 neighborhood civic contribution predicted decreased T4 violence involvement ($p = 0.03$) only in the multivariate model employing the regression-imputation dataset. All other longitudinal multivariate relationships tested were not significant in multivariate models.

The current study offers a framework for understanding attrition in longitudinal research with public school students from low-income urban neighborhoods. Within these settings, students who leave a longitudinal study may be similar to students who stay for the duration of a study. In contrast, students who join a longitudinal study exhibit several differences in psychosocial and behavioral characteristics than those present for the duration of a study. Findings from this study's attrition analysis will inform investigators who are considering study designs and are making generalizations about study samples in similar research settings. The current study also adds to the growing evidence of the utility of data imputation methods to handle missing data in longitudinal research. Finally, findings offer mixed evidence of pro-social "neighborhood connectedness" as a protective factor buffering youth from violence involvement.

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CHAPTER I

THE RESEARCH PROBLEM

A veiled consequence of the economic downturn of the late 2000s is the effect on student retention and mobility in urban school settings (Duffield, & Lovell, 2008; Holladay, & Lockette, 2009; McKibben, 2009; Smith, Fien & Paine, 2008). As families face financial hardship and an equally challenging housing crisis, children, too, are faced with the stressors of family mobility, often disrupting the one constant in their everyday lives—school attendance. Students who change schools, usually a consequence of family mobility, are at risk for poor academic performance (Dunn, Kadane & Garrow, 2003; Engec, 2006; Pribach & Downey, 1999), have been shown to have increased behavioral disruptions in the classroom (Smither & Clark, 2008; South, Haynie & Bose, 2007) and tend to have greater absenteeism than other children (Duffield & Lovell, 2008).

Students absent from classrooms also miss out on a variety of school-based interventions, be they school-led academic research or school-based participatory research. Absentee students not only miss-out on in-classroom activities, missing students also represent lost data in the evaluation of school-based research. Study attrition, particularly in longitudinal studies, is most dramatic in urban school settings where high rates of student mobility are a fact of life (Heywood, Thomas & White, 1997).

Students who move between schools tend to be those engaged in other risk behaviors. Smither and Clark (2008) found that beyond academic underperformance, students who move between schools have increased stress and anxiety at a critical time of peer relationship formation. In their study, fully 77% of elementary school students who

switched schools were reported to have behavioral problems. Furthermore, high school drop-out rates were higher for these same mobile students over time. Externalizing behaviors seen in the classrooms of younger students often manifest as bullying or, as students age, violent behaviors extending beyond the classroom (Hawkins et al, 1998; Herrenkohl et al, 2000). Over the past two decades, the U.S. has enjoyed dramatic decreases in rates of youth violence since the peaks of the early 1990s. But there have been several high-profile cases of extreme violence among youth in many urban areas during the mid to late 2000s that lay heavy on individual communities (Collins, 2008; Saulny, 2009; Walsh & Smith, 2009; Xiong, 2007). Deaths of young people rarely leave the consciousness of society and are frequently revisited in the news media, particularly when the violence is perpetrated by other young adults. Such violent episodes spurred action locally by Minneapolis Mayor RT Rybak, who in 2006 convened a Blue Ribbon Panel of experts to address youth violence as a public health issue. The results of their effort, the *Blueprint for Action*, underscored the importance of an array of prevention efforts and policy changes across the social ecology to reduce violence in Minneapolis, especially among young people. Prevention efforts endorsed by the Blue Ribbon panel and the Mayor's Office were filled with youth development concepts and, in a remarkable shift in juvenile delinquency policy, moved this critical area of youth health within the structure of primary public health prevention (City of Minneapolis, 2008).

Youth Development and Neighborhood Connectedness

Adolescent development theories have incorporated facets of social connection since research of adolescent development began a generation ago. Konopka (1972) was one of the first to identify the critical aspects of fostering positive peer, family and

community connections to buffer adolescents against negative health and developmental outcomes. Since then, research has explored the roles of social capital and other positive community-level influences in promoting health and well-being among adolescent and community members (Boyce, Davis, Gallupe & Shelley, 2008; Crosby & Holtgrave, 2006; Kawachi, 2001; Putnam, 2003; Rew, 2005; Widome, et al, 2008).

Recent studies have highlighted the unique attributes of a concept related to social capital— neighborhood connectedness (Boyce et al, 2008; Duke et al, 2008; Widome, et al, 2008). In the current study, neighborhood connectedness was defined by two constructs: 1) an adolescent's intention to contribute to their community, and 2) and adolescent's perceived connection to interpersonal community resources. Although still underdeveloped as a research construct, neighborhood connections have the potential to emerge as another health promotive asset in the lives of young people in the same vein as school, peer and family connectedness.

Study Purpose

The current study is a secondary data analysis of the Lead Peace demonstration study (Sieving & Widome, 2008). Lead Peace is a middle school service learning program based in the Minneapolis Public School (MPS) District. Outcomes associated with involvement in the Lead Peace program are being evaluated with a cohort of middle school students who were followed over three years beginning in the 2006-07 school year. The evaluation included classroom surveys administered at four time points: the beginning of 6th grade (T1), the end of 6th/beginning of 7th grade (T2), the end of 7th grade (T3), and the end of 8th grade (T4).

The current study seeks: 1) to describe similarities and differences among groups of students who enter, stay, and/or leave a longitudinal, school-based research study; 2) to contrast methods of handling missing data in such longitudinal cohort research; and 3) to compare findings from models examining longitudinal relationships between neighborhood connectedness and youth violence generated from datasets that do and do not include students who are missing at one or more data collection points. Goals of this study are to offer a framework for comprehensive attrition analysis in a school-based evaluation research study and to make a case for handling missing data via multiple imputation. Findings from this attrition analysis shed light on how students may be included in study samples in ways that increase sample size without compromising internal validity. By contrasting methods for handling missing data, similar projects may benefit from increasing sample size and avoiding statistical error with proven imputation methods. And finally, this study offers insight into the protective properties of neighborhood connectedness in preventing violence among young adolescents in their middle-grade years.

Research Contributions

A common feature of longitudinal research is the in-migration and out-migration of study participants. Such mobility within a target population jeopardizes study sample size and generalizability of findings. The current study explores the characteristics of in-migrating and out-migrating urban, middle-school students so scientists can better understand the unique characteristics of mobile students compared to their peers who are present for the duration of this study. Findings have important implications for scientists working with school-aged study participants.

There has been considerable progress in developing methods of handling missing data in social-behavioral research since the publication of Rubin's classic article (1976) describing the phenomenon in longitudinal research. Research scientists commonly ask "what is the extent of missing data in our study?" and "how does missing data effect validity of our findings?" Increasingly, scientists ask "can we impute data for those missing items or cases?" and "how do we impute data statistically?" Methodological papers are being published to illuminate understanding of these questions and further, to compare data imputation methods. The current study is one such study — we move beyond the use of simulated data (Musil, Warner, Yobas & Jones, 2002; Newman, 2003) and examine a sample of young people common in school-based research.

Of particular interest in this study are the influences of the environment and social ecology on the young people and families of the Lead Peace study. Although studies of youth violence have highlighted the unique associations between violent behaviors and specific qualities of neighborhood influence on behavior (Clubb et al, 2001; Irwin, 2004; Hawkins & Weis, 1985; Herrenkohl et al, 2000; Molnar, Cerda, Roberts & Buka, 2007), less has been written about general effects of the *exosystem* as reported by the young persons. By better understanding these contextual influences, we might better understand qualities of the environment beyond more proximal influences of health.

Nursing research benefits from progressive methodological inquiry (Polit & Hungler, 1999). Data imputation has only recently been described in nursing research literature as a method to enhance research (Kneipp & McIntosh, 2001; McCleary, 2002; Musil, Warner, Yobas, & Jones, 2002). Case-available analysis is common in nursing research. Most nurse researchers commenting on the state of the science advocate greater

specificity in exploration of missing data in hopes that nursing research as a whole can benefit from clarity in individual studies (Duffy, 2006; Fox-Wasylyshyn & El-Masri, 2005). Many agree that such steps would increase rigor in nurse-produced research and allow readers to make better judgment about study validity (Fox-Wasylyshyn & El-Masri, p. 494). Furthermore, multiple imputation has evolved recently as the standard for handling missing data in statistics (Allison, 2000; Little, 2010) as its use has expanded in research in nursing and other social-behavioral sciences.

Finally, nurse clinicians working with young people have long weighed health-promotive influences in the adolescent social ecology (Rew, 2005). While peer, family and school connections have been explored and justified as predictors of positive health in young people (Barber & Schluterman, 2008; McNeely, Nonemaker & Blum, 2002; Resnick et al, 1997), less is understood about the potential of neighborhood and community connectedness in the lives of young people. This study will be one of the first to offer evidence of how pro-social neighborhood connectedness is related to youth well-being, in hopes that such knowledge can be integrated into foundations of youth development. This new knowledge will extend beyond nursing research and practice and into other disciplines considering policy and practice to improve youth health and development.

CHAPTER II

LITERATURE REVIEW AND THEORETICAL UNDERPINNINGS

Chapter II begins with a discussion of the phenomenon of student mobility, especially in-migration and out-migration occurring in urban school settings. Written works from educational psychology, educational policy and sociology provide a paradigm to understand why families move residences and why children migrate between schools. When children are missing from classrooms, they are missing from academic progress testing and other forms of school-based evaluation beyond basic classroom instruction. Therefore, the chapter segues into framing the problem of attrition in research and methods of handling missing data when participants are missing from evaluation or a research study. Following this discussion of methods of handling missing data, the social context for the Lead Peace demonstration study is described, emphasizing the current economic and social milieu of North Minneapolis, the community in which the research for this study was conducted. A portrait of community context, North Minneapolis circa mid- to late 2000s, establishes the time-period for the current study. Rates and trends in youth violence relative to the current study are reviewed, including both national and local trends. This chapter concludes by describing two theoretical frameworks (social-ecological theory and the Lead Peace conceptual model) as well as a related theoretical construct (neighborhood connectedness) guiding the current study.

Review of the Literature

Student Mobility in Urban School Settings

There has been a considerable change in the frequency of student mobility in urban classrooms the past decade. Many factors play into pupil mobility, among them: open-enrollment policy, No Child Left Behind policy as well as the higher numbers of homeless and transient families resulting from the economic crisis of the mid- to late-2000s.

Open-enrollment policy was one factor contributing to the rise of student migration. Minnesota was the first state in the country to mandate open enrollment in public schools beginning in 1990 (Corson, 1990). Open enrollment allows families the option of sending students outside ones home school district, in essence offering families the ultimate in school choice. According to the Minnesota Department of Education (2010a), over 30,000 Minnesotan students took part in open enrollment the 2008-09 school year. Public school flight in Minneapolis has meant migration not only to other public schools, but also to charter schools (Center for School Change, 2010). Over the past decade, hundreds of students moved into charter schools due to voluntary open enrollment. Although some students moving into charter schools have shown academic progress (Cheung, Murphy & Nathan, 1998), one is left to wonder about the academic progress of those students left behind in native public schools (Burkham & Lee, 2000; Dunn, Kadane & Garrow, 2003).

A second factor contributing to high levels of mobility among urban students is No Child Left Behind Act of 2001 (NCLB). In their paper, *Students on the Move: Reaching and Teaching Highly Mobile Children and Youth*, Popp, Stronge and Hindman

(2003) described the potential effects of NCLB on urban school settings. These authors outlined standards urban schools would be facing to meet accountability goals of NCLB despite lack of Title I funds to support changes to increase academic progress of the most at-risk students. Popp and colleagues' prognostication has been realized in Lead Peace study schools. Parents in all Lead Peace schools have received information each year about the *Choice is Yours Program*, a precursor to restructuring for marginal schools unable to raise standards (MDE, 2010a). During the three-year demonstration study, five schools involved in Lead Peace were directed to restructure by the Minnesota Department of Education to satisfy NCLB guidelines (MDE, 2010b). These signs of school instability are a contributing factor leading parents to move their students to better achieving schools (Pribesh & Downey, 1999).

The primary reason for student mobility is family housing instability and homelessness (Pribesh & Downey, 1999). Considerable attention to students' academic achievement has been paid to homeless students and those in child protective services (Duffield & Lovell, 2008; McKibbon, 2009; Popp, Stronge & Hindman, 2003). The housing crisis of the 2000s exposed the plight of homeless families and added stress associated with losing one's residence. In addition to homelessness, many families find themselves in transient housing situations, seeking temporary housing with friends or extended family to bide time until a more stable residence becomes available. All of these housing situations often lead to academic disruption and school transitions for the child (Dunn, Kadane & Garrow, 2003; Holladay & Lockette, 2009). Heeding the call to help these vulnerable young people, school districts have shifted resources and methods for handling issues associated with student mobility. Minneapolis Public Schools (MPS) has

been on the forefront of developing a model to work with families and children living in transient housing situations (Hinz, Kapp & Snapp, 2003; Masten et al, 2008). School administrators developed the Homeless and Highly Mobile (HHM) Program in 2004 to identify and offer services to the most at-risk students and families. Minneapolis Public Schools offers families intensive academic resources to improve reading and math skills and tracks student progress within the district despite housing transition and changes of schools (Masten et al, 2008).

Characteristics of student mobility in Minneapolis Public Schools (MPS) mirror those of other diverse, urban school districts struggling with student poverty. With one of the largest student enrollments in Minnesota (33,886 students K-12 during 2008-09 school year), 70% are students of color (40% African American, 9% Asian American, 17% Hispanic and 5% Native American), 66% qualify for free/reduced lunch programs, 23% are enrolled in English Language Learners program and 61% of students attended classes for at least 95% of the school year (MDE, 2010c). Masten and colleagues (2008) compared students participating in the MPS Homeless and Highly Mobile (HHM) Program to a “low-income” cohort of students and to an “advantaged” cohort of students. They found consistently lower reading and math scores among the HHM students compared to the other groups over the two years of their study. Their article uniquely described characteristics of HHM students and low-income students in Minneapolis Public Schools. Low-income students were ethnically diverse and participated in English Language Learners classes at a higher percentage than HHM students (35% versus 12%, respectively) while HHM children were African-American (70.8% versus 49.8% among low-income students) and had a lower attendance rate (90% versus 94% among low-

income students). These findings are important as one considers differences in characteristics and risk among HHM and low-income groups of students who are often classified as a single risk group.

Attrition in Longitudinal Research

Student mobility has a secondary effect on school-based research. When young people move from school to school, students' progress on academic achievement tests go unrecorded and related school-based research is adversely affected by absenteeism. Highly-regarded longitudinal research has the potential of losing validity in settings with high rates of student mobility.

Participant attrition from longitudinal studies is widely discussed in methodological papers (Barry, 2005; Goodman & Blum, 1996; Shadish, Hu, Glaser, Kownacki, & Wong, 1998; Stephens, Thibodeaux, Sloboda & Tonkin, 2007) beginning with Rubin's seminal paper (1976) describing the phenomenon of missing data in research. Attrition plagues longitudinal research by not only decreasing study power but also introducing selection bias and internal and external validity issues. Two forms of missing data are common in longitudinal research (Plewis, 1985; Siddiqui, Flay & Hu, 1996). The first is item non-response, in which individual items are left unanswered either by choice or neglect. The second involves an individual not contributing data at a time point when others in the same cohort are assessed. This form occurs when one is lost completely to the study or when a participant is missing for one or more time points over the life of a study. Such attrition is common in longitudinal studies and its incidence particularly dependent on the population studied (Shadish, Cook & Campbell, 2002). Research involving vulnerable populations, highly mobile persons, the elderly and

persons with rare diseases are examples of studies particularly susceptible to attrition (Davis, Broome & Cox, 2002).

There are examples of lack of treatment effect due to attrition in school-based longitudinal research. Komro and colleagues (2008) reported null findings of *Project Northland Chicago* (PNC), a multi-component alcohol prevention intervention that had previously been shown to delay and reduce young adolescents' alcohol use among middle school students from rural, northeastern Minnesota. The high rate of attrition in the PNC study sample of urban middle school students might explain the lack of treatment effect if the number of students who left PNC exceeded the number of students needed during pre-intervention power analysis (p. 614).

In another example, attrition decreased the sample enough that the study design disintegrated, leaving data only for descriptive analysis. Morsette and colleagues (2009) tested a cognitive-behavioral treatment intervention with a group of 6th grade students from a Plains Indian reservation. While 40 students participated in the study intervention, only seven students consented to participate in the evaluation with only three students remaining when the intervention was completed.

Some studies describe out-migrating sample characteristics in methodological papers to better understand the characteristics of students who leave a study and the effects of attrition on the intervention outcomes. Siddiqui, Flay and Hu (1996) presented an example of attrition analysis and differences in treatment effect and sample characteristics when attriting participants went missing in their intervention research. Their study, the *Television, School and Family Project* (TSFP), was a school-based tobacco prevention program administered in LA and San Diego that surveyed students

over four time points in the late 1980s. Their attrition analysis highlighted differences in individual characteristics between “stayers” and “leavers” in TSFP; out-migrating students exhibited far riskier behaviors than those who stayed in the intervention. They concluded that if attriting students had stayed in the project, the main effects point estimates would be affected enough that the study would have dramatically different research outcomes. These findings illustrate how attriting students can introduce sampling bias in longitudinal research on prevention programming research. In each of these examples, authors of longitudinal, school-based research describe the unique effects of out-migration on their study, highlighting different ways which attrition effects research.

Study attrition is being more carefully reported in prevention science, particularly since Hansen, Tobler and Graham (1990) drew attention to the consequences of neglecting to report attrition in a meta-analysis of cohort attrition. Their analysis described study retention in 85 cohorts of adolescents involved in longitudinal substance abuse prevention research, studies typically lasting three years. After a marked loss to follow-up at the first 6-month follow-up point (mean retention rate of 78%), patterns of participant attrition typically followed a linear, slow downward slope for the remainder of the study. Hansen and colleagues reported a mean retention rate of 73% at one-year follow up, 72% at two-year follow up and 68% at three-year follow up points. Standard deviations around the mean of each time point increased slightly, as expected, due to fewer numbers of studies following participants over longer periods of time. Attrition rates ranged from 13-20% over the 3-year time span of most studies. Though attrition characteristics were not addressed in their meta-analysis, Hansen and colleagues offered

two important summary points from their meta-analysis. First, as differential attrition (between treatment conditions) is a primary source of bias, “the general failure to retain subjects [overall] must also be considered to be a serious threat to internal and external validity (p. 679).” Second, Hansen and colleagues concluded that most evaluation studies did a poor job examining attrition, and its possible causes. They challenged researchers to better document strategies for retaining participants and to clearly note barriers to retaining participants when reporting study findings.

Attrition in longitudinal studies involving adolescent samples. Since Hansen, Tobler and Graham’s review (1990), a number of longitudinal studies involving adolescent participants have included details on participant attrition. Two examples, *Reach for Health* and *Project Northland Chicago*, were conducted in urban public school settings and utilized similar study designs as the Lead Peace demonstration study. Conducted with middle grades students from New York City public schools, the *Reach For Health* evaluation had a 92% retention rate in the same school calendar year (fall-to-spring surveys) and a 75% retention three years later when students were in 9th and 10th grade. There were no systematic differences between attriting students and non-attriting students, save gender; attriting students were more likely to be male than those who stayed with the study the duration. *Project Northland Chicago* had retention rates similar to averages reported in the Hansen, Tobler and Graham (1990) study: 89% at one year, 67% at two years and 61% at three years following study baseline, even as student mobility was remarkably high in the urban school settings in which *Project Northland Chicago* was conducted (Komro et al, 2008). Those students who stayed in the study for

three or four surveys were more likely to be white, live with both parents and drink less alcohol than those only present for one or two surveys.

Although there have been developments in how attrition is being reported in evaluation research since Hansen and colleagues' call for improvement, there still remains a lack of consistent reporting of attrition and minimal description of attrition characteristics.

Avoiding attrition. Several methodological papers have addressed strategies to improve data collection techniques in order to minimize attrition (Boys et al, 2003; Cole, Feinstein, & Bender, 2001; Davis, Broome & Cox, 2002; Epstein & Botvin, 2000; Odiema & Schmidt, 2009; Seed, Juarez & Alnatour, 2009; Stephens, Thibodeaux, Sloboda & Tonkin, 2007; Stewart et al, 2009) including one study from the Lead Peace evaluation team (Secor-Turner, 2010). Davis, Broome and Cox (2002) offered a multi-faceted approach to minimizing attrition. Suggested strategies include: collecting as much personal contact information from students at every encounter; offering participants and research partners appropriate incentives, including multi-level incentives (to each the student, the family, the teacher, the school), to encourage remaining with a study; working with school personnel to track students using school district resources; and using web-based and governmental data resources to track families, if those resources are available. In the Lead Peace demonstration study, a variety of these mechanisms contributed to the high levels of parent consent (Secor-Turner, 2010) and the ability of the Lead Peace evaluation team to survey students who changed schools within MPS or even those who moved out of the school district during the course of the study.

In another study involving an adolescent study sample, this one not conducted in a school setting, authors offered suggestions for augmenting data collection procedures in research with transient populations. Stewart, Reutter, Letourneau and Makwarimba (2009) described findings from a housing support intervention for older adolescents living on the streets in Edmonton, Alberta. This one-group, within subjects design took place over 20 weeks and started with 70 participants (determined by power analysis) pre-intervention. Participants were surveyed at three time points: pre-intervention, mid-intervention (week 10) and post-intervention. Stewart and colleagues' study was unique as it involved the most transient young people sought for adolescent research, homeless youth. Only 59% of their sample remained with the intervention for at least 10 weeks. To reduce attrition with this population of young people, the authors suggested more frequent data collection from transient youth, specifically more frequent intervals mid-intervention. To improve the quality of information on intervention exposure, the authors suggested that future studies clearly document an intervention "dose" at each point of contact with transient and mobile young persons.

Data Imputation to Handle Missing Data

Despite best efforts to retain students in school-based longitudinal research, missing data are inevitable. The following section describes the fundamentals of methods used to handle missing data using imputation techniques.

Since Rubin's seminal article on missing data (1976), researchers from many disciplines have advanced the science of handling missing data in research (Horton & Kleinman, 2007). Missing data is a wide-spread problem, particularly in studies with high levels of attrition and research conducted with groups where attrition is difficult to

avoid (Davis, Broome & Cox, 2002; Flay, 2009; Hansen et al, 1985; Odierna & Schmidt, 2009). Efforts to retain and make usable partial data via statistical techniques are at the foundation of employing imputation methods.

There are four common methods of data imputation (Little and Rubin, 2002). In *mean imputation*, a missing value is filled in by the mean of that variable across cases. In *hot deck imputation*, cases are sorted on specific variables and missing means are filled in, copied from the case above or below the case with the missing data point (Altmayer, 1999; Schoier, 1999). Mean and hot-deck imputation procedures are sometimes called “single imputation” methods, and are considered inferior to “model based” procedures (Allison, 2000; Fichman & Cummins, 2003). Model-based imputation methods are completed using predictive modeling techniques and are favored by imputation experts (Allison, 2009; Little & Rubin, 2002; Rubin, 1987). In *regression-based imputation*, a missing value is filled in based on an estimation of predicted values from that single case. *Multiple imputation* (MI) is an imputation method in which multiple data matrices are created using maximum-likelihood procedures and posterior-predictive re-sampling, giving the researcher the added benefit of an error value in addition to the point-estimate after re-pooling of imputation estimations (Allison, 2002; Little & Rubin, 2002.)

Advancements of theory and statistical computing packages have made data imputation remarkably easy and accessible to researchers and students alike. These methods of handling missing data have become more commonplace in social and behavioral science research. And though no single method has emerged as a “gold standard” for data imputation, maximum-likelihood procedures, including multiple imputation, are considered most reliable by data imputation experts (Allison, 2009).

An alternative to data imputation is to perform complete-case analysis, leaving cases with missing data out of multivariate analysis. A common practice in research, ignoring missing data is not a good option under most circumstances as it does not distinguish data missing at random and there is a loss of information by deleting incomplete cases (Rubin & Little, 2002). Shadish et al. (1998) have argued that dropping persons with missing data points further biases results and should rarely be used as an approach for handling missing data. One important caveat is that when 10% or less data is missing, complete-case analysis results may produce valid results as little information may be gained using an imputation method (Allison, 2002).

Economic Status of North Minneapolis

As noted earlier, data used in the current study were drawn from a longitudinal intervention study of a youth violence prevention program called Lead Peace, conducted in three middle schools in an economically disadvantaged area of Minneapolis. The high rates of residential mobility in the north-side communities and the resulting attrition in the school-based study sample created an opportunity to examine statistical methods for addressing missing data.

The neighborhoods of North Minneapolis (MN) experienced a particularly dramatic economic crisis in the mid-2000s (Brandt, 2008a; City of Minneapolis, 2008). North Minneapolis neighborhoods have historically been substantially below the Minneapolis median for most socio-economic indicators (Hennepin County, 2006). The housing crisis of the mid-2000s hit North Minneapolis neighborhoods especially hard and earlier than other Minneapolis neighborhoods due to the nature of the lending crisis in which banks gave sub-prime loans to persons less qualified to own a home with targeted

“predatory lending” (unfair and abusive home mortgage lending) (Brandt, 2008a; Brandt, 2008b). The housing crisis led to very high rates of home foreclosure in North Minneapolis, dramatically impacting quality of life for residents of entire city blocks and intact neighborhoods.

School Indicators of Economic Crisis

The effects of poor economic times trickled down to young people living in these poor urban neighborhoods who experienced a myriad of life stressors in addition to normal adolescent developmental tasks. Bolland and colleagues (2005; 2007) describe the many negative social consequences of young people growing up in poverty including hopelessness, distress, disconnectedness, in addition the more salient behavioral outcomes of physical and social disorder. Those adolescents reporting high levels of hopelessness and limited future orientation were more likely to engage in fighting and violent behaviors (Bolland, 2001). In Minneapolis schools, basic economic indicators (percent receiving free/reduced fee lunches), while similar to pre-crisis levels, remain highest among all Minneapolis schools and reflect a great economic disparity across MPS by geography (Table 2-1; Appendix A).

The added element of mobility and its counterpart of academic disruption have created a unique time-period-cohort effect (Baltes, Reese & Nesselroade, 1988), concurrent with the timeframe of the Lead Peace demonstration study. Each of the Lead Peace study schools incurred a substantial decrease in the number of students enrolling for an entire school year from 2007 through 2009 (Table 2-1). Minneapolis Public Schools District (MPS) noted dramatic increases of student mobility within North Minneapolis schools, including higher-than-normal rates of homelessness (Chan et al,

2008; Rossen, “The new homelessness; Tundel, “Making education a priority...”). MPS Department of Research and Evaluation reported that highly-mobile students in 7th and 8th grades in North Minneapolis schools were particularly affected by changing schools as reading scores were significantly decreased compared to non-mobile students in the same schools (MPS, 2008). High levels of poverty, mobility and poor academic performance had an effect on research and evaluation performed by MPS during this time and certainly contributed to attrition from the Lead Peace demonstration study.

Table 2-1. Demographic characteristics of Lead Peace study schools

	Free/reduced lunch			% Students enrolled entire year		
	2004-2005	2007-2008	2008-2009	2004-2005	2007-2008	2008-2009
Cityview	92%	93%	92%	82%	83%	73%
NSJ	92%	95%	95%	76%	83%	73%
Jordan Park	94%	N/A	N/A	67%	N/A	N/A
Hmong Academy	N/A	93%	91%	N/A	83%	77%
Lucy Laney	86%	92%	92%	79%	79%	66%
All MPS K-8	70%	90%	64%	83%	88%	81%

Source. Minneapolis Public Schools, Research, Evaluation and Assessment Department,

http://studentaccounting.mpls.k12.mn.us/Reports_Data.html

Youth Violence

The Lead Peace demonstration study will be described in greater detail in Chapter III. A primary goal of the Lead Peace demonstration study was to reduce students' involvement in violent behaviors (Sieving and Widome, 2008). Given that the social context of students participating in Lead Peace included a neighborhood context fraught with violence, we now consider the epidemiology of youth violence.

Former Surgeon General David Satcher released a comprehensive report on youth violence in the wake of well-publicized school shootings in late 1990s and early 2000s (U.S. DHHS, 2001). This report provided a comprehensive picture of youth violence indicators for the decades prior, and emphasized arrest rates for juvenile delinquency and students' reports of serious youth violence. The U.S. Office of Justice and Delinquency (OJJ) monitors violent crime offenses in four main categories: criminal homicide (murder and non-negligent manslaughter); robbery; aggravated assault; and forcible rape (Lipsey & Derzon, 1998; US DHHS, 2001). Data from OJJ confirmed that arrest rates dramatically decreased throughout the 1990s while reports of actual violence varied depending on study and the type of violence being monitored. The Surgeon General's Report concluded that while a peak of arrests and self-reports of youth violent crime occurred around 1993, some indicators had not resolved (U.S. DHHS).

Three *Healthy People 2010* guidelines address youth violence behaviors (US DHHS, 2010). Items 15-32 (reducing homicides), 15-38 (decrease physical fighting among adolescents) and 15-39 (decrease weapon carrying by teens on school property) also constitute three of the core 21 critical health objectives identified and endorsed by the National Initiative to Improve Adolescent Health. Despite dramatic improvements in

health indicators throughout the 1990s, Park and colleagues (2008) reported little improvement in the previous eight years from the 1998 *Healthy People 2010* baseline. Those authors predicted that the U.S. will fall far short of 2010 targets for each of these youth violence indicators unless a variety of socio-political factors changed dramatically.

The Youth Risk Behavior Surveillance Study (YRBSS) is one of the most commonly-used studies to describe the magnitude of youth violence in the U.S. Data from YRBSS suggest that since 2001, trends in youth violence remain flat (Table 2-2). On virtually all youth violence measures in the YRBSS, no statistically significant changes have occurred since 2001 (CDC, 2008a; CDC, 2008b).

Table 2.2. YRBSS¹ violence indicators, 2001-07

YRBSS Youth violence items	2001	2003	2005	2007
Weapon carrying: past month	17.4%	17.1%	18.5%	18.0%
Get in physical fight: past month	33.2%	33.0%	35.9%	35.5%
Weapon carrying on school property: past month	6.4%	6.1%	6.5%	5.9%
Get in fight on school property	12.5%	12.8%	13.6%	12.4%
Threatened or injured with a weapon on school property	8.9%	9.2%	7.9%	7.8%
Did not go to school because felt unsafe at school or on way to school	6.6%	5.4%	6.0%	5.5%

¹ Exact item wording can be found on YRBSS fact sheets: <http://apps.nccd.cdc.gov/yrbss>

Minnesota students exhibited trends that were similar to those seen in YRBSS—modest decreases in indicators of violence with few statistically significant changes since 2001 (MDE, 2010c). Although Minnesota youth remain below US average

rates for violent behavior, these stagnant trends coupled with copious media attention on youth crime and a high-profile school shooting (Red Lake, MN, in 2004) reiterates the importance of youth violence prevention efforts.

In the City of Minneapolis, from 2003 to 2006, nearly half of all deaths of young people between ages 15-24 years old in Minneapolis were due to homicide, and that half of all homicides for all ages in the city took place in a six-square mile area in North Minneapolis (City of Minneapolis, 2008). This area included all Lead Peace study schools located in North Minneapolis. In response to such violence in late 2006, Minneapolis Mayor RT Rybak proposed a city resolution and formation of a “Mayor’s Blue Ribbon Panel” for preventing youth violence in Minneapolis. An intensive prevention effort was developed, the *Blueprint for Action*, which, in the end, included concrete recommendations to decrease youth violence in Minneapolis and organized systems-level changes from a public health perspective (City of Minneapolis, 2008). The Blue Ribbon Panel was convened primarily from a juvenile delinquency and criminal justice standpoint (J. Kahn, personal communication). The inclusion of public health prevention tenants ultimately contributed to the panel’s success at explicating concrete steps to curb violence in the coming years.

Conceptual Frameworks for Understanding Youth Social Context

Students in the Lead Peace demonstration study and Lead Peace community schools live in an environment with disproportionately high levels of violence. Youth violence, in particular, was so prevalent locally in the mid-2000s, systemic policy change was introduced in the *Blueprint for Action* by city government to curb the progression of violence. Recommendations in the *Blueprint* emphasized community partnerships as a

key to mobilize prevention efforts. Such partnerships are inherent in a variety of frameworks that describe contextual influences in the lives of adolescents, as well as the factors that play into the economic milieu of families. Three such frameworks guided the present study: social-ecological framework, the Lead Peace conceptual framework and the concept of *neighborhood connectedness*.

Social-ecological framework. A social-ecological framework offers a theoretical structure to describe the social context of young people. It describes contexts in which a young adolescent might be exposed to violence, live in an unstable housing situation or perform poorly in school. Bronfenbrenner (1979) was one of the first developmental psychologists to explain the socio- and political influences on an individual's life when describing his social ecological framework. Richard Lerner (Lerner, 1998; Rew, 2005) presented similar exosystem explanations with his theory of developmental contextualism. Blum and colleagues (2002) presented an extension of the social ecological framework to describe behavioral influences on youth risk behaviors. As these frameworks offer a more general perspective of environmental influence, others have offered research that specifically associates economic influences and youth behavior outcomes. Glen Elder's research on farm families during the Great Depression and of Iowa farm families during the economic crisis of the 1980s are prime examples of economic factors affecting youth development (Elder, 2001), and as Baltes (1987) describes, a *history-graded* influence on development. Those interactions have been analyzed in studies to better understand cohort effects on mortality and on specific health behaviors (Baltes, Reese & Nesselroade, 1988; Vondracek, 1998). These are some of the few examples of why distal factors should be considered when understanding attrition in longitudinal research

and why social science researchers might preemptively collect such contextual data to better understand reasons for attrition.

Lead Peace Conceptual Framework. Sieving and Widome (Spring 2008) adapted the resiliency framework (Resnick, 2000) to explain mechanisms of action and change in the Lead Peace intervention (Figure 2-1). A resiliency paradigm emphasizes an assets-based approach to preventing problem behavior. A paradigm emphasizing “hope and potential” (p. 14) better resonates with marginalized youth and families and was a guiding principle through Lead Peace demonstration study planning and curriculum development.

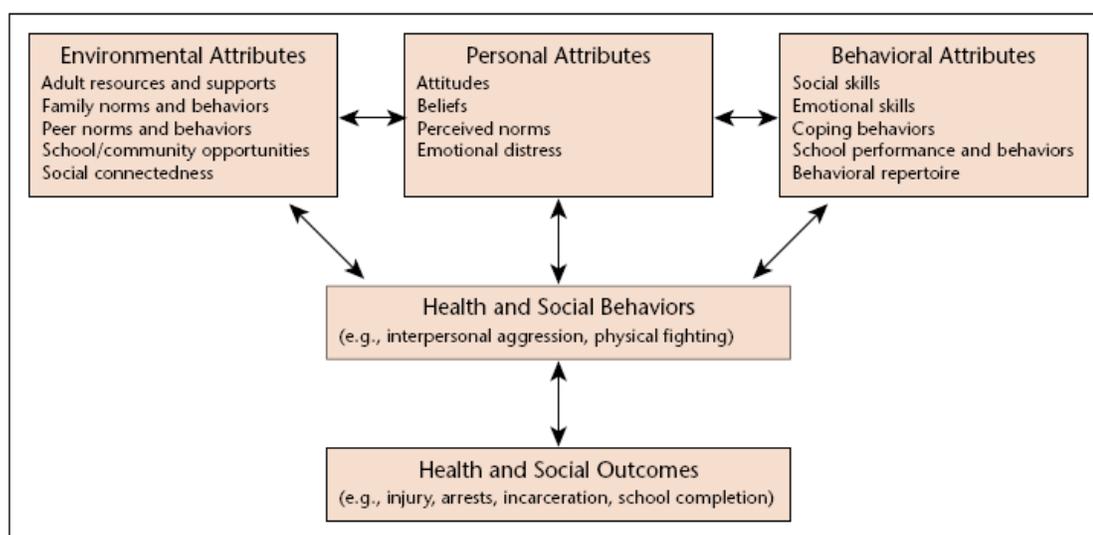


Figure 2-1. Lead Peace Conceptual Model

The current study focused on the environmental attributes arm of the Lead Peace conceptual model, exploring whether neighborhood connectedness (one form of social connectedness) acts as a protective factor, buffering young people from violence

involvement (health and social behaviors). In the Lead Peace study, neighborhood connectedness was operationalized as two constructs, neighborhood social resources (“There are adults in my neighborhood that I look up to”, “I am interested in finding out about new things in my neighborhood”) and intentions for civic contribution (“It is important to me to volunteer to help people in need”, “Working to improve my neighborhood is important”). The current study addresses the link between youth violence involvement and neighborhood connectedness in the lives of Lead Peace students.

Neighborhood Connectedness: Civic Contribution and Social Resources. A relatively recent addition to social theory is the development of a social capital perspective for understanding social interactions. Sociologists have been studying fundamental aspects of social and human capital for years (Portes, 1998; Pearce & Davey Smith, 2003; Weller, 2006). It has been only recently that social capital has been identified as a covariate of health in populations in population-based research. Over the past decade, there has been a considerable increase of the number of articles attempting to explain the relationship of health and social capital (Stzreter & Woolcock, 2004; Putnam, 2004; Kritsotakis & Gamarnikow, 2004). More recently, adolescent health researchers have extended this work to adolescent populations (Schaefer-McDaniel, 2004; Weller, 2006).

Konopka (1973) described the importance of engaging youth in their communities (civic participation and volunteerism), challenging students as citizens (civic engagement), and encouraging experimentation of relationships (reciprocity and generalized trust in others) decades ago. Social capital may be useful to the next generation of adolescent health research by offering a new context for community-level

assets. The current study explores neighborhood connections as an amalgam of two separate constructs, *neighborhood social resources* and *intentions to contribute* to one's community. These scales were constructed using World Bank Social Capital items and clarified in focus groups with young adults and youth-serving adults (Widome et al, 2008). Maguin and colleagues (1995) presented one of the first studies to link youth violence with neighborhood indicators. In their study, as in many studies using this construct as a covariate, "neighborhood" influences were defined as community disorganization and low neighborhood attachment and were often correlated with higher levels of violence involvement. In a recent study examining the pro-social aspects of community, Widome and colleagues (2008) found that students with high levels of neighborhood connectedness reported lower levels of violent episodes in the past year compared to students who reported medium and low levels of neighborhood connectedness. The current study builds on these initial findings from the Lead Peace survey, investigating the relationship between these constructs over time and building a case for the use of pro-social neighborhood connectedness in research.

Summary

Given the state of the science around attrition analysis, the intent of the current study was to advance the science in two ways. First, a framework for completing a comprehensive attrition analysis could provide those in evaluation research another method for completing analyses and reporting attrition in longitudinal studies. To achieve this aim, we sought to answer the following questions: What are the characteristics of young people who come into and leave research studies? And, how do mobile students compare to students who stay for the duration of a study? Second, the

current study contrasted methods for handling missing data resulting from attrition. Then, in contrast to the methodological aims of the current study, the intent was to examine associations between neighborhood connectedness and youth violence involvement, with potential utility for public health and youth health practitioners working within a resiliency paradigm.

CHAPTER III

RESEARCH METHODS

The current study was a secondary analysis of data from the Lead Peace demonstration study. The Lead Peace demonstration study involved five North Minneapolis K-8 public schools, including two schools that implemented a middle grades service learning program that aimed to reduce risks for youth violence and school failure. The 8th grade class of 2009 formed the Lead Peace study cohort, completing self-report surveys at four time points during their 6th through 8th grade years.

This chapter details both the Lead Peace demonstration study and the current study, a secondary analysis of Lead Peace data. First, specific aims of the current study are presented. Next, an overview of the Lead Peace demonstration study is provided. Finally, the design, sample measures and analytic methods for the current study are described.

Specific Aims

The purpose of this study was two-fold: 1) to compare sub-samples of young adolescents completing surveys at one or more of three time points, and 2) to test methods for handling missing data in longitudinal studies. Both aspects of this study will inform future school-based evaluation research involving similar populations of young people.

The following specific aims guided the study:

Primary Aim. Examine similarities and differences between students who completed surveys at T2, T3 and T4 and those who did not complete surveys at one or two of these data collection points.

Research Question 1: Among students participating in the Lead Peace demonstration study, what are the unique characteristics of students in each of these groups?

Secondary Aim. Contrast estimates from multivariate models predicting youth violence involvement using three different datasets, one that includes all students present for all surveys (complete-cases) and two that include imputed data from those missing at time points T3 and T4. The longitudinal model employed will examine relationships between Neighborhood Connectedness measures at T3, Youth Violence Involvement at T2 and Youth Violence Involvement at T4. Two types of data imputation, regression-imputation and multiple imputation, will be used to examine longitudinal datasets.

The goals of this research were to offer a framework for comprehensive attrition analysis in a school-based evaluation study and to comment on methods for handling missing data in longitudinal studies where validity may be compromised due to relatively high levels of participant attrition over time.

The Lead Peace Study

The Lead Peace demonstration study was a joint effort of the University of Minnesota's Prevention Research Center (PRC), the Minneapolis Public School District (MPS) and Hennepin County-Village Social Services. The goal of the demonstration study was to decrease risks for violence and school failure among middle-school youth via school-based service learning and health education programming (Sieving, 2006).

Study Design. A quasi-experimental design was employed for the Lead Peace demonstration study (Sieving, 2006). A true experimental design was not considered as it was impossible to randomly allocate individual students to intervention or comparison conditions. A group-randomized trial (GRT) design was not considered feasible for budgetary reasons; the number of similar schools needed for a GRT was beyond the funding allocated for this small-scale demonstration study (Murray, 1989; Hannan, 2006).

Quasi-experimental designs are described exhaustively in nursing and social science research literature (Brink & Wood, 1998; Issac & Michael, 1997; Polit & Hungler, 1999; Grimshaw, et al, 2000; Morgan, Gliner & Harmon, 2000; Trochim, 1986; Trochim, 2006a,b,c) and can be used efficiently in school-based studies where individual randomization and group randomization are simply not feasible (Shadish, Cook & Cambell, 2002). The original Lead Peace evaluation design involved an untreated comparison group and two intervention groups, with pre-interventions and post-intervention self-report surveys of students in all study groups (Table 3-1). The primary study cohort was the class of 2013, students who were 6th graders during the 2006-07 school year.

Table 3-1. Lead Peace Study Design

School	Intervention allocation	T1	6 th grade LP program	T2	7 th grade LP program	T3	8 th grade LP program	T4
Cityview (CV)	Intervention	O ₁		O ₂	X	O ₃	X	O ₄
Nellie Stone Johnson (NSJ)	Intervention Plus	O ₁	X	O ₂	X	O ₃	X	O ₄
Jordan Park Community (JP, 2006-07) & Lucy Laney (LL, 2007-09)	Comparison	O ₁		O ₂		O ₃		O ₄
Hmong Academy (HA),	Comparison	O ₁		O ₂		O ₃		O ₄

For the duration of this paper, observations O_i correspond with time points T_i as noted in the column header of Table 2.

Intervention. The Lead Peace service learning curriculum was developed by the Minneapolis Public Schools (MPS) for use with youth in grades 6-8; this curriculum was adapted from the Points of Light Youth Leadership curriculum for 9th through 12th grade youth (Sieving, 2006). Lead Peace program activities occurred over three years, starting with the 2006-07 school year with the class of 2013 as 6th graders and ending in 2008-09 in this class' 8th grade year. Two K-8 schools offered different “doses” of intervention; the “Lead Peace Plus” program school (Nellie Stone Johnson, NSJ) offered 30 service learning classroom sessions with 15-20 additional hours of community service, plus health education and parent/family outreach activities per year during students' 6th, 7th

and 8th grade years. The “Lead Peace” program school (Cityview, CV) offered 15-20 service learning classroom sessions per year during students’ 7th and 8th grade years. All students in the intervention grade level at each school participated in the Lead Peace programming activities regardless if their parents gave consent for participating in the evaluation of the intervention. At each school, service projects were determined by student groups. From 2006 through 2009, small groups of students planned and completed over 40 Lead Peace service projects. Across the two intervention schools, as many as 130 students were involved in 45 weekly service learning class sessions per year.

Comparison schools. Table 3-1 shows two K-8 schools allocated to the comparison condition in the Lead Peace demonstration study. During study planning in 2005, MPS identified North Minneapolis’ Jordan Park School as the comparison school for this evaluation study. Jordan Park included a separate charter school program, the Hmong Academy (HA), which included 6th grade class independent of the Jordan Park Community School (JPC) 6th grade class. Analysis of baseline demographic data revealed two group patterns within the pooled JP school data, one for the HA students and another for JPC students. Between-group analysis confirmed clear differences in risk behaviors, risk and protective factors between JPC and HA groups. Thus, JPC and HA were considered separate schools in all Lead Peace evaluation analyses.

At the end of the 2006-07 school year, MPS decided to close numerous schools across the district due to declining enrollment and financial hardship. Among those schools picked for contraction was JPC school. The Lead Peace evaluation team began plans for replacing this Lead Peace comparison school in the spring of 2007.

Minneapolis Public Schools suggested Lucy Craft Laney Community School (also called “Lucy Laney”, LL), a K-8 school located a short distance geographically from Jordan Park School and with student demographic characteristics similar to those of JPC (Appendix A). The Hmong Academy was scheduled to move to the LL campus in fall 2007. MPS gave permission for parent consent and baseline data collection to happen at Lucy Laney School at the beginning of the 2007-08 school year.

Sample. The Lead Peace study cohort is the class of 2013, students who were 6th graders during the 2006-07 school year. At T1, in the fall of 2006, the demonstration study sample included all students with parent permission at CV, NSJ, JPC and HA. Students who transferred in to study schools following the T1 survey (n = 9) were asked to be a part of the demonstration study at T2, the end of the 6th grade, spring 2007. Study participants who transferred out of study schools during the 6th grade (n = 15) were not sought out for T2 data collection.

After JP school closed in spring of 2007, the comparison sample was amended to include students who completed a fall 2007 “baseline” survey at LL Community School, described in greater detail on page 38. The Hmong Academy participant group remained virtually unchanged as most HA students simply transferred to the new school building and continued in the same academic program as before the JP school closure.

During the cohort’s 7th grade year, far greater numbers of study participants transferred out of study schools (n = 48) and new 7th grade students transferred in to study schools (n = 34) than during the cohort’s 6th grade year. All new 7th grade students were invited to participate in the Lead Peace evaluation in May 2008. Furthermore, the evaluation team made a concerted effort to survey student participants who transferred

out of study schools during the 7th grade school year. MPS provided school transfer information for students who transferred to other schools within the MPS district. Research assistants made phone calls to families to gain current school information if home phone numbers were still accurate. In total, 21 of 48 participants who transferred out of the study schools prior to the T3 classroom survey were found and surveyed. Students located at new schools (n = 16 of 21) completed a T3 survey at their new school during the regular school day. In addition, a small group of students (n = 5 of 21) who were located after the school year ended completed a T3 survey via telephone. The same procedure was employed for consenting new students in the study schools and locating students outside the study schools during the cohort's 8th grade year.

Survey instrument. The Lead Peace survey instrument (Appendix B) was designed for this demonstration study, with items drawn from other established youth surveys. To refine items in ways that would be clearly understandable and relevant to young adolescents, survey items were reviewed with three focus groups including parents of young adolescents from North Minneapolis, young adults who worked with middle grade youth from North Minneapolis, and school and community partners involved with the Lead Peace demonstration study. The instrument was also pilot tested with 6th grade students from another MPS school. The original survey was designed to be completed within a 50-minute class period. The final survey contained 40 items covering demographic information; neighborhood involvement and connectedness; family involvement and connectedness; peer involvement and connectedness; school involvement and connectedness; extracurricular activities; tobacco, alcohol and drug use; and bullying, fighting and violence involvement. Survey items related to fighting and

violence involvement were drawn from the student survey instrument used in the National Longitudinal Study of Adolescent Health (Resnick et al, 1997). Neighborhood Connectedness items were developed from existing adult social capital questionnaires, particularly World Bank Social Capital items used to measure social connections in developing countries (Grootaert, 2004).

Ethical considerations, including parent consent. All study protocols were approved by the University of Minnesota IRB and the MPS Research, Evaluation and Assessment Department (REA). Various mechanisms were employed to protect the rights and privacy of students in the Lead Peace demonstration study. Active parent consent was obtained prior to student participation in the study. At T1, nearly 95% of students returned parent consent forms, a high consent return rate in an urban, low-income school population (Secor-Turner, Sieving, Widome, Plowman & Vanden Berk, 2010). At each survey point, parents were notified the survey was taking place and students were asked to assent, to reaffirm that participation in the survey was voluntary.

The current study was covered under Lead Peace study protocols and procedures approved by the University of Minnesota IRB and MPS REA Department. Lead Peace study files linking individual students' names and assigned study ID numbers were not available to this researcher.

Data collection procedures. PRC evaluation staff administered the survey in classrooms of Lead Peace study schools, reading the survey aloud to accommodate for various levels of reading comprehension. Each classroom had at least one bilingual reader to translate into Spanish if needed. Two bilingual research staff persons read the survey in Hmong to limited-English proficiency students in Hmong Academy

classrooms. At each survey time point, every classroom followed the same pre-survey protocol: (a) students were told that they would be taking a Lead Peace survey during a designated class time; (b) students were told most would be taking the survey while others would be spending time on a “workbook”; (c) students were read an abridged assent form, staff verified understanding of assent by asking the class questions about the study; (d) students were asked to sign an assent form; and (e) students were asked to practice using survey response options with an example question. Readers read through every question; students either followed along in real-time or worked ahead at their own pace. If students had questions during the survey, they were asked to raise their hand and a research staff person offered personal assistance. For students who chose to not assent the day of the classroom survey, research staff individually offered alternative times to complete the survey the following week. Research staff returned to schools several times following classroom survey administration to survey students who were absent or unable to participate on the day of the classroom survey.

Research Design of the Current Study

To address the study’s Primary Aim, an attrition analysis and participant group comparisons were completed to examine similarities and differences between students who completed surveys at T2, T3 and T4 and those who are missing at one or more survey time point(s). To address the study’s Secondary Aim, a series of multivariate analyses were completed with samples that include and exclude students missing at any time point, to examine various methods of handling missing data.

Study Sample

Available data from T2-T4 survey points of the Lead Peace demonstration study were used for the current study. Pre-intervention data, surveys from T1, were not used in the current study. The number of participants from each school, at each time point, is noted in Table 3-2.

Table 3-2. Number of surveys completed at each school.

<i>Schools</i>	<i>T2 (May 2007 or Oct 2007)</i>	<i>T3 (May 2008)</i>	<i>T4 (May 2009)</i>
Cityview (CV)	32	33	36
Nellie Stone Johnson (NSJ)	45	58	47
Jordan Park Community (JPC, 2006-07 only) & Lucy Laney (LL, 2007-09)	JPC: 18 LL: 40 (58 total)	LL: 39	LL: 42
Hmong Academy (HA)	36	35	44
Students at other schools outside the above schools	n/a	23	49
Total	171	188	218

With the closing of JP schools at the end of 2006-07, the T2 sample has a total of 171 students including both JPC students (surveys at the end of 6th grade) and LL students (surveyed at the beginning of 7th grade). Students completing the T2 survey in May 2007 and October 2007 were compared on survey demographic, psychosocial and behavioral measures. In some cases, response characteristics of students completing the

survey at these two points were similar. However, the prevalence of key behavioral measures differed between these two groups of students, including bullying behaviors and overt violence involvement. Students in the May 2007 survey group reported lower levels of involvement in these risk behaviors than those in the October 2007 survey group. Therefore, statistical analyses in the current study adjusted for timing of T2 survey administration. This procedure is explained in more detail on page 46.

Measures

Primary Aim Measures

Bivariate comparison analyses examined a variety of demographic indicators as well as measures of environmental, personal and behavioral attributes in the Lead Peace conceptual framework (page 25; Figure 2-1). Demographic characteristics included student gender, ethnicity, number of parents in the home, length of time in one's neighborhood, length of time attending current school, and number of schools attended during the current school year. Students' age was typical for each grade and was not included in these. Environmental, personal and behavioral measures included parent/family connectedness, peer connectedness, school connectedness, cooperative behaviors, stress management skills, intention for civic contribution, neighborhood social resources, tobacco, alcohol and marijuana use, school misbehavior, bullying victimization, bullying perpetration and overall violence involvement. Table 3-3 shows all Lead Peace survey scales, the number of items in each scale, the range of Cronbach's alpha for the three years and sample items for each scale.

Table 3-3. Scales and items from Lead Peace Evaluation Survey

Scale/item	# of items in measure	Cronbach's alpha ^a	Item examples
Parent/family connectedness	7	.78 - .81	<ul style="list-style-type: none"> • My family understands me. • My family has fun together. • My family pays attention to me. • My mother cares about me. • My father cares about me.
Peer connectedness	8	.90 - .92	<ul style="list-style-type: none"> • My peers care about me. • My peers understand me. • My peers accept me for who I am. • My peers are easy to talk to. • I trust my peers. • I can tell my peers about my problems and troubles.
Cooperative behaviors	11	.76 - .81	<ul style="list-style-type: none"> • I helped other students solve problem • I cooperated with others. • I gave someone a compliment. • I helped others participate in a group. • I took responsibility for a mistake.
Lack of stress management ^b	4	.69 - .73	<ul style="list-style-type: none"> • I think most things I do will turn out ok. • I try not to hurt other people's feelings. • It is easy to tell people how I feel. • I get too upset about things. • Having friends is important. • I can stay calm when I'm upset. • I am able to respect others.

School connectedness	10	.77 - .84	<ul style="list-style-type: none"> • People at my school expect me to do well. • My classes are interesting. • I like school. • My teachers have gotten to know me well. • My teachers respect me. • It is important for me to be at school every day.
Intentions for civic contribution	5	.81 - .85	<ul style="list-style-type: none"> • Working to improve my neighborhood is important. • It is important to me to volunteer my time to help people who need help. • It is important to me to find a job that helps others. • I feel that I can make a difference in my neighborhood. • I plan to work with others to improve my neighborhood.
Neighborhood social resources	9	.83 - .87	<ul style="list-style-type: none"> • I regularly stop and talk with people in my neighborhood. • If I needed advice about something, I could go to someone in my neighborhood. • I know someone I could borrow money from. • There are adults in my neighborhood I look up to. • I am interested in finding out about new things that happen in my neighborhood.
School misbehavior	6	.71 - .75	<p>In school ,</p> <ul style="list-style-type: none"> • it is hard for me to stay out of trouble. • it is hard for me to obey the rules. • it is hard for me to do the right thing. • it is hard to be accepted. <p>In the past month, how often did you cut or skip school?</p>

Bullying victimization	12	.86 - .89	In the past week, how many times did someone: <ul style="list-style-type: none"> • Leave you out on purpose? • Pick on you? • Say things about you to make others laugh? • Ignore or stop talking to you? • Hit, shove or push you? • Make fun of your family?
Bullying perpetration	12	.88 - .90	In the past week, how many times did you: <ul style="list-style-type: none"> • Leave someone out on purpose? • Pick on someone? • Say things about another student to make others laugh? • Ignore or stop talking to someone? • Threaten to hit or hurt another student? • Ruin someone's stuff?
Violence involvement (sum scale)	4	n/a	In the past year, how often did you: <ul style="list-style-type: none"> • Get into a physical fight? • Hurt someone badly enough... • Use or threaten to use a weapon to get something? • Take part in a fight where a group of your friends were against another group?
Past month use of tobacco use ^c	1	n/a	How often have you smoked a cigarette or part of one in the past month?
Past month use of alcohol use ^c	1	n/a	How often have you had an alcoholic beverage to drink in the past month?
Past month use of marijuana use ^c	1	n/a	How many times have you used marijuana in the past month?

^a Cronbach's alpha reliability coefficients are the low and high value from the 3 time points

^b A high score on the 'Lack of stress management skills' scale indicates a poor aptitude for handling stress.

^c This five-option item was recoded as a yes-no, "never used" verses "have tried" item.

Secondary Aim Measures

Analyses addressing the study's Secondary Aims utilized neighborhood connectedness indicators (intentions for civic contribution and neighborhood social resource scales) measured at T3 and youth violence involvement measured at T2 and T4.

Neighborhood connectedness. Two neighborhood connectedness scales were created by Widome and colleagues (2008) using exploratory factor analysis with Lead Peace data. The first, *neighborhood social resources*, included eight items which asked students how familiar they were with their neighborhood and neighbors as well as about supportive interactions with others living around them. At T3, Cronbach's alpha for this scale was 0.83. The second scale, *intentions to contribute*, reflected youths' interest in improving their community and helping others in their neighborhood. This 5-item scale had an alpha of 0.82 at T3. Because each scale had been shown to behave differently in relation to violence involvement (Widome, et al, 2008), separate scales were used in the current study.

Youth violence. Violence involvement was a sum of responses to four violence items in the Lead Peace survey: "In the past year, how often did you: a) Get into a physical fight? b) Hurt someone badly enough for them to need bandages or care from a doctor or nurse? c) Use or threaten to use a weapon to get something from someone? d) Take part in a fight where a group of your friends was against another group? Cronbach's alpha for this set of items is 0.77 at T2 and 0.81 at T4. A sum score, rather than the mean scale score, was employed in this study because sum scores were thought to better convey the magnitude of violence involvement for an individual student.

Analytic Plan

Table 3-4 shows the constellation of groups for this analysis. For the remainder of this dissertation, comparisons by group refer to these mutually-exclusive group assignments.

Table 3-4. Group assignment by participation in Lead Peace

Group	T2	T3	T4	n
G1	X	X	X	114
G2	X			19
G3	X	X		26
G4		X		11
G5		X	X	37
G6	X		X	12
G7			X	55

Primary Aim Analysis

Prior to attrition analyses, univariate analyses were completed on each variable, for each group. Patterns of missing item responses and of missing subjects were noted, as were item means, standard deviations and range.

Sample attrition rate was calculated by dividing the number of youth completing a survey at each study time point by total number of students with parent consent to participate in the study at T2 (n = 171). In this study, all students with parent consent at T2 served as the denominator of sample attrition rate.

Comparison of group characteristics included a comparison of demographic characteristics and other measures in Table 3-3 (page 44). The first comparison was made between G1 and all students surveyed at T2. Though the latter group was overwhelmingly made up of G1 students, it also includes 6th grade students who would out-migrate from the study, offering another indication of similarity or difference of the entire cohort.

Six two-group comparisons were chosen to test for homogeneity across groups of Lead Peace students. These included:

- #1: G1 versus G2, to understand characteristics of students lost after the first year (traditional attrition analyses);
- #2: G1 versus G3, to understand characteristics of students lost after the second year of the project (again, traditional attrition analyses);
- #3: G1 versus G5, to understand characteristics of students who joined the study for the final two surveys;
- #4: G1 versus G7, to understand characteristics of students who join the study for only the final survey;
- #5: G1 versus G6, to understand similarities or differences of youth missing only one midpoint survey;

- #6: G2 versus G7, to understand similarities or differences between youth leaving after the T2 survey and youth joining the study for the T4 survey (cross-sectional sample demographic information only.)

For bivariate group comparisons of categorical measures, both Chi-squared tests and Fisher's Exact tests were used. Because cell sizes were relatively small for all groups other than G1, a non-parametric statistical test—Fisher's Exact test—was considered the most accurate test statistic for comparisons; group proportions and p-values for Fisher's Exact Test are reported in Chapter IV. Statistical significance was set at $p = 0.05$ for group differences. For bivariate group comparisons of continuous measures, t-tests and Wilcoxon-Rank Sum tests (the non-parametric analogue to the t-test) were used. T-tests and Wilcoxon tests performed similarly in these comparisons; the latter considered the more accurate statistic and reported in results. Statistical significance was set at $p = 0.05$ for comparisons of means.

As described on page 33, due to the closing of a comparison school in the Lead Peace study and replacement with a demographically similar school, students in the T2 sample were surveyed in two groups with a 4-month period of time separating data collection points. Previous cross-sectional analyses of T2 data by the Lead Peace evaluation team revealed differences of risk behaviors between groups surveyed in Spring 2007 and those surveyed in Fall 2007. Because of these differences, it was determined that multivariate group comparisons should include a statistical adjustment for whether students completed the T2 survey in Spring 2007 or Fall 2007.

The final set of comparisons was between G2 versus G7, two groups that shared no common survey time point. Furthermore, G2 included Spring 2007 and Fall 2007

subgroups. G2 was split into two different T2 subgroups and descriptive statistics reported for each subgroup. Univariate summary statistics for each group's single time point were used to calculate test statistics. Welch's approximation for unequal variances was added as an option to these t-tests, to compensate for the small sample sizes as there was no option to hand-code a Wilcoxon rank-sum option.

Hypothesis testing of multiple comparisons. It is important describe how multiple hypotheses comparisons were handled in the current study. As noted above, an $\alpha = 0.05$ was chosen for hypothesis testing criteria. As multiple statistical tests were performed simultaneously, proper adjustment of alpha-rejection beyond a standard Bonferroni adjustment was considered (Strassburger & Bretz, 2008). There has been debate in the literature about the usefulness of a "single-step" adjustment, verses a "step-wise" procedure (Strassburger & Bretz, 2008) verses no adjustment at all (Perneger, 1998; Nakagawa, 2004). The main argument against Bonferroni adjustment was that in most cases, multiple tests do not represent a family of tests, for which an adjusted alpha corrects in hypothesis testing. In other words, a test for a difference between classes on one characteristic is unrelated to a next test of difference on another characteristic.

In the present study, the decision was made to adjust only those comparisons by characteristic, as suggested by Perneger (1998). For characteristics measured as continuous variables, a base alpha rejection value of 0.05 was applied. Variables with two levels (i.e. gender, ever/never smoking, etc) were adjusted with a final alpha $p = 0.03$; those with three levels (i.e. number of parents in home, length of time in neighborhood, etc) adjusted with a final alpha $p = 0.02$; and that comparison with four levels (race/ethnicity) was adjusted to a final alpha $p = 0.01$.

Secondary Aim Analysis

This aim contrasted estimates from models predicting youth violence derived from different approaches for handling missing data. Identical multivariate analyses were completed with a sample with complete-case (G1) data and two other samples with imputed data. Publications by Rubin (1987), Little and Rubin (2002), Graham and colleagues (Graham, 2005; Graham, Olchowski & Gilreath, 2007) and Allison (2001; 2002) served as the foundation for handling missing data.

Two data imputation methods were employed in the current study—regression-imputation and multiple imputation via the `MICE` command in Stata 10.0 (Royston, 2007). These two methods were selected to highlight different options for handling missing data and to examine the effects of adding an error term in imputation methods (when employing MI).

As noted in Table 3-5, only data from students in G1, G2 and G3 groups were used in these analyses. These three groups represent the typical pattern of monotonic missing data in longitudinal studies (Allison, 2009) and a pattern of attrition that is common in longitudinal research. The numbers of students in these mutually-exclusive groups ($n = 159$) offered enough statistical power to test an appreciable difference in sample size after data imputation. By contrasting estimates of the “natural” and imputed datasets, this study was able to ascertain whether data in an imputed dataset with a larger sample of students behaves differently in multivariate models than data from a dataset featuring only complete-cases (G1).

Table 3-5. Structure of multiple imputed datasets^a

Group	T2	T3	T4
G1	X	X	X
G2	X	Imp ^b - neighborhood connection scales	Imp ^b - violence involvement scale
G3	X	X	Imp ^b - violence involvement scale

^a “X” refers to data collected on participants at the corresponding timepoint and

^b “Imp” represents data that were imputed to fill the data matrix for that time point.

Creation of imputed datasets. Three datasets were created. The first was a complete-case (G1) dataset, which was created simply by retaining data from only students who completed surveys at T2-T4. Though 114 students existed in G1 bivariate analyses (Primary Aim analyses), students who missed survey items were excluded from these analyses, leaving data from as few as 108 students in regression models.

A second dataset was created using regression-imputation for students in G1, G2 and G3. Imputed variables of interest were created from a regression model of common T2 variables including: gender, ethnicity, number of parents living at home, number of schools attended in past year, hopefulness, intrapersonal skills, interpersonal skills neighborhood social resources, intentions for civic contribution and violence involvement. The choice of T2 variables for the regression model was guided by the study’s conceptual framework. Various combinations of imputation predictors were selected and trialed before settling on a final model for the imputation dataset.

A third dataset was created using the MICE command in Stata 10.0 (Royston, 2007) for students in G1, G2 and G3. Imputed values for missing data at T3 and T4 were

created by using multiple-imputation chained equations. Predictor variables for the multiple imputation regression models were the same for regression-imputation. Five unique datasets were created and beta estimates with standard errors collapsed within cases, by model, into one meta dataset using Rubin's Rule (Allison, 2001; Allison, 2009; Little & Rubin, 2002; Royston, 2007). This collapsing of datasets co-occurs within one data-coding step as an inherent process of multiple imputation (Royston, 2007). Ten datasets were imputed in a subsequent exploratory analysis; MI with ten datasets added no additional information to predictive models.

The focal relationship tested in this analysis is the association between neighborhood connectedness and youth violence. Youth violence involvement at T4 was a behavioral outcome of interest in the Lead Peace demonstration study. Previous research indicates that violent behavior is a strong predictor of violent behavior at subsequent points in time (Borowsky, Widome & Resnick, 2008; Hawkins et al, 1998; Herringkohl et al, 2000; Resnick, Ireland & Borowsky, 2004). This analysis examined the autocorrelation of violent behavior measured at two time points during early adolescence (separated by approximately two years) as well as the relationship between neighborhood connectedness at T3 and violent behavior at T4.

Initially, bivariate correlations between each indicator in Figure 3-1 were examined using data from each imputation dataset. Bivariate with a p-value of $p < 0.05$ were reported as statistically significant.

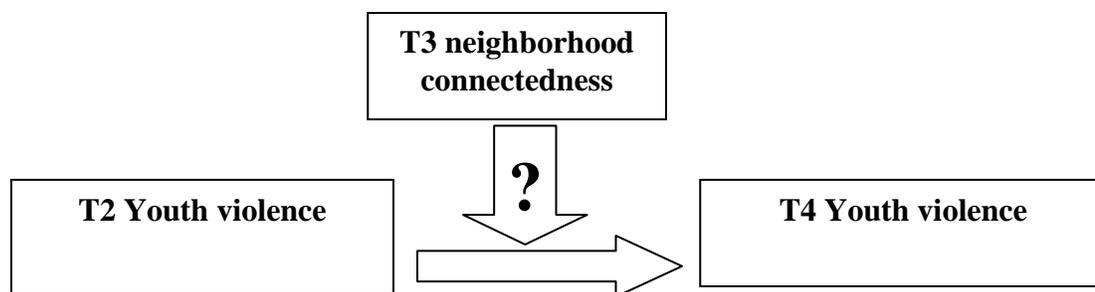


Figure 3-1. Moderating relationship of neighborhood connections and youth violence

Multivariate models employing ordinary least squares regression was used to investigate the relationships depicted in Figure 3-1. To investigate whether neighborhood connectedness at T3 moderated the relationship between T2 and T4 violence (Bennett, 2000; Fairchild & MacKinnon, 2009), a 3-step analysis was completed: 1) tests of the predictor variable on the outcome variable of interest (T2 violence involvement predicting T4 violence involvement), 2), the addition of a second predictor variable with the focal relationship (T3 neighborhood connectedness scales and T2 violence involvement predicting T4 violence), and 3) the addition of an interaction term between the independent variables predicting the outcome variable of interest (the product of T2 violence involvement and T3 neighborhood connectedness scales predicting T4 violence). To create an interaction term that was easily interpretable, each neighborhood connectedness scale was re-coded as a two-level categorical variable differentiating “high” and “low” levels of connectedness. This was done by first taking the median value of the Civic Contribution scale and of the Neighborhood Social Resources scale and re-classifying those above the median as having “high connectedness” and those below the median “low connectedness”.

With each dataset, variables were introduced into multivariate models in a step-wise fashion as detailed above. Multivariate models were as follows:

$$\text{Model \#1: } y (\text{T4viol}) = b_0 + b_1 (\text{T2viol}) + \varepsilon$$

$$\text{Model \#2: } y (\text{T4viol}) = b_0 + b_1 (\text{T2viol}) + b_2 (\text{T3civcon}) + \varepsilon$$

$$\text{Model \#3: } y (\text{T4viol}) = b_0 + b_1 (\text{T2viol}) + b_2 (\text{T3socres}) + \varepsilon$$

$$\text{Model \#4: } y (\text{T4viol}) = b_0 + b_1 (\text{T2viol}) + b_2 (\text{T3civcon}) + b_3 (\text{T3civcon}) * (\text{T2viol}) + \varepsilon$$

$$\text{Model \#5: } y (\text{T4viol}) = b_0 + b_1 (\text{T2viol}) + b_2 (\text{T3socres}) + b_3 (\text{T3socres}) * (\text{T2viol}) + \varepsilon$$

CHAPTER IV

RESULTS

Chapter IV presents findings related to each of the study aims. To review, the specific aims of the current study were to:

1. Examine similarities and differences between students who completed Lead Peace surveys at T2, T3 and T4 and those who did not complete surveys at one or two of these data collection points; and
2. Contrast estimates from longitudinal models predicting youth violence involvement using three datasets that include: 1) a dataset from students present for Lead Peace surveys at T2, T3 and T4, 2) a dataset with *regression-imputed data* for students missing at time point T4 and at time points T3 and T4 and 3) a dataset created by *multiple imputation* from students missing at time point T4 and at time points T3 and T4. The longitudinal models examined relationships between youth violence involvement at T2, neighborhood connectedness at T3 and youth violence involvement at T4.

This chapter begins with a description of overall attrition rates in the Lead Peace demonstration study. Next, findings related to the primary aim are presented. Group comparisons outlined on page 44 (Table 3-4) in Chapter III are reported. Finally, findings related to the study's secondary aims are presented.

Attrition Rate

Annual attrition rate from T2 to T3 was 18.1% (31/171) and from T3 to T4 the attrition rate was 18.6% (26/140). Overall longitudinal attrition from T2 to T4 was 33.3%; 114 of the 171 students who consented/assented at T2 completed all three rounds of the Lead Peace survey.

Primary Aim: Examine similarities and differences between students who completed Lead Peace surveys at T2, T3, and T4 and those who did not complete surveys at one or two of these data collection points.

Six different group comparisons were conducted to understand the Primary Aim. The first group of 114 students in Group 1 (G1) completed all three Lead Peace surveys and is the reference group for all but one of these independent comparisons.

Group 1 demographic characteristics

Demographic characteristics for G1 are noted in Table 4-1. In general, G1 participants were similar to the overall T2 cross-sectional sample of 171 students across comparison characteristics; statistical tests revealed no differences between these two groups.

Table 4-1. G1 and T2 demographic characteristics (G1 n = 114; T2 n = 171)

Characteristic	Level	G1 n (%)	T2 n (%)
Gender	Male	57 (50%)	87 (48%)
	Female	57 (50%)	89 (52%)
Race/ethnicity	Black	47 (41%)	73 (43%)
	Hispanic	15 (13%)	21 (12%)
	Asian /Hmong	35 (31%)	48 (28%)
	Native American	1 (1%)	1 (0.06%)
	Mixed	14 (12%)	26 (15%)
	Other	2 (2%)	2 (1%)
# Parents in home	Neither	11 (10%)	14 (8%)
	One	37 (32%)	61 (36%)
	Two	66 (58%)	96 (56%)
Length of time living in neighborhood	<1 yr	33 (30%)	60 (35%)
	1-3 yrs	35 (31%)	46 (27%)
	>3 yrs	45 (40%)	64 (38%)
How many schools have you attended this year?	Only this school	91 (2%)	137 (85%)
	One other school	9 (8%)	11 (7%)
	More than 2 schools	9 (8%)	13 (8%)
Cigarette use in last 30 days?	Never	97 (87%)	142 (85%)
	Ever	15 (13%)	25 (15%)
ETOH use in last 30 days?	Never	76 (68%)	111 (66%)
	Ever	36 (32%)	57 (34%)
MJ use in last 30 days?	Never	103 (92%)	152 (90%)
	Ever	9 (8%)	16 (10%)

Note. All categorical comparisons tests were N.S. using Chi² tests for significance

Table 4-1 (continued). G1 and T2 demographic characteristics (G1 n = 114; T2 n = 171)

Continuous Scales	Range	G1 Mean (sd)	T2 Mean (sd)
Family connectedness	0-3	2.50 (0.53)	2.47 (0.55)
Peer connectedness	0-3	1.90 (0.71)	1.98 (0.70)
School connectedness	0-3	2.18 (0.50)	2.16 (0.48)
Cooperative behavior (11 items)	0-11	6.33 (3.07)	6.44 (3.03)
Stress management (reverse coded)	0-3	1.37 (0.78)	1.40 (0.78)
Civic contribution	0-3	1.70 (0.70)	1.68 (0.70)
Neigh social resources	0-3	1.47 (0.75)	1.46 (0.74)
School misbehavior (6 items)	0-3	0.93 (0.06)	0.97 (0.61)
Bully victimization	0-2	0.50 (0.49)	0.48 (0.48)
Bully perpetration	0-2	0.58 (0.52)	0.60 (0.51)
Violence involvement	0-8	1.74 (2.20)	1.84 (2.18)

Note. All continuous measure comparisons tests were N.S. using t-tests for significance

Group comparisons

Participants all were placed in one of seven mutually exclusive groups depending on time of completion and number of Lead Peace surveys (Table 3-4, page 44).

Traditional attrition analyses are summarized in the first two group comparisons, G1 versus G2 and G1 versus G3. Other group comparisons were chosen representing common ways a student might be missing from a longitudinal study. Students who left

the Lead Peace demonstration study hereafter are referred to as “attritors” in these traditional attrition analyses.

Comparison #1, G1 v G2

This analysis compared participants who stay in a study versus those who leave a study after one data collection point. The sample of G2 attritors consisted of 19 students. There were isolated differences between the two groups at T2 (Table 4-2). A higher proportion of the attriting group was girls ($p = 0.03$) and lived less than one year in their current neighborhood ($p = 0.03$). Students in G2 reported lower levels of family connectedness than G1 students ($p = 0.02$). Conversely, students in G2 reported higher levels of peer connectedness than their G1 peers ($p = 0.03$).

Table 4-2. G1 v. G2 comparison analyses^a

	G1 (n = 114)	G2 (n = 19)	p-value ^b	
Gender			0.03	
	Male	0.50	0.22	
	Female	0.50	0.78	
Race/ethnicity				
	Black	0.41	0.58	0.19
	Hispanic	0.13	0.15	0.81
	Asian/Hmong	0.28	0.15	0.22
	Mixed	0.12	0.11	0.86
# Parents in home				
	Neither	0.10	0.00	--
	One	0.32	0.56	0.06
	Two	0.58	0.44	0.29
Time living in neighborhood				
	<1 yr	0.28	0.55	0.03
	1-3 yrs	0.31	0.17	0.22
	>3 yrs	0.40	0.27	0.30
# of schools attended this year?				
	Only this school	0.84	0.85	0.90
	One other school	0.08	0.06	0.70
	More than one other school	0.07	0.08	0.85
Cigarette use in last 30 days?				
	Yes	0.13	0.11	0.76
ETOH use in last 30 days?				
	Yes	0.32	0.41	0.47
MJ use in last 30 days?				
	Yes	0.08	0.06	0.71

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

^b P-values reported for categorical group differences were pair-wise comparisons.

Table 4-2 (continued). G1 v. G2 comparison analyses^a

	Range	G1 mean	G2 mean	p-value
Family connectedness	0-3	2.50 (.05)	2.17 (.13)	0.02
Peer connectedness	0-3	1.90 (.06)	2.28 (.16)	0.03
School connectedness	0-3	2.17 (.05)	2.13 (.11)	0.69
Cooperative behavior	0-11	6.32 (.28)	6.60 (.69)	0.70
Stress management (reverse coded)	0-3	1.37 (.07)	1.64 (.18)	0.17
Civic contribution	0-3	1.70 (.06)	1.60 (.16)	0.56
Neigh social resources	0-3	1.47 (.07)	1.63 (.17)	0.38
School misbehavior	0-3	0.93 (.06)	1.04 (.14)	0.46
Bully victimization	0-2	0.50 (.05)	0.41 (.12)	0.50
Bully perpetration	0-2	0.59 (.05)	0.70 (.12)	0.40
Violence involvement	0-8	1.76 (.2)	1.83 (.50)	0.89

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

Comparison #2, G1 v G3

This analysis compared a group of participants who left after two data collection points (G3, n = 26) versus the non-attributing group (G1, n = 114). Comparison tests are summarized in Table 4-3 using T2 variables and in Table 4-4 using T3 variables.

On all T2 characteristics, there were no statistically significant differences between G1 and G3. One T2 comparison trended towards significance—G3 students reported a mean score of 1.18 for neighborhood social resources while G1 students reported a mean score of 1.47 on the same measure ($p = 0.08$).

The groups were similar on all but one comparison at T3. G3 students reported an adjusted mean violence involvement score of 2.80 at T3, significantly higher than 1.68 reported by G1 students ($p = 0.02$). Though not statistically significant, there was a trending difference between the two groups in amount of time living in their neighborhood less than one year at T3. 0.40 of G3 students had lived in their neighborhood less than 1 year compared to 0.23 of G1 students ($p = 0.08$).

Table 4-3. G1 v. G3 comparison analyses, using T2 variables^a

	G1 (n= 114)	G3 (n = 26)	p-value ^b
Gender			0.56
	Male	0.50	0.44
	Female	0.50	0.56
Race/ethnicity			
	Black	0.41	0.48
	Hispanic	0.13	0.04
	Asian		
	/Hmong	0.27	0.22
	Mixed	0.12	0.22
# Parents in home			
	Neither	0.10	0.04
	One	0.32	0.38
	Two	0.58	0.58
Length of time living in neighborhood			
	<1 yr	0.29	0.40
	1-3 yrs	0.31	0.29
	>3 yrs	0.40	0.31
How many schools have you attended this year?			
	Only this school	0.84	0.95
	One other school	0.08	0.00
	More than one other school	0.07	0.05
Cigarette use in last 30 days?			
	Yes	0.13	0.11
ETOH use in last 30 days?			
	Yes	0.32	0.23
MJ use in last 30 days?			
	Yes	0.08	0.10

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

^b P-values reported for categorical group differences were pair-wise comparisons.

Table 4-3 (continued). G1 v. G3 comparison analyses, using T2 variables^a

	Range	G1 mean (se)	G3 mean (se)	p-value
Family connectedness	0-3	2.50 (.05)	2.54 (.11)	0.72
Peer connectedness	0-3	1.90 (.07)	2.09 (.14)	0.22
School connectedness	0-3	2.17 (.05)	2.16 (.10)	0.94
Cooperative behavior	0-11	6.32 (.29)	6.56 (.61)	0.72
Stress management (reverse coded)	0-3	1.37 (.07)	1.48 (.15)	0.51
Civic contribution	0-3	1.70 (.07)	1.66 (.14)	0.78
Neigh social resources	0-3	1.47 (.07)	1.18 (.15)	0.08
School misbehavior	0-3	0.93 (.06)	1.02 (.12)	0.51
Bully victimization	0-2	0.50 (.04)	0.38 (.09)	0.24
Bully perpetration	0-2	0.59 (.05)	0.53 (.10)	0.63
Violence involvement	0-8	1.77 (.20)	1.74 (.41)	0.95

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

Table 4-4. G1 v. G3 comparison analyses, using T3 variables

	G1 (n=114)	G3 (n= 26)	p-value ^a
# Parents in home			
Neither	0.10	0.08	0.79
One	0.34	0.37	0.84
Two	0.56	0.55	0.97
Length of time living in neighborhood			
<1 yr	0.23	0.40	0.08
1-3 yrs	0.33	0.27	0.63
>3 yrs	0.45	0.32	0.27
How many schools have you attended this year?			
Only this school	0.88	0.94	0.40
One other school	0.05	0.00	--
More than one other school	0.06	0.05	0.88
Cigarette use in last 30 days?			
Yes	0.18	0.25	0.44
ETOH use in last 30 days?			
Yes	0.40	0.35	0.63
MJ use in last 30 days?			
Yes	0.16	0.17	0.85

^a P-values reported for categorical group differences were pair-wise comparisons.

Table 4-4 (continued). G1 v. G3 comparison analyses, using T3 variables

	Range	G1 mean (se)	G3 mean (se)	p-value
Family connectedness	0-3	2.45 (.05)	2.38 (.11)	0.57
Peer connectedness	0-3	2.08 (.07)	2.28 (.14)	0.22
School connectedness	0-3	2.18 (.05)	2.19 (.10)	0.90
Cooperative behavior	0-11	6.13 (.27)	6.91 (.58)	0.23
Stress management (reverse coded)	0-3	1.39 (.07)	1.60 (.15)	0.21
Civic contribution	0-3	1.77 (.06)	1.73 (.13)	0.79
Neigh social resources	0-3	1.47 (.07)	1.42 (.14)	0.75
School misbehavior	0-3	0.99 (.06)	0.94 (.12)	0.71
Bully victimization	0-2	0.49 (.04)	0.53 (.10)	0.75
Bully perpetration	0-2	0.69 (.05)	0.66 (.10)	0.79
Violence involvement	0-8	1.68 (.20)	2.80 (.43)	0.02

Comparison #3, G1 v G5

G5 consisted of 37 students who participated in the final two data collection points, only missing the first survey in the series. Like comparison #2, two time points, T3 and T4, were used as comparison variables for these analyses. Results are reported in Table 4-5 for T3 variables and Table 4-6 for T4 variables. As there were no T2 variables in common for these comparisons, Fisher's Exact tests and Rank Sum tests were used to compute statistics of categorical variables and continuous scales, respectively. There was no need to adjust for differences in T2 spring-fall survey administration in these comparisons.

On T3 characteristics, several indicators differed from G1 and G5 students including the number of schools attended during the school year ($p = 0.00$). Both family and school connectedness were statistically different between the two groups, with G1 students reporting higher connectedness in each compared to G5 students ($p = 0.04$ for both comparisons). There was a trend towards differences in length of time living in ones' neighborhood and violence involvement (G5 students reported higher levels of violence involvement at T3), though these differences were not significant applying an adjusted Bonferroni's criteria.

Using T4 as comparison variables, family connectedness was the sole characteristic that differed significantly between the groups. G5 students reported lower levels of family connectedness than G1 students ($p = 0.03$). G5 students reported being victims of bullying at levels which trended towards significance ($p = 0.09$). There were no significant differences in school connectedness or violence involvement at T4. It should be noted that some students in G5 changed their self-reported ethnicity between

T3 and T4; this reporting difference did not statistically change the comparison test between G1 and G5.

Table 4-5. G1 v. G5 comparison analyses, using T3 variables

	G1 (n = 114)	G5 (n = 37)	p-value	
Gender			0.35	
	Male	0.50	0.59	
	Female	0.50	0.41	
Race/ethnicity			0.87	
	Black	0.49	0.46	
	Hispanic	0.12	0.11	
	Asian /Hmong	0.30	0.35	
	Mixed	0.07	0.05	
# Parents in home			0.88	
	Neither	0.10	0.06	
	One	0.35	0.37	
	Two	0.56	0.57	
Length of time living in neighborhood			0.04	
	<1 yr	0.23	0.44	
	1-3 yrs	0.32	0.19	
	>3 yrs	0.45	0.36	
How many schools have you attended this year?			0.00	
	Only this school	0.87	0.49	
	One other school	0.05	0.32	
	More than one other school	0.07	0.19	
Cigarette use in last 30 days?				
	Yes	0.18	0.17	0.56
ETOH use in last 30 days?				
	Yes	0.40	0.25	0.07
MJ use in last 30 days?				
	Yes	0.16	0.17	1.00

Table 4-5 (continued). G1 v. G5 comparison analyses, using T3 variables

	Range	G1 mean (se)	G5 mean (se)	p-value
Family connectedness	0-3	2.44 (.05)	2.22 (.10)	0.04
Peer connectedness	0-3	2.08 (.05)	1.96 (.12)	0.37
School connectedness	0-3	2.18 (.05)	1.98 (.10)	0.04
Cooperative behavior	0-11	6.13 (.28)	5.63 (.48)	0.38
Stress management (reverse coded)	0-3	1.39 (.07)	1.56 (.15)	0.24
Civic contribution	0-3	1.77 (.06)	1.83 (.11)	0.66
Neigh social resources	0-3	1.47 (.07)	1.37 (.10)	0.43
School misbehavior	0-3	0.98 (.06)	1.10 (.11)	0.32
Bully victimization	0-2	0.49 (.04)	0.65 (.08)	0.08
Bully perpetration	0-2	0.68 (.05)	0.72 (.09)	0.73
Violence involvement	0-8	1.67 (.20)	2.49 (.43)	0.06

Table 4-6. G1 v. G5 comparison analyses, using T4 variables

	G1 (n = 114)	G5 (n = 37)	p-value
Race/ethnicity			0.54
Black	0.47	0.38	
Hispanic	0.12	0.08	
Asian /Hmong	0.31	0.35	
Mixed	0.09	0.16	
# Parents in home			0.33
Neither	0.08	0.11	
One	0.35	0.46	
Two	0.57	0.43	
Length of time living in neighborhood			0.57
<1 yr	0.25	0.33	
1-3 yrs	0.26	0.28	
>3 yrs	0.48	0.39	
How many schools have you attended this year?			1.00
Only this school	0.89	0.91	
One other school	0.08	0.06	
More than one other school	0.03	0.03	
Cigarette use in last 30 days?			
Yes	0.15	0.29	0.08
ETOH use in last 30 days?			
Yes	0.38	0.34	0.84
MJ use in last 30 days?			
Yes	0.16	0.23	0.45

Table 4-6 (continued). G1 v. G5 comparison analyses, using T4 variables

	Range	G1 mean (se)	G5 mean (se)	p-value
Family connectedness	0-3	2.41 (.05)	2.18 (.10)	0.03
Peer connectedness	0-3	2.08 (.05)	2.09 (.12)	0.92
School connectedness	0-3	2.19 (.05)	2.18 (.08)	0.86
Cooperative behavior	0-11	6.68 (.28)	6.82 (.46)	0.79
Stress management (reverse coded)	0-3	1.25 (.07)	1.50 (.13)	0.11
Civic contribution	0-3	1.67 (.07)	1.60 (.12)	0.61
Neigh social resources	0-3	1.44 (.07)	1.44 (.11)	0.97
School misbehavior	0-3	0.87 (.06)	1.03 (.09)	0.14
Bully victimization	0-2	0.38 (.04)	0.51 (.08)	0.09
Bully perpetration	0-2	0.54 (.05)	0.61 (.08)	0.46
Violence involvement	0-8	1.66 (.21)	1.77 (.35)	0.79

Comparison #4, G1 v G7

Comparisons between G1 and G7 revealed characteristics of students who join the survey for one time point, at the end of the project period. Table 4-7 presents the differences between G1 and the 55 students that comprise G7.

There were many statistically significant differences between these groups. Nearly three-quarters of G7 were girls, as opposed to 50% in G1 ($p = 0.01$). A greater proportion of students in G7 were black and lower proportions were Asian/Hmong and Hispanic students than G1 ($p = 0.01$). A greater percentage of students in G7 (61%, compared to 25% in G1) had lived in their neighborhood less than one year while a smaller percentage had lived in the same neighborhood longer than 3 years (17% compared to 48% in G1). Also, 56% of the students in G7 had attended at least one other school that school year, compared to only 11% in the G1 sample ($p = 0.001$). G7 students reported significantly lower mean scores on family connectedness and neighborhood social resources measures ($p = 0.05$ and $p = 0.05$, respectively) and higher mean scores of bully victimization and violence involvement measures than their G1 peers ($p = 0.05$ and $p = 0.02$, respectively). Finally, G7 students reported less of an aptitude for stress management than their G1 peers ($p = 0.01$).

Table 4-7. G1 v. G7 comparison analyses, using T4 variables

	G1 (n = 114)	G7 (n = 55)	p-value
Gender			0.01
Male	0.50	0.29	
Female	0.50	0.71	
Race/ethnicity			0.01
Black	0.46	0.56	
Hispanic	0.12	0.07	
Asian /Hmong	0.31	0.26	
Mixed	0.09	0.09	
# Parents in home			0.81
Neither	0.08	0.06	
One	0.35	0.39	
Two	0.57	0.56	
Length of time living in neighborhood			0.00
<1 yr	0.25	0.61	
1-3 yrs	0.26	0.22	
>3 yrs	0.48	0.17	
How many schools have you attended this year?			0.00
Only this school	0.89	0.44	
One other school	0.08	0.37	
More than one other school	0.03	0.19	
Cigarette use in last 30 days?			
Yes	0.15	0.16	1.00
ETOH use in last 30 days?			
Yes	0.38	0.39	1.00
MJ use in last 30 days?			
Yes	0.16	0.27	0.14

Table 4-7 (continued). G1 v. G7 comparison analyses, using T4 variables

	Range	G1 mean (se)	G7 mean (se)	p-value
Family connectedness	0-3	2.41 (.05)	2.24 (.08)	0.05
Peer connectedness	0-3	2.08 (.05)	2.08 (.09)	0.99
School connectedness	0-3	2.19 (.05)	2.18 (.07)	0.92
Cooperative behavior	0-11	6.68 (.28)	7.00 (.41)	0.51
Stress management (reverse coded)	0-3	1.25 (.07)	1.62 (.10)	0.01
Civic contribution	0-3	1.67 (.07)	1.55 (.10)	0.31
Neigh social resources	0-3	1.44 (.07)	1.18 (.10)	0.05
School misbehavior	0-3	0.87 (.06)	0.99 (.09)	0.22
Bully victimization	0-2	0.38 (.04)	0.51 (.07)	0.05
Bully perpetration	0-2	0.54 (.05)	0.59 (.06)	0.54
Violence involvement	0-8	1.66 (.21)	2.61 (.38)	0.02

Comparison #5, G1 v G6

The comparison of the group youth who took all surveys (G1) versus students who missed only the T3 survey (G6) sheds light on whether or not students in this latter group can be merged with the sample that has complete data. The G6 sample was comprised of only 12 students. Very few students refused assent during T3 ($n = 3$) so it is likely that students out-migrated then returned to study schools for their 8th grade year. Group comparisons using T2 variables are reported in Table 4-8; comparisons using T4 variables are reported in Table 4-9. In summary, there was only one statistically significant difference between these groups across all comparisons.

On T2 characteristics, there was a significant difference in cigarette use; 45% of G6 students had used tobacco in the past 30 days versus only 13% of G1 students ($p = 0.01$). While not significant, the same trends were evident in both alcohol use and marijuana use with G6 having higher rates of use than G1 students. Most other characteristics were proportionally similar between the groups after adjusting for spring-fall 2007.

While there were no significant differences in groups in T4 comparisons, both cigarette use trended towards being different by group with 36% of G6 students reporting tobacco use in the past 30 days compared to only 15% of G1 students ($p = 0.08$). Cooperative behavior trended towards significance with G6 students having a higher group mean than G1 students (8.35 v. 6.67, respectively, $p = 0.06$).

Table 4-8. G1 v. G6 comparison analyses, using T2 variables^a

	G1 (n = 114)	G6 (n = 12)	p-value ^b
Gender			0.12
Male	0.50	0.75	
Female	0.50	0.25	
Race/ethnicity			
Black	0.41	0.15	0.09
Hispanic	0.13	0.16	0.75
Asian /Hmong	0.27	0.33	0.69
Mixed	0.12	0.33	0.06
# Parents in home			
Neither	0.10	0.17	0.46
One	0.32	0.24	0.54
Two	0.58	0.60	0.90
Length of time living in neighborhood			
<1 yr	0.28	0.51	0.12
1-3 yrs	0.31	0.00	--
>3 yrs	0.40	0.50	0.52
How many schools have you attended this year?			
Only this school	0.83	0.84	0.99
One other school	0.08	0.07	0.94
More than one other school	0.08	0.08	0.96
Cigarette use in last 30 days?			
Yes	0.13	0.45	0.01
ETOH use in last 30 days?			
Yes	0.32	0.57	0.09
MJ use in last 30 days?			
Yes	0.08	0.24	0.09

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

^b P-values reported for categorical group differences were pair-wise comparisons.

Table 4-8 (continued). G1 v. G6 comparison analyses, using T2 variables^a

	Range	G1 mean (se)	G6 mean (se)	p-value
Family connectedness	0-3	2.50 (.05)	2.51 (.15)	0.96
Peer connectedness	0-3	1.90 (.07)	2.06 (.21)	0.50
School connectedness	0-3	2.17 (.05)	2.11 (.15)	0.70
Cooperative behavior	0-11	6.31 (.29)	7.06 (.89)	0.43
Stress management (reverse coded)	0-3	1.37 (.07)	1.13 (.23)	0.31
Civic contribution	0-3	1.70 (.07)	1.70 (.20)	0.99
Neigh social resources	0-3	1.47 (.07)	1.64 (.22)	0.44
School misbehavior	0-3	0.93 (.06)	1.04 (.18)	0.56
Bully victimization	0-2	0.50 (.05)	0.54 (.14)	0.79
Bully perpetration	0-2	0.59 (.05)	0.68 (.14)	0.52
Violence involvement	0-8	1.76 (.21)	2.51 (.63)	0.26

^a Estimates adjusted for survey administration during spring 2007 or fall 2007

Table 4-9. G1 v. G6 comparison analyses, using T4 variables

	G1 (n = 114)	G6 (n = 12)	p-value ^a
# Parents in home			
Neither	0.07	0.16	0.26
One	0.35	0.24	0.44
Two	0.57	0.59	0.91
Length of time living in neighborhood			
<1 yr	0.25	0.42	0.24
1-3 yrs	0.26	0.25	0.92
>3 yrs	0.48	0.33	0.33
How many schools have you attended this year?			
Only this school	0.89	0.76	0.19
One other school	0.08	0.16	0.36
More than one other school	0.03	0.08	0.33
Cigarette use in last 30 days?			
Yes	0.15	0.36	0.08
ETOH use in last 30 days?			
Yes	0.38	0.41	0.86
MJ use in last 30 days?			
Yes	0.16	0.33	0.16

^a P-values reported for categorical group differences were pair-wise comparisons.

Table 4-9 (continued). G1 v. G6 attrition analyses, using T4 variables

	Range	G1 mean (se)	G6 mean (se)	P-value
Family connectedness	0-3	2.41 (.05)	2.36 (.14)	0.77
Peer connectedness	0-3	2.08 (.05)	2.22 (.16)	0.42
School connectedness	0-3	2.19 (.05)	2.18 (.15)	0.95
Cooperative behavior	0-11	6.67 (.27)	8.35 (.84)	0.06
Stress management (reverse coded)	0-3	1.26 (.07)	1.13 (.21)	0.54
Civic contribution	0-3	1.67 (.06)	1.86 (.20)	0.37
Neigh social resources	0-3	1.44 (.07)	1.40 (.23)	0.76
School misbehavior	0-3	0.87 (.06)	0.91 (.18)	0.80
Bully victimization	0-2	0.38 (.04)	0.35 (.11)	0.81
Bully perpetration	0-2	0.54 (.04)	0.40 (.13)	0.31
Violence involvement	0-8	1.67 (.21)	2.02 (.65)	0.61

Comparison #6, G2 v G7

These analyses highlight the characteristics of students taking a single survey either at T2 or at T4, about two years later. Results are presented in Table 4-10. For the purposes of this unique comparison, two independent G2 sub-samples were considered—one group completed the T2 survey in spring 2007 (n = 14) and a second that completed a T2 survey in fall 2007 (n = 5). As there were only five students in the latter sub-sample, a consolidated G2 group was used in comparisons with the G7 group. The p-value reported for these tests was for the merged G2 verses G7 hypothesis testing.

Only demographic characteristics were compared between G2 and G7. During the current school year, a greater percentage of students in G2 reported attending only this school (84% versus 44%, $p = 0.00$) while a greater percentage of G7 students attended one other school (36% versus 5%, $p = 0.00$).

Table 4-10. G2 v. G7 Comparisons

	Spring 2007 (n = 14)	Fall 2007 (n = 5)	G1 (n = 114)	G7 (n = 26)	P-value ^a
Gender					0.49
Male	0.21 (3)	0.20 (1)	0.21 (4)	0.29 (16)	
Female	0.79 (11)	0.80 (4)	0.79 (15)	0.71 (39)	
Race/ethnicity					
Black	0.43 (6)	0.80 (4)	0.53 (10)	0.56 (30)	0.89
Hispanic	0.21 (3)	0.00	0.16 (3)	0.07 (4)	0.33
Asian /Hmong	0.21 (3)	0.20 (1)	0.21 (4)	0.26 (14)	0.66
Mixed	0.14 (2)	0.00	0.11 (2)	0.09 (5)	0.81
Parents in home					
Neither	0.00	0.00	0.00	0.06 (3)	--
One	0.57 (8)	0.40 (2)	0.53 (10)	0.39 (21)	0.31
Two	0.43 (6)	0.60 (3)	0.47 (9)	0.56 (30)	0.51
Length of time living in neighborhood					
<1 yr	0.64 (9)	0.40 (2)	0.58 (11)	0.61 (33)	0.83
1-3 yrs	0.14 (2)	0.20 (1)	0.16 (3)	0.22 (12)	0.56
>3 yrs	0.21 (3)	0.40 (2)	0.26 (5)	0.17 (9)	0.44
How many schools have you attended this year?					
Only this school	0.79 (11)	1.0 (5)	0.84 (16)	0.44 (23)	0.00
One other school	0.07 (1)	0.00	0.05 (1)	0.36 (19)	0.00
More than one other school	0.14 (2)	0.00	0.10 (2)	0.19 (10)	0.39

^a P-values represents pair-wise test of significance between G2 (combined) and G7

Secondary Aim: Methods of handling missing data

The secondary aim of this study was to compare three approaches to handling missing data using data from the Lead Peace demonstration study. The *first dataset* used data from G1, the group that completed surveys at T2, T3 and T4. Regression models included sample sizes ranging from 106-109 students depending on missing items within the model. The *second dataset* included data from groups G1, G2 and G3 with values imputed for missing data points for G2 and G3 utilizing regression-imputation. As described in Chapter III, values of missing variables were predicted for an individual case based on linear regression of predictor variables from that single student. There were 159 students in the G1, G2 and G3 sample; regression-imputation maintained that number of cases in post-imputation model estimation. The *third dataset* which included data from groups G1, G2 and G3 was created using multiple imputation (MI) via chained-equations to create a user-defined number of datasets across which post-hoc estimation occurred. Multiple imputation allows for more precise calculation of error across dataset imputations, theoretically increasing the accuracy of the point estimates for the regression models (Little & Rubin, 2002; Allison, 2002). Like regression-imputation, MI maintains the same number of cases after estimation models; 159 students comprised the MI dataset for multivariate regression model estimation.

Aim II analyses were completed to contrast estimates from longitudinal models employing these three datasets. Longitudinal models examined relationships between youth violence involvement at T2, neighborhood connectedness at T3 and youth violence involvement at T4.

Bivariate correlations

Bivariate correlations of these variables were calculated using each dataset prior to multivariate regression. Those correlations are shown in Tables 4-11, 4-12 and 4-13. It should be noted that the multiple imputation dataset includes 795 cases, or 159 (students) * 5 (imputations).

In each dataset, there were highly correlated, statistically significant ($p < 0.05$) bivariate relationships between T2 violence involvement and T4 violence involvement. Neighborhood connectedness measures (neighborhood social resources and civic contribution) at T3 were also highly correlated in all three datasets, though each performed as unique constructs as they did in a previous study (Widome et al, 2008). Significant bivariate relationships were observed between T2 violence involvement and T3 neighborhood social resources and between T3 civic contribution and T4 violence involvement *only in the multiple imputation dataset*. In the former, a positive correlation between T2 violence involvement and neighborhood social resources the following school year. Conversely, T3 civic contribution was negatively correlated with T4 violence involvement.

Table 4-11. Bivariate Correlations of Modeled Variables, G1-only dataset (n = 114)

Variable	1	2	3	4
1. T2 violence	—			
2. T4 violence	0.47*	—		
3. T3 civic contribution	-0.02	-0.12	—	
4. T3 neighborhood social resources	0.13	0.00	0.56*	—

* p < 0.05

Table 4-12. Bivariate Correlations of Modeled Variables, Regression-imputation dataset (n = 159)

Variable	1	2	3	4
1. T2 violence	—			
2. T4 violence	0.47*	—		
3. T3 civic contribution	-0.01	-0.12	—	
4. T3 neighborhood social resources	0.11	0.00	0.48*	—

* p < 0.05

Table 4-13. Bivariate Correlations of Modeled Variables, Multiple Imputation datasets (n = 795)

Variable	1	2	3	4
1. T2 violence	—			
2. T4 violence	0.44*	—		
3. T3 civic contribution	0.06	-0.09*	—	
4. T3 neighborhood social resources	0.16*	0.05	0.49*	—

* p < 0.05

Linear Regression Models

Results from linear regression for models employing datasets 1-3 are shown in Tables 4-14 through 4-16. For each variable, the point-estimate, standard error, p-value and standardized Beta coefficient (for the first two datasets) are presented. The MI dataset has no standardized Beta coefficients reported as point estimates cannot be standardized across multiple-imputed datasets.

Across datasets, T2 violence was a significant predictor of T4 violence in each step-wise model. Moreover, neighborhood connectedness measures behaved as two independent constructs across datasets.

In the complete-case dataset of G1-only students (Table 4-14), there were no significant findings beyond T2 violence involvement predicting T4 violence involvement ($p = 0.00$).

The addition of nearly 50 cases in the regression-imputation dataset (Table 4-15) added power enough to slightly adjust point-estimates, standard errors and thus, p-values. Unique to the regression-imputation dataset, T3 civic connectedness became a statistically significant ($p = 0.03$) predictor of decreased T4 violence involvement with the addition of 50 imputed values and controlling for T2 violence.

Results from regression analysis were slightly modified again in the multiple imputation dataset (Table 4-16), which like the regression-imputation dataset, retained 159 cases after pooling MI results. The key difference in this dataset was the large standard errors in each of the point estimates, which in turn changed the p-values of

each point estimate. The statistically significant relationship between T3 civic contribution and T4 violence involvement in the previous dataset was erased in the MI dataset.

Interaction variable were created to model T3 social resources and T3 civic contribution moderation on the relationship between T2 violence involvement and T4 violence involvement. In each dataset, regardless of neighborhood connectedness measure, moderating relationships were not statistically significant.

Table 4-14. Summary of Multiple Linear Regression Analysis for Variables Predicting T4 Violence, G1-only dataset (n =106-109)

Variable	B	SE B	<i>B</i>	P-value
<i>Step 1</i>				
T2 violence	0.48	0.09	0.47	0.00
<i>Step 2</i>				
T2 violence	0.51	0.09	0.48	0.00
T3 civic contribution	-0.44	0.29	-0.13	0.13
<i>Step 3</i>				
T2 violence	0.51	0.09	0.49	0.00
T3 neighborhood social resources	-0.26	0.29	-0.08	0.38
<i>Step 4</i>				
T2 violence	0.59	0.12	0.56	0.00
T3 civic contribution	-0.25	0.30	-0.08	0.45
T2 violence*T3 civic contribution	-0.19	0.17	-0.14	0.26
<i>Step 5</i>				
T2 violence	0.45	0.15	0.43	0.00
T3 neighborhood social resources	-0.37	0.36	-0.11	0.30
T2 violence*T3 neighborhood social resources	0.10	0.19	0.09	0.59

Table 4-15. Summary of Multiple Linear Regression Analysis for Variables Predicting T4 Violence, Regression-Imputation Dataset (n = 159)

Variable	B	SE B	<i>B</i>	P-value
<i>Step 1</i>				
T2 violence	0.55	0.07	0.56	0.00
<i>Step 2</i>				
T2 violence	0.54	0.06	0.55	0.00
T3 civic contribution	-0.49	0.22	-0.15	0.03
<i>Step 3</i>				
T2 violence	0.55	0.07	0.57	0.00
T3 neighborhood social resources	-0.25	0.21	-0.08	0.24
<i>Step 4</i>				
T2 violence	0.57	0.08	0.58	0.00
T3 civic contribution	-0.43	0.26	-0.13	0.10
T2 violence*T3 civic contribution	-0.14	0.11	-0.12	0.22
<i>Step 5</i>				
T2 violence	0.56	0.10	0.57	0.00
T3 neighborhood social resources	-0.23	0.25	-0.07	0.36
T2 violence*T3 neighborhood social resources	-0.01	0.12	-0.01	0.91

Table 4-16. Summary of Multiple Linear Regression Analysis for Variables Predicting T4 Violence, Multiple Imputation Datasets (n = 159)

Variable	B	SE B	P-value
<i>Step 1</i>			
T2 violence	0.52	0.10	0.00
<i>Step 2</i>			
T2 violence	0.52	0.10	0.00
T3 civic contribution	-0.44	0.41	0.31
<i>Step 3</i>			
T2 violence	0.52	0.11	0.00
T3 neighborhood social resources	-0.05	0.30	0.87
<i>Step 4</i>			
T2 violence	0.69	0.13	0.00
T3 civic contribution	-0.13	0.37	0.73
T2 violence*T3 civic contribution	-0.29	0.19	0.14
<i>Step 5</i>			
T2 violence	0.54	0.15	0.00
T3 neighborhood social resources	-0.02	0.41	0.96
T2 violence*T3 neighborhood social resources	-0.03	0.20	0.88

Note. Standardized Beta coefficients are unavailable with MI

CHAPTER V

DISCUSSION

The primary aim of the current study was to examine characteristics of young people who participated in the Lead Peace demonstration study. While many students ($n = 114$) participated in the evaluation for the entire study, a majority of the Lead Peace study sample ($n = 160$) completed surveys at only one or two time points. While specific circumstances for why students left the study are unknown to investigators, high levels of attrition are linked to high rates of student mobility in study schools. This study sought to compare and contrast characteristics of groups of these students, to shed light on similarities and differences of in-migrating and out-migrating students and those who stayed the duration of a longitudinal study. If investigators better understand characteristics of groups of mobile students attending school, this information may help better design future school-based evaluation studies. For example, a study design may include in-migrating and out-migrating students in the general sample of students to appropriately increase sample size and statistical power.

The secondary aim of this study was to compare methods of handling missing data. We offer evidence on the best methodological practice, specifically data imputation, for similar studies with small sample sizes where a majority of the sample is not present at all data collection points. To better understand methods for handling missing data, linear regression models were employed to examine relationships of T2

and T3 predictor variables with youth violence at T4. Neighborhood connectedness was examined as a potential predictor of youth violence based on its presence as an environmental attribute linked to youth violence in the Lead Peace conceptual framework (Sieving & Widome, 2008). Evidence from this study can inform scientists as they consider use of imputation methods in future longitudinal analyses of adolescent data sets where sizable proportions of the sample are not present at all data collection points.

This chapter opens with discussion of findings related to the study's primary aim and secondary aim. Study limitations and study strengths are then discussed. Finally, implications for future research and public health nursing practice are addressed.

Primary Aim Findings

Sample attrition often plagues longitudinal research, especially so with mobile adolescent populations (Noelle & Ochs, 2001; Rew, 2005; Seed, Juarez & Alnatour, 2009). Participant attrition is a particular risk with research in school settings that have high levels of student mobility. The Lead Peace study schools continue to have the highest rates of mobility in the Minneapolis Public School District (Appendix A), and rates similar to other urban school districts (Hartman, 2002). Attrition rates for the Lead Peace demonstration study were similar to those in other longitudinal studies of young adolescents in urban school-based settings (Apsler, 2009; Komro et al, 2008). This might be due to the fact that some youth health promotion interventions are

completed in urban schools which are faced with relatively high levels of student mobility (Hartman, 2002).

Overall attrition rates for the Lead Peace study were remarkably congruent with other longitudinal studies involving middle-grades adolescents (Hansen, Tobler & Graham, 1990). In fact, 33.3% overall attrition rate in Lead Peace was the exact mean for the six studies remaining after 36 months in their meta-analysis.

Despite small sample sizes within Lead Peace sub-sample groups (G2-G7), there were remarkably few differences in characteristics and behaviors across groups that were compared. This was especially evident in the traditional attrition analyses, out-migrating students lost to T3/T4 or T4 alone compared to the students who were present at all three survey points. Students who left the Lead Peace demonstration study in traditional longitudinal fashion were very similar to students who stayed in the Lead Peace study the entire time. Furthermore, out-migrating students who missed only T3 (G6) or T4 (G3) survey time point were virtually indistinguishable, depending on which time point variables were compared, from students who stayed in the survey for all three survey time points.

This may suggest that attrition/mortality for out-migrating students may not as concerning a validity issue as assumed in a small, school-based intervention like Lead Peace. One notable exception is violence involvement in G3 at the end of their 7th grade year, a time when these students reported significantly higher levels of violence involvement in the past 30 days compared to G1, and not congruent with T2 reporting at the end of their 6th grade year. Behavioral concerns, particularly violence involvement

at the end of a school year, among this group of students could be a sign of behavioral disruption leading to the student having to move rather than family residential mobility. Or perhaps family mobility is leading the student to become more disruptive in the classroom, as prior evidence has suggested (Smither & Clarke, 2008). More exploration is needed with individual students and families to understand if these hypotheses are true.

In-migrating student groups (G5 and G7) were different than G1 students on some characteristics, most notably bullying and violence measures. Differences were commonly seen in the first survey after a group moved into a new school. Psychosocial and behavioral measures were significantly different at T3 for G5 and at T4 for G7. In the former comparison, in-migrating students reported both less family connectedness and less school connectedness than G1 students at T3, the first survey for G5 students. And while not statistically significant, G5 students reported higher levels of violence involvement and bully victimization than G1 students. In the T4 survey, only family connectedness remained different between the same two groups of students. In the comparison between G1 and G7, in-migrating students reported having attended at least one other at greater proportions than G1 students despite survey administration happening at the end of the school year. Length of time living in the neighborhood was dramatically different between the two groups with the in-migrating group living in their neighborhood less than a year at far greater proportions than G1. Among the in-migrating students, nearly three-quarters were girls compared to half in the G1 group. Finally, among connectedness scales, in-migrating students (G7) were less connected to

their families, less connected to neighborhood social resources, reported lower ability for stress management, were more likely to be victims of bullying and engage in violence.

These juxtaposition findings of in-migrating and out-migrating students raise questions. While we see sample homogeneity among out-migrating groups and students present for the entire study, students joining a classroom environment seem to bring with them a different set of attributes, often disruptive in nature and with less pro-social connectedness. These new students could disrupt the general day-to-day flow of the classroom or the administration and evaluation of an intervention, at least in the initial period of adjusting to the classroom. If a classroom or a school is measured a cross-sectional intervals, an influx of in-migrating students could potentially skew responses in a negative fashion, diminishing an intervention effect for an entire classroom of students. Out-migrating students present for two years (G3) also reported higher levels of violence involvement at the end of their 7th grade year. As there was no follow-up to understand true reasons for a school move, one could consider a behavioral reason based on the difference seen in violence involvement. None-the-less, these students could also skew individual behavioral outcomes in cross-sectional evaluation.

Timing of survey administration may play a part in understanding group differences. When groups were compared using data at two different survey time points, some students responded in ways that deviated from earlier response patterns. For example, risk behaviors in groups G3 and G6 were no different than G1 during the 6th grade T2 survey, but were different from the G1 group during the 7th grade survey

(Group 3) or 8th grade survey administration (Group 6). Or another example, in the G1 versus G5 comparison, in-migrating students were quite different on many characteristics at T3 (their first year at the new school) but analogous on the same characteristics the following year at T4. This phenomenon was especially apparent in school connectedness—G5 students reported much lower levels of school connectedness compared to G1 at the end of their 7th grade year, but very similar levels during their 8th grade year. This may suggest a “melting-pot” effect in which in-migrators absorb into the classroom and school setting, becoming more homogeneous with other students over time. This was echoed in the words of mobile, homeless youth in a qualitative study by Rhodes (2008) where young people described a period of time fitting-in their new schools. Students in Rhodes (2008) study described a period of time marked by “showing off” to better fit in with students in their new school as well as nervously and cautiously picking peer groups at a new school. Further analyses of data from longitudinal studies with similar youth populations may uncover if this is simply artifact or truly a phenomenon.

The final group comparison analyses (G2 versus G7) highlighted the attributes of two groups of students, two years apart in age, who participated in the survey only once at either the beginning or once at the end of the study. These two groups of students were similar by gender and ethnic/racial self-report as well as the number of parents living with them at home. Interestingly, while the length of time living in their neighborhood was virtually analogous for both groups, the number of schools students had been in that school year was significantly different. Eighth-grade students reported

higher levels of school mobility than the 6th grade student group. An extension of this study would be to uncover behavioral differences by grade, perhaps by using school disciplinary records to understand if school change is associated with disciplinary reasons rather than family mobility.

Secondary Aim Findings

The study's secondary aim tested methods of handling missing data using statistical models that predicted T4 violence with T2 violence and T3 neighborhood connectedness indicators. Three methods of handling missing data were contrasted: analysis with data from those who only completed surveys at T2, T3 and T4 (G1), regression-imputation, and multiple imputation (MI). The sample for the regression-imputation dataset and the MI dataset included students who took all three surveys as well as those who left the study after T2 (G2) or left after T3 (G3). These students were chosen because they represent groups included in traditional attrition analysis typically reported in longitudinal studies. Three independent datasets created via these methods were used in linear regression models examining relationships between T2 violence involvement, T3 neighborhood connectedness and T4 violence involvement.

Methods of handling missing data and ease of computation

Each of the methods used to handle missing data had merits and limitations. As Ordinary Least Squares (OLS) regression was used for all three methods of handling missing data, each can be contrasted by their ease of statistical computation (McCleary, 2002; Patrician, 2002) and specificity of statistical output explained by prior

mathematical theory (Allison 2002; Musil, 2002; Patrician, 2002; Horton & Kleinman, 2007).

By default, regression analyses uses cases only with complete data, automatically decreasing sample size for that model. Analyses using commercial statistical packages are straightforward. If the variables modeled have less than 10% missing data and sample size large enough, there is little statistical power lost by not imputing data (Hansen et al, 1985; Allison, 2001; Allison, 2009). In the case of the Lead Peace dataset, 31-33% of the cases were missing for the variables included in these models. With such a large proportion of the sample missing, statistical power was compromised in our multivariate analyses.

Regression-based imputation, or imputation-by-case, required an extra step of statistical code to replace missing values prior to OLS regression. Still, the code required for regression-imputation is quite simple in common commercial statistical packages (SAS, SPSS, Stata) and the code for the OLS analysis is the same as any OLS regression, completed after and independently of the imputation step. The main limitation of this method, as described in Chapter II, is omission of an individual cases' standard error for the model point-estimates. Recall, the predicted values are a perfect linear function of the outcome in regression-imputation, so standard deviations of collated data will always be underestimated (Allison, 2009). Musil and colleagues (2002), Patrician (2002) and Newman (2003) model this phenomenon, comparing other imputation methods with simulated data. These authors caution that there is a potential for statistical invalidity when choosing regression-imputation over a "higher level"

imputation method especially when a study sample is as small as the Lead Peace study dataset.

Multiple imputation using Stata 10 required extra data analysis steps and a number of practice data analysis “runs” to progress to computing final models. Still, computation in Stata was remarkably simple and is said to be even easier and user-friendly with the recently-released Stata 11 (StataCorp, College Station, TX), with inherent multiple imputation modules. In contrast to regression-based imputation, MI output provides robust standard errors increasing the reliability of hypothesis testing.

Post-hoc correlations

Pair-wise correlations were computed after imputation datasets were created by regression-imputation or MI. These results paint a murkier picture of bivariate relationships in each of the datasets. As expected, a strong, positive, statistically significant relationship exists between T2 and T4 violence variables irrespective of method of handling missing data. This corroborates evidence from previous studies of youth violence (Borowsky, Widome & Resnick, 2008; Hawkins et al, 1998; Resnick, Ireland & Borowsky, 2004).

Neighborhood connectedness scales, neighborhood social resources and civic contribution, at T3 are highly correlated, though they continued to perform as independent constructs in these analyses. This T3 relationship between neighborhood connectedness scales and T4 violence involvement mirrors cross-sectional analysis

findings from an earlier data collection point in the Lead Peace demonstration study (Widome et al, 2008).

In all three datasets (G1 only, regression-imputation and MI), there is no relationship between T3 neighborhood social resources and T4 violence (non-significant, $r = 0.00, 0.00, \text{ and } 0.05$, respectively). However, there was a modest inverse relationship between T3 civic contribution and T4 violence, with that relationship significant at $p < 0.05$ in only the MI dataset ($r = -0.12, -0.12, \text{ and } -0.09$, respectively). This finding is striking, as it signals the potential promotive aspects of civic contribution on subsequent violence involvement.

Multivariate point estimates, standard errors and p-values by dataset

With a relatively small sample of students involved in the Lead Peace demonstration study, adding 50-53 young people to the sample by using imputation methods decreases the chances of Type II error (accepting a false null hypothesis) in hypothesis testing. If the full sample of young people who were present at one or two time points (groups G4-G7) were added into the imputed dataset, the number of participants would be even greater (total $n = 280$). This is a compelling reason for imputing data, especially in other small-sample studies.

Multivariate point-estimates were similar across datasets with isolated differences according to method of imputation. There was no clear trend in how the beta-value increased or decreased by method or by model, which is similar to findings in prior studies utilizing several imputation methods (Musil et al, 2002; Patrician, 2002;

Newman, 2003). Of particular interest were differences in standard errors (SEs) in each dataset for each regression model. In regression-imputation, the SEs decreased, as would be expected with an increase in sample size without accounting for respective changes in the standard deviation of that sample. The larger sample size in the regression-imputation models changed the p-values of some point-estimates. In particular, in the multivariate model testing the independent effect of civic contribution at T3 on violence involvement at T4, the p-value associated with the T3 civic engagement point-estimate was statistically significant ($p = 0.03$). Multiple imputation performed as described in Allison (2000) and Rubin & Little (2002)—the imputation of multiple datasets retained individual SEs across chained-equations and produced SEs much larger than those of the regression-imputation or OLS models. These increased SEs contributed to increased p-values in hypotheses tests, negating significant effects exhibited in the regression-imputation method.

Finally, there were paradoxical outcomes in statistical significance of bivariate correlations depending on imputation method. In our bivariate correlation analyses, there were significant relationships between T2 violence involvement and T3 neighborhood social resources as well as the relationship between T3 civic connectedness and T4 violence involvement. Those same relationships were not statistically significant in regression analysis using the same dataset. In multivariate models, there was a statistically significant relationship between T3 civic contribution and T4 violence in the model employing the regression-imputation dataset while no such relationship existed in the model utilizing the MI dataset. One possible explanation

is that in each test, the sample size and standard errors are at a “tipping point” so that adjusting the standard error slightly in either analysis shifted the significance of hypothesis testing. Another explanation may come from the nature of imputed datasets. Bivariate analysis with the MI dataset included all 795 cases without the mathematical adjustment that the Stata MI module provides during the “MIM” procedure in multivariate analysis. Thus, there is a chance that bivariate correlational analyses completed on datasets derived by MI are simply artifact.

In summary, each method of handling missing data had its merits and drawbacks. Despite concerns of “making up data,” the current standard in handling missing data involves an imputation method, preferably either a multiple-chained equation method or a maximum-likelihood estimation method (Allison, 2009; Little, 2010).

Study Limitations

Several limitations of the present study are noteworthy. First, and most concerning, was lack of statistical power in the Lead Peace dataset to detect compelling statistical differences. The Lead Peace demonstration study from the onset was designed as a small quasi-experimental project in a relatively homogenous geographic area of North Minneapolis, in four fairly homogeneous middle schools. Replicating the evaluation study in numerous schools serving low, middle and upper income student populations would not only have increased sample size and statistical power, it also would allow for school-level generalizations more in-line with properties of group-

randomized trials (Murray, 1989; Murray & Hannon, 2006). Furthermore, replicating the study in more heterogeneous schools with respect to socio-economic indicators may offer insights about student mobility and behavior in strata of students not accustomed to residential mobility linked to living in poverty.

As there was little study power, multivariate models were limited in the number of covariates which could be included in multivariate statistical models. The analyses of sub-groups in the present study further partitioned the already small sample, adding to the threat to statistical validity of the primary aim findings in particular. Given a larger sample, demographic covariates could be added to better examine relationships between the focal variables and other confounding factors.

Another potential threat was selection bias. Active parental consent and day-of-survey student assent were both required in order for data collection. The Lead Peace evaluation team has already described consent procedures and demonstrated that selection bias was greatly minimized in the baseline Lead Peace survey (Secor-Turner, 2010). In later rounds of the survey, there is a possibility that parents who chose not to consent or young people who chose not to assent were different than those who participated in the survey. In fact, the 33% parent refusal rate in T1 had decreased to 13% at T4, the end of the 8th grade year. There is a chance that over time as parents became more comfortable with the Lead Peace demonstration study and more consented to survey participation, families who chose not to consent may be systematically different than ones who consented.

Another limitation of the study is the validity threat of history, the concurrence of independent outside-study effects that might affect the outcome variable. It is difficult to untangle the potential threat of history, particularly environmental and time-period effects, on individual students in North Minneapolis. The years during which Lead Peace occurred were remarkable for violent episodes in these students' neighborhoods, especially in the first two years of the study. In fact, students in one of the study schools were subject to a random public shooting just one block from their school on a school day during the Lead Peace study period (Pabst & Chanen, "Teenager arrested in shooting..."). Most students have grown up and lived in these neighborhoods their entire lives. Still, the contemporary events in the lives of these young people certainly may influence how they responded to items on survey day. These factors include many aspects of the social-ecology: high neighborhood crime rates, general community malaise, high numbers of home foreclosures, "doubling-up" in family living situations, negative perception of public schools in the media, school closings, individual hopelessness and many others.

Adolescent researchers must routinely consider how to account for typical developmental growth (maturation) within a group of young people in longitudinal research (Lerner & Galambos, 1998). This effect was omnipresent and quite striking in our T2 survey as students were surveyed cross-sectionally as two groups with a summer of potential risk defining the two groups. Over the course of three months the summer of 2007, a seemingly homogeneous group of young people returned to school reporting increased reports of bullying, violent behaviors, and alcohol use, especially among

black, male students. While these analyses controlled for spring-fall 2007 survey administration, such adjustment merely adjusts the distribution for statistical analysis and is not an actual report of behavior among the two samples. An attempt at partitioning the T2 sample into two separate samples was considered for G2 v. G7 analyses, but the very small number of students in G2 taking the survey would have made statistical models null.

Finally, a determination of attrition missingness (missing completely at random (MCAR), missing at random (MAR) and not missing at random (NMAR)) is required in the first stages of data analysis planning (Duffy, 2006; Fitzmaurice, Laird & Ware, 2004; Zhang, 2008). Analyses addressing the study's secondary aim were completed with an assumption of missing at random (MAR). This determination was based on the finding from these primary aim findings and findings in Secor-Turner et al (2010) that those who did not consent were not systematically different at baseline measurement. In future studies of attrition, the type of missingness should be determined with planning study design to best inform statistical analyses for that study.

Study Strengths

Potential threats to validity were averted in both the current study and in the Lead Peace demonstration study as a whole. To assure the greatest number of students being surveyed at each survey point, there was a great effort to gain consent from parents of new students (and the new school) at the beginning of each survey period (Secor-Turner et al, 2010). Also, vigorous steps were taken by the Lead Peace

evaluation team to track students and survey in their new schools if they had moved from study schools.

Next, the current study is a study of attrition and common patterns of in-migration and out-migration of study participants in longitudinal research. Certainly, it would be of great benefit to follow-up with the families of students who left the study to better understand the rationale for having to move residences and to better understand individual student behaviors. Still, this detailed attrition analyses is an important step in informing methods for longitudinal research design (Hanson et al, 1985) and is a model for future research methodologies. While generalizability of findings may be limited to young adolescents in urban public schools within high-poverty neighborhoods, such schools are often the exact environments where such interventions often take place.

Implications for Future Research

The current study offers unique insight into the characteristics of middle school students missing at one or more data collection points in longitudinal studies. While we do not have information on the exact reasons why students left or joined study schools, this study shares valuable information about students who left and students who joined the Lead Peace demonstration study over three school years.

Serial cross-sectional verses longitudinal research

At least in this study, students who left the Lead Peace study were remarkably similar to the majority—students who participated in the study at all time points. But as

described earlier in this chapter, in-migrating students tended to be somewhat different than those present for all time points. These are notable findings for those choosing a study design involving mobile student populations, particularly when considering a serial cross-sectional design versus a longitudinal design. Researchers have debated the merits of serial cross-sectional designs over longitudinal designs, mostly in terms of cost-savings (Diehr et al, 1995; Murray, 1998; Stevens et al, 2005). However, the primary reason for choosing one of these designs over the other should be the focal research question (Murray, 1998). The choice of study design should be based on the researchers' interest in investigating change at a population level versus change at an individual level. With school-based studies, if the former was the goal, a serial cross-sectional design would be employed with the goal of assessing school-level change. If the latter was the research goal, school-based studies would employ a longitudinal design to measure individual change over time (Stevens et al, 2005).

In a sample of young people with high levels of mobility, or in a study involving high levels of in-migration and out-migration, investigators should consider the special implications for choosing a longitudinal design over a cross-sectional not only because of risk for attrition and study power (Stevens et al, 2005) but also the unique individual characteristics in-migrating students bring to their new schools. A study employing a serial cross-sectional design would need to take in to account the amount of time in the study school or treatment "dose" and adjust for that in analyses to account for students' time in the school. If environmental or classroom change is the standard for evaluation,

investigators should prepare for threats to statistical validity if there are high rates of student mobility.

The Lead Peace Evaluation Team invested a sizeable amount of resources (human and financial capital) to track and survey participants who left the Lead Peace demonstration study schools. Investigators studying individual change via repeated measures often lament this resource expenditure needed to obtain longitudinal data. There are instances when evaluating individual change should be the goal, such as in the case of youth violence. As our findings have shown, T4 violence involvement is strongly correlated with T2 violence involvement. Those students at highest-risk for violence involvement may be the same adolescents we wish to invest the most resources (both intervention and evaluation). In such instances, it may be important to carefully evaluate changes in individual-level behaviors, risk and protective factors over time.

Missing data methods

Data imputation computation is easy to perform, as noted by experts of missing data methodology (Allison, 2009). As statistical science evolves and researchers embrace imputation techniques, there is little doubt that data imputation will become a standard method in statistical analysis of longitudinal data. Multiple imputation commercial software has evolved so dramatically that anyone with even a basic statistical program package can use multiple-imputation chained-equations to easily impute missing data. Regression-imputation, while very easy to perform, does not have the same recognition of random effects error as MI methods with the same ease of

computing. Thus, a “newer” imputation method (MI) should be favored over single imputation methods (such as mean imputation and “hot deck” imputation). And as MI has been used as a proven imputation method (Allison, 2009), it should be favored over other imputation methods in most cases. Importantly, those planning longitudinal data analysis should strongly consider *any* method of imputation over analysis of data from available-case only when 10% or more of the sample are missing (Allison, 2002). The old adage “imputing data is too similar to making-up data” should be reconsidered when planning longitudinal data analysis. Researchers have much to gain by adding to their collected data using robust and proven imputation methods rather than disregarding incomplete data.

Implications for Public Health and Public Health Nursing Practice

Findings from the current study have practice implications for public health nurses, youth health workers, and public health program planners. The intended goal of the Lead Peace demonstration study was to decrease youth violence and school failure via involvement in a school-based service learning program that addressed risk and protective factors for youth violence and school failure, emphasizing opportunities to practice social skills, develop emotional skills, build caring relationships with peers and adults, and gain experience in pro-social school and community involvement. While the main effects of the Lead Peace demonstration study are still under investigation, this study invoked student perceptions about their neighborhoods and how they might give back to their communities as potential predictors of behavior change. Indeed, aspects of

neighborhood and community context have been shown to have a powerful impact on adolescent development and health (Brooks-Gunn, Duncan & Aber, 1997; Scales et al, 2001; Molnar, Cerda, Roberts & Buka, 2005). In this study, evidence of increased neighborhood connectedness predicting a decrease in youth violence at a later time was modest at best. The association between a particular neighborhood connectedness indicator, civic contribution, and subsequent violence involvement was in the desired direction and statistically significant in analyses using the regression-imputation dataset. Those planning youth development programs may well consider ways to enhance young peoples' civic contributions and neighborhood connectedness, if anything, as a part of a promoting "positive social connections" in the lives of young people (Konopka, 1973). In addition, health promotion and youth development programs might consider evaluating aspects of neighborhood that contribute to adolescents' health and well-being.

A foundation of this study was to explore the effects of student mobility on study designs, and to better understand characteristics of students who live in highly mobile environments. While much inference is needed to understand the phenomenon of mobility from the findings of this study, we have at least highlighted characteristics of mobile students. Further research is needed to better understand students' social contexts and reasons for student mobility so we can continue to offer increased support and encouragement. This latter idea was extended by Heywood, Thomas and Garrow (1997) who failed to see an impact on aggregate test scores in classrooms with high mobility students. They concluded "...perhaps increased rates of mobility are a fact of

urban life” and that educators might work to expand efforts to increase achievement in classrooms rather than decreasing mobility (p. 369). There remains a significant academic risk associated with student mobility. Practitioners might further consider the potential effects of mobility on health indicators.

Finally, the Lead Peace demonstration study was implemented with young adolescents, aged 11-14 years in their 6th – 8th grade years. Many youth prevention efforts tend to be implemented much later in adolescence, while middle and late adolescents are even more at-risk or actively engaged in violent acts. Beginning to intervene in the lives of young people in middle and late adolescence is simply too late. Prior research has shown that intervening much earlier “upstream” in adolescence can have positive outcomes, even lasting effects (Barnett, 1993; Hawkins et al, 1998; Herrenkohl et al, 2000; Livingston, McCafferey & Rennie, 2006). Further, school-level work to create a culture of peace and non-violence offers an important and unique impact on young adolescents’ social context as well as being a prime example of a public health approach to improve community health.

Conclusions

The current study offers new evidence describing a mobile population of young people at-risk for leaving longitudinal school-based research studies. The evidence herein may help investigators consider whether longitudinal or cross-sectional study design is most prudent, given the characteristics of students in study schools.

Further, the current study demonstrates methods of handling missing data in evaluation studies when study attrition and missing information is inevitable.

Traditional methods of dropping individual cases should be reconsidered. This study is evidence that sample size can be retained despite missing cases, and the accuracy of information not compromised using advanced statistical methods such as multiple imputation or maximum-likelihood estimation.

Finally, this study explores a new concept for health promotion in the lives of young people — neighborhood connectedness. In the current study, the evidence of the health promotive effects of neighborhood connectedness to prevent youth violence was modest at best. Further concept development is needed to refine this aspect of adolescents' social ecology. When this concept is more fully refined, adolescent health practitioners and advocates may have yet one more tool to add to the toolbox of promoting health and healthy development among young people.

ADDENDUM

Upon further review of the regression analyses in this study's secondary aim, it was determined that point estimates for the outcome variables in both regression imputation and multiple imputation may be considered theoretically invalid as many scholars recommend not imputing outcome variables or y-values. Therefore, T4 violence involvement findings utilizing imputed data in this dissertation study should be read and considered with extreme caution.

CHAPTER VI

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Appendix A- Demographic characteristics of study schools

	Attended '05-'06 ^a , (>95% attend)	Attended '07-'08 ^a , (>95% attend)	Inflow ^b , '05-'06	Inflow ^b , '06-'07	Enrolled full year, '05-'06	Enrolled full year, '07-'08	Free/reduced lunch, '05-'06	Free/reduced lunch, '07-'08	Suspensions for threats to safety, '05-'06	Suspensions for threats to safety, '07-'08
Cityview	60	55	20	17	80	83	91	92	21	14
NSJ	49	67	30	27	72	83	90	95	10	11
Jordan Park ^c	67	n/a	23	25	79	n/a	98	n/a	16	n/a
Lucy Laney	57	41	18	24	83	79	91	91	15	22
District average	57	61	19	19	83	88	76	72	11	7

^a Attended 95% is the percent of students who attended school at least 95 days and attended classes 95% or more of their enrolled days.

^b Inflow is the MPS measure of “turnover”, a measure of the number of new students since October divided by enrollment at that school. The lower the proportion, the fewer new students a school takes on.

^c Jordan Park Community School closed after the 2006-2007 school year.

Source. Minneapolis Public Schools, Research and Evaluation, [http:// www.incschools.com/mpls/main/selectreports.aspx](http://www.incschools.com/mpls/main/selectreports.aspx)

Appendix B- Lead Peace Survey

Study Identification Number



Lead Peace Survey

This instrument was developed by the Healthy Youth Development Prevention Research Center at the University of Minnesota, with support from a cooperative agreement from the Centers for Disease Control and Prevention (5 U48 DP000063-03). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

This research was approved for study by the University of Minnesota Institutional Review Board, IRB No. 0607S90127, and the Minneapolis Public Schools Research, Evaluation and Assessment Department No. 0-2006-17.

For further information about this questionnaire, contact:
Healthy Youth Development Prevention Research Center
Division of Adolescent Health and Medicine
Department of Pediatrics
University of Minnesota
200 Oak Street, S.E., Suite 260
Minneapolis, MN 55455-2002
Telephone: (612) 625-1674
FAX: (612) 626-2134
E-Mail: prc@umn.edu

Example Question.

Circle the response that most applies to you. Circle “YES!” if the statement is very true for you, “yes” if it is somewhat true, “no” if it is somewhat false, and “NO!” if it is very false.

I like Broccoli.	YES!	yes	no	NO!
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Thanks again for your help!

Section A. About You

Please circle one answer.

1. What grade are you in?

- a. 6th grade
- b. 7th grade
- c. 8th grade

2. How old are you?

- a. 10 years old or younger
- b. 11 years old
- c. 12 years old
- d. 13 years old
- e. 14 years old
- f. 15 years old or older

3. Are you...

- a. Male
- b. Female

4. How do you describe yourself? Are you...(Circle all that apply)

- a. American Indian or Alaskan Native
- b. Asian \longrightarrow

If Asian, are you Hmong?	Yes	No
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- c. Black or African American
- d. White
- e. Hispanic/Latino
- f. Some other race: _____

5. Do you live with your mother/stepmother or another person you consider to be your mother?

- a. Yes
- b. No

6. Do you live with your father/stepfather or another person you consider to be your father?

- a. Yes
- b. No

7. Is this the only school you have attended this school year, since September?

- a. Yes
- b. No → If no, how many **other** schools have you attended this school year?

Section B. Neighborhood

The next questions are about where you live or stay.

8. How long have you lived in your neighborhood?

- a. Less than 1 year
- b. More than 1 year but less than 3 years
- c. More than 3 years

9. Circle the response that most applies to you. Circle “YES!” if the statement is very true for you, “yes” if it is somewhat true, “no” if it is somewhat false, and “NO!” if it is very false.

a. People in my neighborhood are willing to help each other.	YES!	yes	no	NO!
b. I regularly stop and talk with people in my neighborhood.	YES!	yes	no	NO!
c. If I needed advice about something I could go to someone in my	YES!	yes	no	NO!

neighborhood.					
d.	I know someone I could borrow money from (for bus fare or something else).	YES!	yes	no	NO!
e.	There are adults in my neighborhood I look up to.	YES!	yes	no	NO!
f.	I am interested in finding out about new things that happen in my neighborhood.	YES!	yes	no	NO!
g.	My neighborhood is safe.	YES!	yes	no	NO!
h.	I visit with my neighbors in their homes.	YES!	yes	no	NO!
i.	I know the names of a lot of people in my neighborhood.	YES!	yes	no	NO!
j.	If I got into trouble I know someone who would help me out in my neighborhood.	YES!	yes	no	NO!
k.	Working to improve my neighborhood is important.	YES!	yes	no	NO!
l.	It is important to me to volunteer my time to help people who need help.	YES!	yes	no	NO!
m.	It is important to me to find a job that helps others.	YES!	yes	no	NO!
n.	I feel that I can make a difference in my neighborhood.	YES!	yes	no	NO!
o.	I plan to work with others to improve my neighborhood.	YES!	yes	no	NO!
p.	People should find time to help out in their neighborhood.	YES!	yes	no	NO!

Section C. Family and Friends

The next questions are about you and your family or who you consider to be your family.

10. Circle the response that most applies to you.

a. My family understands me.	YES!	yes	no	NO!
b. My family has fun together.	YES!	yes	no	NO!
c. My family pays attention to me.	YES!	yes	no	NO!
d. I feel close to my mother (or the person who is most like a mother to me).	YES!	yes	no	NO!
e. My mother cares about me.	YES!	yes	no	NO!
f. I feel close to my father (or the person who is most like a father to me).	YES!	yes	no	NO!
g. My father cares about me.	YES!	yes	no	NO!

11. In the past three months, has a parent or guardian talked to you about:

a. Problems at school	Yes	No
b. Fighting	Yes	No
c. Not using alcohol	Yes	No
d. Not using marijuana (grass, pot, weed)	Yes	No

12. These are questions about your peers (people who are the same age as you).

a. My peers care about me.	YES!	yes	No	NO!
b. I can tell my peers about my problems and troubles.	YES!	yes	No	NO!
c. My peers understand me.	YES!	yes	No	NO!
d. My peers accept me as I am.	YES!	yes	No	NO!
e. My peers listen to what I have to say.	YES!	yes	No	NO!
f. My peers are easy to talk to.	YES!	yes	No	NO!
g. I trust my peers.	YES!	yes	No	NO!

h. I talk to my peers' parents.	YES!	yes	No	NO!
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13. During the past week, did you:

a. Get a phone call, e-mail or text message from a friend?	Yes	No
b. Make a phone call, send an e-mail or text message to a friend?	Yes	No
c. Go to a friend's house?	Yes	No
d. Have a friend come over to your house?	Yes	No

14. In the past month, please indicate if you did the following:

a. I tried to stop other students from making fun of or teasing another student.	Yes	No
b. I tried to stop students from leaving another student out.	Yes	No
c. I helped someone stay out of a fight.	Yes	No
d. I told other students how I felt when they did something I didn't like.	Yes	No
e. I cooperated with others.	Yes	No
f. I protected someone from a bully.	Yes	No
g. I gave someone a compliment.	Yes	No
h. I helped other students solve a problem.	Yes	No
i. I tried not to break the rules at school.	Yes	No
j. I told students how I felt when they upset me.	Yes	No
k. I helped others participate in a group.	Yes	No
l. I took responsibility for a mistake.	Yes	No
m. I listened to another student when they had a problem.	Yes	No

Section D. Beliefs and Attitudes

The next questions are about you and how you feel.

15. Circle the response that most applies to you.

a. I think that most things I do will turn out okay.	YES!	yes	no	NO!
b. I usually know how other people are feeling.	YES!	yes	no	NO!
c. I hope for the best.	YES!	yes	no	NO!
d. I try not to hurt other people's feelings.	YES!	yes	no	NO!
e. It is easy to tell people how I feel.	YES!	yes	no	NO!
f. I get too upset about things.	YES!	yes	no	NO!
g. Having friends is important.	YES!	yes	no	NO!
h. I can stay calm when I'm upset.	YES!	yes	no	NO!
i. I am able to respect others.	YES!	yes	no	NO!
j. I fight with people a lot.	YES!	yes	no	NO!
k. It is hard to control my anger.	YES!	yes	no	NO!
l. I know things will be okay.	YES!	yes	no	NO!
m. Nothing bothers me.	YES!	yes	no	NO!
n. I feel confident.	YES!	yes	no	NO!
o. I like most people I meet.	YES!	yes	no	NO!
p. I can talk easily about my feelings.	YES!	yes	no	NO!
q. I care what happens to other people.	YES!	yes	no	NO!

Section E. School Experiences

The next questions are about education and your experiences in this school.

16. Circle the response that most applies to you.

a. People at school expect me to do well.	YES!	yes	no	NO!
b. I try hard on my schoolwork.	YES!	yes	no	NO!
c. My classes are interesting.	YES!	yes	no	NO!
d. I like school.	YES!	yes	no	NO!
e. My teachers have gotten to know me well.	YES!	yes	no	NO!
f. My teachers respect me.	YES!	yes	no	NO!
g. It is important for me to be at school everyday.	YES!	yes	no	NO!
h. Most people in my school trust me.	YES!	yes	no	NO!
i. If I need help on my schoolwork, I know someone I could ask.	YES!	yes	no	NO!
j. I get into conversations with adults at my school.	YES!	yes	no	NO!

17. Have you ever repeated a grade or been held back a grade?

- a. Yes
- b. No

18. Circle the response that most applies to you.

a. In school, it is hard for me to stay out of trouble.	YES!	yes	no	NO!
b. In school, it is hard for me to obey the rules.	YES!	yes	no	NO!
c. In school, it is hard for me to do the right thing.	YES!	yes	no	NO!
d. In school, it is hard to make friends.	YES!	yes	no	NO!
e. In school, it is hard to be accepted.	YES!	yes	no	NO!

19. During the past month, how often did you skip or cut school (whole day or a class)?

- a. I never skipped a full day or cut a class
- b. 1 or 2 times
- c. 3 or 4 times
- d. 5 to 9 times
- e. 10 times or more

20. Which of these best describes your school plans?

- a. I would like to quit school as soon as I can
- b. I plan to finish high school but don't think I'll go to college
- c. I'd like to go to some kind of trade school or vocational school after high school
- d. I'd like to go to college after high school

Section F. Activities

The next questions are about how you spend your time.

21. In the last year, have you participated in any activities outside of school, such as park & rec, church activities, music, media, dance, or volunteer work?

- a. Yes
- b. No

22. In the past month, how many times have you gone to a:

a. Public library?	Never	Once	More than Once
b. Church/Mosque/Synagogue?	Never	Once	More than Once
c. Park?	Never	Once	More than Once
d. YMCA/YWCA?	Never	Once	More than Once
e. Mall?	Never	Once	More than Once
f. Movie theater?	Never	Once	More than Once
g. Coffee house/Restaurant	Never	Once	More than Once

23. Briefly describe one activity that you do that is important to you.

-
24. Is this activity...
- a. In school
 - b. Outside of school
 - c. Both in school and out of school

25. In the past year, how many months have you been involved in this activity?

- a. I have not participated in this activity in the past year
- b. Less than 6 months
- c. About 6 months
- d. More than 6 months
- e. Nearly every month

26. How often do you attend this activity when it is held?

- a. Hardly ever
- b. Sometimes
- c. Often
- d. Most of the time

27. How important is this activity to you?

- a. Not important
- b. Important
- c. Very important

Section G. Teasing, Bullying, & Violence

The next questions are about teasing, fighting, and violence.

28. For each question, mark how many times you did this to another student at school or on the school bus during the past week. During the past week, how many times did you...

a. Leave someone out on purpose?	Never	Once	More than Once
b. Pick on someone?	Never	Once	More than Once
c. Say things about another student to make other students laugh?	Never	Once	More than Once
d. Ignore or stop talking to someone?	Never	Once	More than

			Once
e. Spread rumors or gossip about someone?	Never	Once	More than Once
f. Make fun of someone's family?	Never	Once	More than Once
g. Threaten not to be someone's friend?	Never	Once	More than Once
h. Threaten to hit or hurt another student?	Never	Once	More than Once
i. Ask someone to fight?	Never	Once	More than Once
j. Hit, shove, or push someone?	Never	Once	More than Once
k. Say something hurtful to someone in email or on the internet?	Never	Once	More than Once
l. Ruin someone's stuff?	Never	Once	More than Once

29. Think about what happened to you in the past week. For each question, mark how many times another student did this to you at school or on the bus. In the past week, how many times did someone...

a. Leave you out on purpose?	Never	Once	More than Once
b. Pick on you?	Never	Once	More than Once
c. Say things about you to make other students laugh?	Never	Once	More than Once
d. Ignore or stop talking to you?	Never	Once	More than Once
e. Spread rumors or gossip about you?	Never	Once	More than Once

f. Make fun of your family?	Never	Once	More than Once
g. Threaten not to be your friend?	Never	Once	More than Once
h. Threaten to hit or hurt you?	Never	Once	More than Once
i. Ask you to fight?	Never	Once	More than Once
j. Hit, shove, or push you?	Never	Once	More than Once
k. Say something hurtful to you in email or about you on the internet?	Never	Once	More than Once
l. Ruin your stuff?	Never	Once	More than Once

30. During the past month, how many times did you carry something that could be used to hurt someone?

- a. Never
- b. Once
- c. More than Once

31. When someone gets into a physical fight they look (check all that apply):

- Cool
- Stupid
- Grown-up
- Tough
- Out of control or crazy
- None of the above

32. Being in a gang is (check all that apply):

- Cool
- Stupid

- Grown-up
- Dangerous
- None of the above

33. In the past year, how often did you...

a. Get into a physical fight?	Never	Once	More than Once
b. Hurt someone badly enough for them to need bandages or care from a doctor or nurse?	Never	Once	More than Once
c. Use or threaten to use a weapon to get something from someone?	Never	Once	More than Once
d. Take part in a fight where a group of your friends was against another group?	Never	Once	More than Once

Section H. Tobacco, Alcohol, and Marijuana

The following questions are about cigarettes, alcohol, and marijuana.

34. How often have you smoked a cigarette or part of a cigarette in the past month?

- a. I have never smoked a cigarette
- b. I have smoked, but not in the past month
- c. 1 or 2 times
- d. 3 to 10 times
- e. More than 10 times in the past month

35. Circle the response that most applies to you.

a. Kids who smoke cigarettes are more grown-up.	YES!	yes	no	NO!
b. Kids who smoke cigarettes have more friends.	YES!	yes	no	NO!
c. Smoking cigarettes makes kids more relaxed.	YES!	yes	no	NO!
d. Smoking cigarettes makes kids look cool.	YES!	yes	no	NO!

36. How many times have you had an alcoholic beverage to drink, such as beer, wine, or win coolers, to drink in the past month?

- a. I have never had an alcoholic beverage to drink
- b. I have had an alcoholic beverage to drink, but not in the past month
- c. 1 or 2 times
- d. 3 to 10 times
- e. More than 10 times

37. Please indicate how strongly you agree or disagree with each statement.

a. Kids who drink alcohol are more grown-up.	YES!	yes	no	NO!
b. Kids who drink alcohol have more friends.	YES!	yes	no	NO!
c. Drinking alcohol makes kids more relaxed.	YES!	yes	no	NO!
d. Drinking alcohol makes kids look cool.	YES!	yes	no	NO!

38. How many times have you used marijuana in the past month (pot, grass, weed)?

- a. I have never used marijuana
- b. I have used marijuana, but not in the past month
- c. 1 or 2 times in the past month
- d. 3 to 10 times
- e. More than 10 times in the past month

39. Please indicate how strongly you agree or disagree with each statement.

a. Kids who use marijuana are more grown-up.	YES!	yes	no	NO!
b. Kids who use marijuana have more friends.	YES!	yes	no	NO!
c. Using marijuana makes kids more relaxed.	YES!	yes	no	NO!
d. Using marijuana makes kids look cool.	YES!	yes	no	NO!

☺ You are Done! ☺
Thank you for filling out this survey!