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Abstract

Adolescents engage in many risk-taking behaviors that have the potential to lead to injury. The school environment has a significant role in shaping adolescent behavior, and this study aimed to provide additional information about the benefits associated with connectedness to school. Early adolescents aged 13 to 15 years ($N = 509$, 49% boys) were surveyed about school connectedness, engagement in transport and violence risk-taking, and injury experiences. Significant relations were found between school connectedness and reduced engagement in both transport and violence risk-taking, as well as fewer associated injuries. This study has implications for the area of risk-taking and injury prevention, as it suggests the potential for reducing adolescents' injury through school based interventions targeting school connectedness.

Keywords: school connectedness; adolescents; risk-taking; injury

The Impact of School Connectedness on Violent Behavior, Transport Risk-taking Behavior,
and Associated Injuries in Adolescence

Injury is the leading cause of death among young people (Krug, McGee & Peden, 2002). Involvement in risk-taking behavior, including transport and violence-related risk-taking, is related to a greater risk of injury among adolescents. Transport-related risk-taking behaviors, defined in this study as passenger, motorcycle, and driving-related risk behaviors, account for the majority of adolescent injuries, and in Australia, transport-related injuries accounted for 30% of all injury deaths among young people (Australian Institute of Health & Welfare, AIHW, 2008). Young males and Indigenous Australians are overrepresented in transport-related deaths—with the transport-related death rate for young males being three times that of young females and the transport-related death rate for young Indigenous Australians being twice that of non-Indigenous young people (AIHW, 2008).

Other risk-taking behaviors that contribute to injury-related morbidity and mortality among adolescents include, for example, violence-related risks. Whereas injuries associated with violence are not often fatal, they are prevalent, and they can have significant injury consequences. For example, results from the Youth Risk Behavior Survey (YRBS, Centers for Disease Control and Prevention, CDC, 2010) showed that 32% of grade 9 to 12 students reported getting into a fight in the previous 12 months and that 4% of these had to be treated by a doctor or nurse (CDC, 2010). Similar to transport risks and injuries, boys participating in the YRBS were more likely to report getting into fights than girls (i.e., 33.9% of boys versus 22.9% of girls) and were also more likely to have been injured in fights than girls (i.e., 5.1% of boys versus 2.2% of girls). Hospitalization rates for assault during 2005 and 2006 were also 6 times higher among young Indigenous Australians than non-Indigenous young Australians (AIHW, 2008).

Due to its prevalence, unintentional injury and violence prevention have become an important part of health practice. Increasingly, injury prevention strategies for adolescents aim to reduce the risks and strengthen the protective factors associated with risk-taking behavior. School connectedness has been identified as a critical protective factor in adolescent development, and it has been shown to be related to higher levels of school retention, improved emotional health and wellbeing, and reduced problem behavior (e.g., Bond et al., 2007; Dornbusch, Erickson, Laird, & Wong, 2001; Shochet, Smyth & Homel, 2007). Students' sense of connectedness to their school, therefore, has the potential to serve in a protective role with respect to many adolescent outcomes, both physical and emotional. School connectedness has been defined as "the extent to which students feel personally accepted, respected, included and supported by others in the school social environment" (Goodenow, 1993, p. 80). The sense of connectedness goes beyond simply the relationships with individuals in the school setting and includes feelings of commitment to the institution and feeling connected to a larger community in a more global sense (Pittman & Richmond, 2008).

The literature relating to school connectedness arises from a variety of disciplines and encompasses a number of related terms and definitions. For example, in addition to school connectedness, diverse terms such as *school engagement*, *school bonding*, and *school attachment* are used in the literature. This diversity is also reflected in the fact that the construct has been assessed using many different measurement tools, with items reflecting factors such as attitudes toward school, commitment to school, involvement in school and school-related activities, relationships with teachers and peers, and overall school climate. Several papers summarizing the literature on connectedness (e.g., Jimerson, Campos, & Greif, 2003; Libbey, 2004; Maddox & Prinz, 2003; O'Farrell & Morrison, 2003) have, however, been able to identify a number of common components that appear to underlie the

construct. These components include *affective connectedness* (e.g., feelings of belonging in school and positive peer relationships), *behavioral connectedness* (e.g., academic engagement and extracurricular involvement), and *cognitive connectedness* (e.g., perceptions of teacher support and having a sense of rule fairness and a perception of safety).

Despite a general lack of consensus on terminology and definitions in the literature, there are underlying commonalities that suggest school connectedness is an important construct that has been shown to be related to a number of adolescent developmental outcomes. For example, research has shown that students' increased connectedness to school is related to a greater likelihood of school completion (Bond et al., 2007). A recent Canadian study of the relations between school connectedness and early high school dropout also found that a global measure of connectedness, incorporating behavioral components (i.e., attendance and discipline), affective components (i.e., liking school and interest in school), and cognitive components (i.e., willingness to learn), was significantly predictive of school dropout (Archambault, Janosz, Fallu, & Pagani, 2009).

Positive relations have also been found between school connectedness and both emotional and physical health. Shochet, Dadds, Ham, and Montague (2006), for example, found in a prospective study of Australian high school students that school connectedness was strongly and negatively correlated with current and future depressive symptoms, a finding which was supported in a later study that showed that connectedness accounted for more of the variance in depressive symptoms than parental attachment (Shochet et al., 2007). Another Australian study showed that students in grades 6, 8, and 10 who had a strong connection to their school were more likely to report feeling "healthy" on a self-rated health scale (McLellan, Rissel, Donnelly, & Bauman, 1999), and a United States study found a relation between students' feelings of disconnectedness from school and both declining

health status and increasing visits to the school nurse (Bonny, Britto, Klostermann, Hornung, & Slap, 2000).

Of particular relevance to the current study, students' connectedness to school has been found to be negatively related to a number of risk-taking behaviors in adolescence, including violence, alcohol use, and other drug use. For example, a study using data from the National Longitudinal Study of Adolescent Health showed that higher levels of school connectedness among adolescents were related to delayed initiation of deviant behavior, including cigarette smoking, marijuana use, delinquency, and violent behavior (Dornbusch et al., 2001). A United States study of students in grades 6 to 8 also showed that school connectedness was significantly related to a measure of problem behavior including involvement in vandalism, fighting, and weapon carrying as well as alcohol use and substance use (Simons-Morton, Davis Crump, Haynie, & Saylor, 1999). Bond and colleagues (2007), meanwhile, have further demonstrated the relation between students' connectedness to school and participation in health risk behaviors; Australian students in grade 8 with low school connectedness but good social connectedness were more likely to participate in health risk behaviors in grade 10, including smoking tobacco, smoking cannabis, and excessive drinking.

Considering its relation with reduced problem behavior and improved emotional health, as well as its relation with academic engagement and school retention, school connectedness is a potentially important factor to target in school-based prevention programs. Connectedness is also an achievable target for change, because many of the school-related factors shown to be related to increased levels of connectedness are able to be modified in the school context (Eggert & Kumpfer, 1997). In particular, factors relating to the school climate have been identified as important in fostering students' connectedness to school (Blum, 2005). For example McNeely, Nonnemaker, and Blum (2002), using data from the National

Longitudinal Study of Adolescent Health, found that students reported higher school connectedness when their teacher managed the class in a controlled and positive way, when the school enforced tolerant disciplinary policies, when the school population was small, and when the students were engaged in extracurricular activity. Blum (2005) further indicated that three school characteristics are particularly important in encouraging connectedness and student achievement: high academic standards and strong teacher support, a school environment characterized by positive and respectful relationships, and a physically and emotionally safe school environment.

Several studies targeting change in the classroom and school environment have shown some success in increasing students' connectedness to school. Examples include studies from the Child Development Project (Battistich, Schaps, & Wilson, 2004) and the Seattle Social Development Project (Catalano, Haggerty, Oesterle, Fleming, & Hawkins, 2004). These intervention programs both incorporated aspects of classroom change (e.g., collaborative focus, teacher training in classroom management) and school-wide strategies (e.g., strengthening school community and parent education) and demonstrated important changes in students' connectedness, including their sense of the school as a community, their liking of school, and their overall engagement. Whereas these studies have shown that it is possible to increase students' connectedness to school, it is important to broaden our understanding of the potential benefits of such school based programs in terms of adolescent health outcomes.

In summary, previous research has shown that school connectedness is an important and modifiable protective factor associated with a number of adolescent outcomes, including engagement in risk-taking behaviors (e.g., Dornbusch et al., 2001). However, although this research has demonstrated that increased school connectedness is related to a decrease in involvement in specific risk behaviors, it is limited in that studies have primarily employed measures of violence, alcohol use, and substance use behaviors (e.g., Bond et al., 2007;

Dornbusch et al., 2001). These studies do not incorporate measures of those risks known to cause the most serious injuries in adolescence and contribute most significantly to the burden of harm for this age group—namely, transport risks. To date, there is minimal research into possible links between school connectedness and transport risk-taking behavior, including riding as passengers with dangerous drivers, underage driving, and motorcycle use.

Additional research is also needed to consider the health outcomes of such risk behaviors. Increased involvement in risk-taking behavior is known to be associated with increased injury among adolescents (e.g., Pickett et al., 2002). The education literature has extended our understanding of school connectedness through demonstrating its relations with both student behavior, including academic achievement and school conduct, as well as outcomes of such behavior, including engagement and conversely, disengagement and school dropout. It is also important to extend our understanding of school connectedness to its relations with associated injury and harm. These extensions would have significant implications for school-based injury prevention strategies and would further contribute to our understanding of the potential benefits of increasing students' connectedness to school.

The aim of this study was to, therefore, determine whether the protective factor of school connectedness is related to the risk-taking behaviors of adolescents, particularly in areas involving transport and violence as well as injuries resulting from both. Such findings may have important implications for the development of strategies to target school connectedness as a point of intervention with the aim to reduce these specific risk-taking behaviors and subsequent injuries sustained by adolescents.

For the purposes of the current research, school connectedness was defined as the extent to which students feel included, supported, and engaged within the school and by the school community. This definition encompasses the findings from the literature (e.g., Jimerson et al., 2003; Maddox & Prinz, 2003) that shows that school connectedness can be

conceptualized globally and that it includes factors such as students' relationships with teachers, perceptions of fairness, and engagement in the school community.

Four hypotheses were generated to address the research aim: (a) Participants with higher school connectedness scores will be significantly less likely to have engaged in transport risk-taking behaviors, (b) Participants with higher school connectedness scores will be significantly less likely to have engaged in violent risk behavior, (c) Participants with higher school connectedness scores will be significantly less likely to have sustained transport-related injuries, and (d) Participants with higher school connectedness scores will be significantly less likely to have sustained violence-related injuries. It was also hypothesized that transport and violence risk behavior and injury would vary by gender and ethnic background and that school connectedness would contribute to the prediction of these outcomes over and above demographic variables.

Method

Participants

Grade 9 students who were enrolled in five state-funded high schools in the greater Brisbane area of Queensland, Australia, were invited to participate in the research. The Index of Relative Socio-Economic Advantage/ Disadvantage, as derived from the 2001 Census, was obtained for the five schools. The Index is constructed from attributes of the population in the area, such as educational attainment, income, employment and occupation, and ranges from 1 to 10, with low values indicating disadvantage and high values indicating advantage. Three of the schools are located in somewhat advantaged areas (Index scores of 7-8) and the other two schools are located in disadvantaged areas (Index scores of 1; Australian Bureau of Statistics, 2005).

Parental consent for participation was received for 540 of 901 Grade 9 students enrolled across the five schools (60%)¹. Some differences in parental consent rates were

observed across the schools; however, importantly, there were no differences among schools in connectedness scores. All of the 540 students provided their own written assent to participate. Of the 540 participants, 49% were boys. Participants ranged in age from 13 to 15 years, with a mean age of 13.45, and they reported their ethnic backgrounds as Aboriginal/Torres Strait Islander (4.75%), Pacific Islander (8.12%), Asian (9.50%), and White Caucasian (77.62%). Of those identifying as White Caucasian, 92.35% were born in Australia, 5.61% born in New Zealand, and 2.04% born in Europe and South Africa.

Measures

Demographics. Students were asked to provide demographic information including age, gender, and ethnic background (with response options including Aboriginal, Torres Strait Islander, Asian, Pacific Islander and other, including White Caucasian).

Risk-taking behavior. The measure of risk-taking behavior was based on the Australian Self-Reported Delinquency Scale (ASRDS; Mak, 1993), with adjustments made by Western, Lynch, Ogilvie, and Fagan (2003). Each item was the description of a risk-taking behavior (e.g., ridden with a dangerous driver and taken part in a group fight), and participants were asked to respond with yes responses if they had engaged in the behavior during the past three months. Western et al.'s (2003) adjustments resulted in a measure with clearly defined subscales comprising of related risk behaviors, including assault, illegal vehicle use, public disorder, drug and alcohol use, theft and burglary, and vandalism. The measure was also able to differentiate between groups, with differences in total scale scores demonstrated between school-based, vulnerable cohorts and offending cohorts, and showed good scale reliability, with Cronbach's alphas for each subscale ranging from .67 to .85 (Western et al., 2003).

Participants completed the entire adjusted ASRDS; however, for the current study, only items from two subscales were included: four relating to violence and five relating to

transport risk behavior (as shown in Table 1). The four items relating to violence risk behavior formed a subscale, yielding a Cronbach's alpha of .76 (Western et al., 2003). For the current study, Cronbach's alpha for the violence subscale was .65. The items relating to transport risk behavior were further modified from Western et al.'s (2003) "illegal vehicle use" subscale to be more appropriate for an early adolescent sample. For example, "driven without a license" was modified to "driven a car on the road" because all participants were unlicensed. In addition, the "illegal vehicle use" subscale reported by Western et al. consisted of six items; the item "stolen things or parts from a vehicle" was removed because this item did not relate to a potentially injury-causing risk behavior. The result was a five-item transport risk behavior subscale. For the current study, Cronbach's alpha was .70, whereas Cronbach's alpha for Western et al.'s six-item subscale was .85.

Injury. Self-reported injury was assessed using the Adolescent Injury Checklist (AIC; Jelalian, Spirito, Rasile, Vinnick, & Arrigan, 1997). Each item was the description of an injury situation (e.g., injured in a fight and injured as a passenger in a vehicle), and participants were asked to respond with yes responses if they had been injured in that situation in the past 3 months. Cronbach's alpha for the 17-item injury situation scale in the current study was .76, whereas a Cronbach's alpha coefficient of .68 was reported by Jelalian et al. (1997). The entire scale was administered, but the current study included subscales from only three relating to motor vehicle (transport) injuries and two items relating to interpersonal violence injuries (as shown in Table 1).

School connectedness. School connectedness was assessed using the School as a Caring Community Profile-II (Lickona & Davidson, 2003). Students rated statements regarding their perceptions of the school community and school relationships on a five-point Likert scale, with responses ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Example items include, "students care about each other," "teachers go out of their way to

help students,” and “teachers are unfair to students.” Total scores were calculated by summing across items. The Cronbach’s alpha coefficient for the eight-item scale was .71.

Procedure

Approval for the conduct of this research in the selected high schools was initially obtained from a University Human Research Ethics Committee and from the relevant State Education Board. Individual school principals were then contacted for permission to conduct the research in their schools. Active parental consent was obtained prior to students’ participation by sending an information sheet about the research project and consent form home. Parents signed the consent form and returned it to the school to indicate their permission for their children to participate.

The questionnaires were administered during 45-minute sessions by researchers trained in the questionnaire administration procedure. Only students with parental consent for participation were present. Teachers remained in their classes to supervise but were not involved in the research process. Information sheets and consent forms were distributed to the students, after which a researcher read aloud a standardized instruction sheet. Researcher training included practicing responses to typical student questions, and teachers were asked to not respond to student queries. Data collection was conducted in the first half of the school year, and school vacations did not fall within the three month reporting period.

Data Analysis

Questionnaire responses were entered initially into SPSS v17.0, with 10% of the questionnaires being randomly selected and accuracy of their data entry checked by a second researcher. The level of agreement between these researchers was greater than 95%.

All analyses were conducted with significance level set at $p < .05$. Due to the small proportion of missing data (<5% for each variable) and the large sample size, pairwise deletion was used (see Tabachnick & Fidell, 1996).

All assumptions for logistic regression analysis were initially examined and found to be met. These assumptions include the assumption of linearity, which was assessed through tests of significance of the interaction between predictors and their log transformations, for each of the four outcome variables (see Hosmer & Lemeshow, 1989). Results revealed that all four interaction terms were statistically significant, $p < .01$.

Results

Risk-taking and Injury Experience

The top two sections of Table 1 show the proportion of students who reported participation in risk-taking behaviors in the previous 3 months. Riding as passengers of dangerous drivers and being involved in a group fight were the most common transport and violence-related risk-taking behaviors among both boys and girls. The bottom section of Table 1 also shows the proportion of boys and girls within the sample who reported having sustained transport or violence-related injuries in the past 3 months. Injuries sustained riding motorbikes, mopeds, or quad bikes were the most frequently reported transport-related injuries among boys, whereas injuries sustained as a passenger in a vehicle were the most frequently reported among girls.

The majority of students do not report participation in risk taking or experience of injuries; 62.0% reported no transport risk behaviors, 66.4% reported no violence risk behaviors, 74.2% reported no transport-related injuries, and 72.6% reported no violence-related injuries. These variables were therefore coded as dichotomous, reflecting (a) participation in at least one of the risk-taking behaviors or experience of at least one of the injuries or (b) none of the risk-taking behaviors or injuries. Table 1 also presents, at the bottom of each section of the table, the proportion of boys and girls who reported at least one of the transport risk behaviors, violence risk behaviors, transport injuries, or violence injuries.

Analyses were initially undertaken to determine differences in the four risk-taking behavior or injury variables according to gender and ethnic background and to identify factors that may need to be controlled for in subsequent analyses. Chi-square analyses revealed that more boys than girls reported participation in transport risk behaviors, $\chi^2(1) = 9.78, p = .002$; violence risk behaviors, $\chi^2(1) = 11.25, p < .001$; and also transport-related injuries, $\chi^2(1) = 6.20, p = .013$. Additionally, analyses by ethnic background revealed that differences existed for participation in violence risk behaviors, $\chi^2(3) = 13.16, p = .004$; experiences of violence injuries, $\chi^2(3) = 7.99, p = .046$; and experiences of transport injuries, $\chi^2(3) = 11.01, p = .012$. Considering the differences in outcome variables observed for both gender and ethnic background, subsequent analyses controlled for these two factors.

Hypothesis Testing

Four separate sequential logistic regression analyses were conducted to determine whether school connectedness statistically predicted participation in transport and violence risk-taking and experiences of transport and violence injury². For each of these analyses, the dependent variable was participation in at least one of the transport or violence risk-taking behaviors (versus none) or experience of at least one of the transport or violence injuries (versus none). Gender and ethnic background were entered as a block at the first step in the regression model for all analyses. Table 2 shows the findings of the logistic regression analyses predicting transport and violence risk behavior and injuries from school connectedness, statistically controlling for gender and ethnic background. All four hypotheses were supported by the data with school connectedness significantly predicting each of the dependent variables after accounting for the variance attributed to gender and ethnic background.

The complete model, including gender, ethnic background and school connectedness, significantly predicted involvement in transport risk-taking behaviors, $\chi^2(5) = 32.07, p < .001$,

Nagelkerke $R^2 = .09$. At the first step, with gender and ethnic background included, the model was significant, $\chi^2(4) = 15.65, p = .004$, Nagelkerke $R^2 = .04$. At this step, gender was the only significant predictor, with boys 1.71 times more likely to report transport risk behaviors than girls. At the second step, school connectedness significantly contributed to the prediction of transport risk-taking, $\chi^2(1) = 15.31, p < .001$. For each unit increase in school connectedness scores, the odds of involvement in transport risk-taking became 73% smaller than the odds of not participating in transport risks, after holding demographic variables constant.

The full model predicting violence risk-taking was also significant, $\chi^2(5) = 54.29, p < .001$, Nagelkerke $R^2 = .15$. The first step, including gender and ethnic background, significantly predicted violence risks, $\chi^2(4) = 21.59, p < .001$, Nagelkerke $R^2 = .06$. Boys were 1.66 times more likely to report violence risk behaviors than girls, and students of Pacific Islander descent were 4.25 times more likely to report these risks than students of other ethnic backgrounds, including White Caucasian students. At the second step, higher school connectedness scores also predicted lower involvement in violence risk-taking behavior after controlling for the significant effects of gender and ethnic background, $\chi^2(1) = 28.60, p < .001$. For each increasing unit in school connectedness scores, the odds of participating in violence risk behavior became 62% smaller than the odds of non-involvement.

The complete model, including gender, ethnic background and school connectedness, also significantly predicted both transport injuries, $\chi^2(5) = 23.16, p < .001$, Nagelkerke $R^2 = .09$, and violence injuries, $\chi^2(5) = 28.38, p < .001$, Nagelkerke $R^2 = .11$. The first step of both these models was significant; for transport injuries: $\chi^2(4) = 15.12, p = .004$, Nagelkerke $R^2 = .06$; and for violence injuries: $\chi^2(4) = 12.71, p = .013$, Nagelkerke $R^2 = .05$. Gender was not found to be a significant predictor in either of these analyses; however, Pacific Islander students were found to be 2.33 times more likely to report transport injuries and 2.48 times

more likely to report violence injuries than students of other ethnic backgrounds, including White Caucasian students. At the second step, school connectedness significantly contributed to the prediction of both transport injuries, $\chi^2(1) = 7.66, p = .006$, and violence injuries, $\chi^2(1) = 14.34, p < .001$, over and above demographic variables. For each unit increase in school connectedness scores, the odds of experiencing transport-related injuries became 77% smaller than the odds of not experiencing these injuries. Similarly, for each increasing unit in school connectedness scores, the odds of experiencing violence-related injuries became 69% smaller than the odds of not having experienced violence injuries, holding demographic variables constant.

Discussion

The aim of the current research was to further develop understanding of the protective nature of school connectedness by exploring relations between connectedness and risk-taking behavior and associated injury. In particular, this paper explored links between reports of school connectedness and transport and violence risk and injury. Understanding these links is important in that, whereas research has shown a relation between school connectedness and health risk behaviors such as violence and substance use, there has been no exploration of how this link may extend to transport-related risk behaviors and how it may impact injury outcomes.

It was hypothesized that higher levels of school connectedness would be related to reduced participation in transport and violence risk behaviors and with decreased reports of transport and violence-related injuries. All four hypotheses were supported. Higher scores on the school connectedness scale predicted lower involvement in both transport and violence risk-taking behaviors, after accounting for the variance in these risk behaviors attributable to gender and ethnic background. Similarly, higher ratings of school connectedness were related to fewer reports of transport and violence-related injuries. Although the effect sizes found in

this study were relatively small, the findings are similar to those found in previous research regarding relations between students' connectedness to school and other risk behaviors, including violence, delinquency and substance use (e.g., Dornbusch et al., 2001, who reported odds ratios of 0.68 to 0.79 for these behaviors).

In particular, the finding that violence risk-taking behavior is related to school connectedness reflects the results of previous research including Wilson (2004), who found that school connectedness was inversely associated with students' level of aggression and victimization, and Henrich, Brookmeyer and Shahar (2005), who showed that school connectedness was related to decreased exposure to weapon violence over time. It would appear, however, that school connectedness also acts to protect adolescents from involvement in a wider range of risk behavior than previously studied. Students in the current study who have higher school connectedness scores also reported lower participation in transport risk behaviors. These behaviors included motor vehicle risks, such as being a passenger of a dangerous driver and underage driving, and motorcycle risks. This finding is valuable as it identifies school connectedness in early adolescence as an important protective factor for risk behaviors that take place outside of the school setting.

In the current study, gender was also found to be a significant predictor of participation in transport-related risk-taking behavior, with boys reporting more transport risk behavior than girls. This finding is consistent with previous research indicating that boys are at greater risk for transport-related deaths (AIHW, 2008). Also in line with previous research (e.g., CDC, 2010), gender was found to be a significant predictor of violence-related risk behavior, with more boys than girls engaged in such risks.

A new and significant finding of the current research, however, was that students of Pacific Islander descent reported more frequent involvement in violent behavior, and reported more injuries, than did students of other ethnic backgrounds. Previous research by the authors

has also found that school connectedness was a significant predictor of risk-taking behavior among students of Pacific Islander descent, whereas factors such as peer pressure and parental attachment were not (Chapman, Buckley, & Sheehan, 2009). Such findings suggest the need for more research to be conducted into ethnic background, school connectedness, and risk behavior and the potential for injury prevention strategies to be tailored to students of different backgrounds.

This study was also designed to determine whether school connectedness was related to the outcome of adolescent risk behavior: injury experience. It was found that school connectedness is significantly associated with students' reports of transport and violence-related injuries, over and above the impact of gender and ethnic background, which is likely a result of the relations between connectedness and participation in transport and violence risk-taking behaviors. Again, although the proportion of variance accounted for in this study was relatively small, these results have important implications for future research into adolescent injury and for potential intervention programs.

Implications for Prevention Programs

The current findings have some important implications for prevention programming. Adolescent risk-taking and injury prevention programs are generally limited to individual attitude or knowledge change for one particular aspect of behavior (Nigg, Allegrante, & Ory 1999). The current findings, however, suggest that school based prevention programs may also incorporate social and contextual protection in the form of increased school connectedness. It has been previously suggested that interventions for adolescent risk-taking behavior should focus on changing institutions that are important in adolescents' lives as well as seeking to change individual attitudes and behaviors (e.g., Dryfoos, 1990). Approaches that target change in students' connectedness to school may also have an additional benefit through the fact that increases in connectedness are protective against a number of additional

health risk behaviors as well as internalizing problems such as depression (e.g., Shochet et al., 2007).

It may be that the school level is an appropriate context in which to intervene, and that wider school-level changes may complement implementation of individual attitude and behavior change programs. Students' connectedness to school is considered to be potentially modifiable (Eggert & Kumpfer, 1997), considering that many factors associated with connectedness are able to be targeted within the school social context, including the classroom management environment and disciplinary practices (e.g., McNeely et al., 2002). School connectedness interventions targeting such aspects of the school environment have also been successfully implemented, with positive results on students' connectedness and risk-taking behaviors. For example, the Seattle Social Development Project targets students' problem behavior and their connectedness to school through a combination of teacher training in classroom management and instruction methods, parent education, and a social competence training curriculum (Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999). A long-term follow up of this program showed that fewer students in a full-intervention group (where the intervention was provided from grades 1 to 6) than students in a late-intervention group (where the intervention was provided from grades 5 to 6 only) reported violent behavior, heavy drinking, sexual risks, and pregnancy when followed up to age 18 years. The full-intervention group also reported greater connectedness to school as well as more commitment and less school misbehavior (Hawkins, et al., 1999).

Evaluation has also been undertaken of an Australian program, the Gatehouse Project, which targets increases in school connectedness among high schools students (Bond, Glover, Godfrey, Butler & Patton, 2001). This program involved implementation of specific strategies tailored to each school, with strategies including whole school bullying prevention programs, training in classroom management and teaching styles, and the incorporation of

developing social and emotional competency into curriculum materials. In addition, teacher professional development, which focused on classroom strategies such as the use of small group work and role play for general curriculum delivery, was encouraged. Although the results of this evaluation have not shown an impact on students' connectedness, they have shown some important effects for a reduction in health risk behaviors, including smoking and alcohol use (Bond et al., 2004). Considering the results of the current study, the potential may exist to use the positive findings of school connectedness interventions in adolescent injury prevention research.

Qualifications and Future Research Directions

This study does, however, have several limitations, including a reliance on self-reported levels of risk-taking behavior, injury, and connectedness. Although self-reports have been suggested to be biased by participant recall or socially desirable responses, a number of studies have supported the reliability and validity of adolescent self report responses to school-based questionnaires involving both injury (e.g., Begg, Langley & Williams, 1999) and risk-taking behaviors (Brener et al., 2002). The reliability coefficients for the currently used measures, including those from the ASRDS, AIC, and School as a Caring Community Profile – II, are considered acceptable but low, with Cronbach's alphas ranging from .65 to .76 (Murphy & Davidshofer, 1988). Previous research has also not assessed the validity of the injury or school connectedness scales. These measurement limitations should be taken into account when considering the results of the current study.

This study also only involves cross-sectional data, and therefore the direction of causality in the relation between school connectedness and risk-taking behaviors and injury is unable to be examined. Previous longitudinal research has, however, shown that increasing levels of school connectedness over time are related to decreased risk-taking behaviors including alcohol use and violence (Hawkins et al., 1999). Therefore, although the current

results are insufficient to infer direction of causality, previous research has provided some evidence that connectedness acts as a protective factor in the development of adolescent risk behavior.

The data are also based on Australian adolescent responses, and therefore, results may not generalize to other populations. Again, however, previous research appears to add some support to the cross-cultural nature of these findings, because school connectedness has been shown to be related to risk-taking behavior in adolescent populations in the United States (e.g., Dornbusch et al., 2001; Simon-Morton et al., 1999).

Finally, this study is also limited in that it focused on only school connectedness as a predictor of adolescent risk behavior and injury. Additionally, only gender and ethnic background were controlled for in the analysis. The effect sizes observed in the current study were quite small, with full model Nagelkerke R^2 in the range of .09 to .15. Participation in risk-taking behavior is clearly linked with other factors, both intrinsic to the adolescent as well as existing in the adolescent's wider social environment, including individual attitudes and beliefs as well as peer and family relationships. This research was limited in that these factors, as well as other potentially relevant demographic factors such as socioeconomic status, were not included and, therefore, were not able to be analyzed for the current study. As previously stated, effective interventions are those that target risk and protective factors across a number of levels, including individual based factors and those in the wider social environment, such as connectedness to school.

Considering these limitations, future research may assess the protective nature of school connectedness in terms of reduced injury using longitudinal designs. This research would enable an understanding of the causal processes underlying the relation between connectedness and adolescent risk and injury. Research could also potentially incorporate measures of injury with established validity and those that do not rely on adolescent self

reports, such as medical records or school based reports of injury. Additionally, research could be progressed through the implementation and evaluation of interventions that target school connectedness – either alone or in conjunction with other school-based injury prevention strategies – with evaluation focusing on impact on adolescent risk behavior and associated injury.

Conclusion

The school environment has a demonstrated and significant role in shaping adolescent behavior. This study provided additional information about the benefits associated with feeling connected to one's school. Although the causal direction of this relation is unknown due to the cross-sectional nature of the research, significant relations were found between higher school connectedness and (a) reduced engagement in transport and violence-related risk-taking and (b) lower violence and transport-related injuries. Thus, this study has implications for the area of adolescent risk-taking and injury prevention.

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Footnotes

¹ An initial analysis of response rates for the current study revealed that parental consent rates by school did not differ by the socioeconomic status of the area in which the school is located, as measured by the Index of Relative Socio-Economic Advantage/Disadvantage (comparing students in areas with Index scores of 7-8 with students in areas with Index scores of 1), $\chi^2(1) = 2.24, ns$. Comparisons between students for whom consent was obtained or not obtained were unable to be made, as no information was collected regarding non-consenting students.

² Initially, analyses were conducted to determine appropriate use of individual and school-level data. An ANOVA test showed that there were no significant differences in school connectedness scores by school ($p = .191$). Logistic regression analyses controlling for school effects at the first step showed that school effects did not contribute any unique variance to any of the four outcome variables ($ps = .174$ to $.899$). Therefore, and considering also the small sample size of schools, only individual-level analyses are reported.

Table 1

Proportion of Students Reporting Risk-taking Behaviors and Injuries, Past 3 Months, by Gender

	%	%
	Boys	Girls
Transport risk-taking behaviors		
Ridden with dangerous driver	26.3	19.6
Ridden motorcycle on the road	24.4	8.1
Ridden with drunk driver	21.5	17.8
Driven car on the road	18.7	8.9
Driven car or motorcycle after drinking	7.3	1.9
At least one transport risk-taking behavior	45.0	31.9
Violence risk-taking behaviors		
Taken part in a group fight	26.2	24.0
Deliberately hurt or beaten up somebody	21.1	10.1
Used a weapon in a fight	13.4	4.1
Threatened someone or forced them to give you things	13.0	5.6
At least one violence risk-taking behavior	41.4	27.6
Transport-related injuries		
Injured riding a motorbike, moped or quad bike	24.6	11.2
Injured riding as a passenger in a vehicle	13.5	13.2
Injured driving	7.2	4.4
At least one transport-related injury	31.7	21.6
Violence-related injuries		
Injured in a physical fight with someone	22.8	17.2

Injured by being physically attacked by another person	21.4	17.1
At least one violence-related injury	31.8	23.9

Note. All missing data < 5%.

Table 2

Logistic Regression Analyses Predicting Transport and Violence Risk-taking and Injuries from School Connectedness, Gender, and Ethnic Background (N = 509)

Variable	R^2	b (SE)	Wald	OR (95% CI)	p
Transport risk-taking					
Step 1	.04				
Gender ^a		0.53 (0.20)	7.35	1.71 (1.16, 2.51)	.007
Ethnic background ^b					
Aboriginal/Torres Strait Islander		0.88 (0.45)	3.84	2.41 (1.00, 5.80)	.050
Pacific Islander		0.67 (0.36)	3.48	1.96 (0.97, 3.98)	.062
Asian		0.13 (0.33)	0.15	1.14 (0.59, 2.18)	.699
Step 2	.09				
School connectedness		-0.31 (0.08)	15.31	0.73 (0.63, 0.86)	<.001
Violence risk-taking					
Step 1	.06				
Gender ^a		0.51 (0.21)	5.86	1.66 (1.10, 2.50)	.015
Ethnic background ^b					
Aboriginal/Torres Strait Islander		0.84 (0.46)	3.34	2.31 (0.94, 5.67)	.068
Pacific Islander		1.45 (0.38)	14.79	4.25 (2.03, 8.88)	<.001
Asian		0.14 (0.35)	0.16	1.15 (0.58, 2.29)	.694
Step 2	.15				
School connectedness		-0.47 (0.09)	28.60	0.62 (0.58, 0.74)	<.001
Transport injury					
Step 1	.06				
Gender ^a		0.34 (0.25)	1.84	1.41 (0.86, 2.31)	.175

Ethnic background ^b					
Aboriginal/Torres Strait Islander	0.97 (0.55)	3.16	2.65 (0.91, 7.73)	.075	
Pacific Islander	0.84 (0.42)	4.05	2.33 (1.02, 5.29)	.044	
Asian	-1.11 (0.62)	3.21	0.33 (0.10, 1.11)	.073	
Step 2	.09				
School connectedness	-0.27 (0.10)	7.66	0.77 (0.63, 0.93)	.006	
<hr/>					
Violence injury					
Step 1	.05				
Gender ^a	0.34 (0.24)	1.97	1.40 (0.87, 2.26)	.161	
Ethnic background ^b					
Aboriginal/Torres Strait Islander	1.07 (0.55)	3.77	2.92 (0.99, 8.61)	.052	
Pacific Islander	0.91 (0.42)	4.72	2.48 (1.09, 5.62)	.030	
Asian	-0.47 (0.47)	0.98	0.63 (0.25, 1.58)	.322	
Step 2	.11				
School connectedness	-0.37 (0.10)	14.34	0.69 (0.57, 0.84)	<.001	

Note. R^2 = Nagelkerke's R^2 . OR = odds ratio. CI = confidence interval. Wald = Wald statistic,

which tests whether the b coefficient is significantly different from zero. b = regression coefficient. SE = standard error.

^aReference category is girls. ^bReference category is White Caucasian