The Traumatic Impact of Motor Vehicle Accidents in High School Students

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ObjectivesTo obtain the year prevalence of nonfatal motor vehicle accidents (MVAs) in adolescents, to describe trauma symptoms (posttraumatic stress, depression, anxiety, dissociation), and to test a theoretical model of traumatic events. MethodsA community-based sample of 3,007 adolescents (mean age: 14.6 years) completed questionnaires regarding MVAs, appraisals, coping, support, and trauma symptoms. ResultsThree percent of the adolescents reported being injured in a MVA during the past year. Of the adolescents who reported a MVA in their life (22.4%), 11.0% reported significant posttraumatic stress or other trauma symptoms. Structural equation modeling revealed that negative appraisals mediated the relation between trauma symptoms and MVA severity. Avoidant coping partially mediated the relation between appraisal and trauma symptoms. Social support was associated with less negative appraisals and with more avoidant coping. ConclusionsResults suggest the need for a better registration of young traffic victims to optimize screening for psychological problems.

Key wordsadolescents; motor vehicle accidents; risk and protective factors; trauma symptoms; year prevalence rate.

IntroductionIn high-income countries approximately 1,500 per 100,000 children and adolescents are injured each year in motor vehicle accidents (MVAs) (Mayhew, Singhal, Simpson, & Beirness, 2004; Olofsson, Bunketorp, & Andersson, 2009). There is consensus that these data underestimate the actual number of victims (World Health Organization, 2009). Official rates often only include severely injured children. However, criterion A of the Posttraumatic Stress Disorder Diagnosis (PTSD, DSM-IV-Tr, 2000) describes a traumatic event as an event that “involves actual or threatened death or serious injury, or a threat to the physical integrity of oneself or others,” which also includes young traffic victims with only mild or no injuries. Between 16% and 35% of children and adolescents injured in traffic develop posttraumatic stress symptoms (PTSS) 1 month after the accident (Landolt, Vollrath, Timm, Gnehm, & Sennhauser, 2005; Olofsson et al., 2009). About 18% of them experience symptoms up to 6 months to 1 year after the MVA (Bryant, Mayou, Wiggs, Ehlers, & Stores, 2004; Landolt et al., 2005). In addition to PTSS, these children may also suffer from other trauma symptoms such as depression, anxiety, or dissociation (Bryant et al., 2004; Stallard, Velleman, Langsford, & Baldwin, 2001).
To better understand posttraumatic reactions, various models on risk- and protective factors have been investigated. Recently, Bal and colleagues (2009) integrated the general stress model (Lazarus, 1991) and the transactional model of Spaccarelli (1994) and found support for their model when tested in sexually abused adolescents (Figure 1). According to this model, negative appraisals and avoidant coping mediate the relation between trauma severity and symptoms. Social support is assumed to have an indirect protective influence on trauma symptoms through its negative relation with both negative appraisals and avoidant coping. Even though it is found that appraisals, coping, or support affect the development of PTSS in young traffic victims (Keppel-Benson, Ollendick, & Benson, 2002; Meiser-Stedman, Dalgleish, Glucksman, Yule, & Smith, 2009; Stallard & Smith, 2007), no study has yet investigated the interrelations between all these factors.

Most research on young traffic victims concluded that injury severity, often used as an objective index of trauma severity, was not related with PTSS (Olofsson et al., 2009). Only one study reported a positive relation between injury severity and PTSS (Keppel-Benson et al., 2002). Possibly the victims in this study, who were recruited via police reports, may have represented a broader degree of injury in comparison to studies that recruited victims via emergency departments. Also, in contrast to most other studies, this study did not control for the effects of appraisals (Bryant et al., 2004; Landolt et al., 2005), which are assumed to be mediating between trauma severity and subsequent symptoms (Bal et al., 2009).

Appraisals can be defined as the victims’ beliefs to what extent a traumatic event is threatening or is causing emotional or physical harm (Lazarus, 1991). It has been shown that perceived threat during the MVA is predictive for trauma symptoms in children (Bryant et al., 2004; Olofsson et al., 2009). A longitudinal study in young survivors from assaults or MVAs suggested that perceived threat may only have an effect in the acute phase, whereas other negative appraisals (e.g., of intrusive memories, MVA, or symptoms) may be involved in PTSS development and maintenance over time (Meiser-Stedman et al., 2009). Research on other stressful events has related appraisals to avoidant coping (Lengua, Sandler, West, Wolchik, & Curran, 1999). For example, Shelton and Harold (2008) found that adolescents’ appraisals mediated the relation between interparental conflict and avoidant coping.

Coping is generally defined as the cognitive and behavioral efforts to manage stress (Lazarus & Folkman, 1984). A review in pediatric injury patients concluded that avoidant coping plays a predictive role in trauma symptoms (Langeland & Olff, 2008). Stallard, Velleman, Langsford and Baldwin (2001) found an association between PTSS and avoidant coping in children who were injured in traffic, which was later confirmed in two longitudinal studies in young traffic victims (Ehlers, Mayou, & Bryant, 2003; Stallard & Smith, 2007).

Social support, defined as the presence of individuals who provide help, plays a protective role in the development of trauma symptoms (Langeland & Olff, 2008). The model of Bal et al., (2009) proposes that the relation between social support and trauma symptoms is indirect and has an effect through its association with the victims’ appraisals and coping strategies. The relation of avoidant coping with social support has mainly been described in other traumatic events (Bal, Van Oost, De Bourdeaudhuij, & Crombez, 2003; Vernberg, LaGreca, Silverman, & Prinstein, 1996). Keppel-Benson et al., (2002) found that social support from parents reduced later avoidance in children who were injured in traffic. The relation between negative appraisals and social support is less investigated in children and adolescents and results are equivocal (Bal et al., 2009; Ellis, Nixon, & Williamson, 2009).

Following the current status of research in MVAs, this study aims to (a) estimate year prevalence of MVAs among Flemish adolescents, (b) assess prevalence rates of trauma symptoms in adolescents who experienced a MVA during

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**Figure 1.** Theoretical model of traumatic events.
*Note: The information for this figure is adapted from Bal et al. (2009).*
their life-time, (c) test the theoretical model of Bal et al., (2009) in order to explain the role of appraisals, coping and social support in the development of these trauma symptoms.

Methods
Participants
Of the initially 3,722 randomly selected Flemish high school students, parents of 469 students did not provide consent, and parents of 37 adolescents did not return the informed consent papers. Also, 150 students did not participate due to illness or absence on the day of testing. Data from 12 participants were excluded from the study cohort as they filled out the questionnaires incorrectly. Forty-seven participants were excluded as they were younger than 11 or older than 18 years. Information on these nonrespondents (19.2%) is not available.

Our analyses are based on data from 3,007 students (80.8% from the total sample; 52.5% boys). Mean age of the sample was 14.62 (SD = 1.83), and all age groups were equally represented (11–13 years: 32.9%, 14–15 years: 34.3%, 16–18 years: 32.8%). Fifty-five percent of the students attended general secondary school, 30.3% technical secondary school, 14.3% vocational training, and 0.7% art education. Socioeconomic status (SES) was based on the profession of the father, according to the EGP-classification (Erikson, Goldthorpe, & Portocarero, 1979). Fifteen percent of the students were classified with high SES, 41.4% with average SES, and 33.6% with low SES. The sample was assumed to be representative for Flemish adolescents.

Procedure
The research protocol was approved by the Ethical Committee of the Ghent University Hospital. Written informed consents were obtained from students and their parents. To obtain a representative cross-sectional sample, we used cluster sampling (for school and classes). Of the 45 randomly selected Flemish high schools, 17 schools declined to participate because of time restrictions. In every school, the students of two randomly selected classes from each year took part. During two sequential lessons, participating students completed the questionnaires in groups of 10–12 under supervision of the researcher. Adolescents who reported to have personally experienced in their life a MVA, defined as accidents that occurred on a public road and with at least one motor vehicle involved, were categorized in the MVA Group (22.3%). Students who indicated two or more MVAs were asked to reflect upon the most distressing accident. The remaining adolescents were categorized in the Control Group (77.7%) and filled out dummy questionnaires. To compare our results to existing research on risk-and protective factors, we focused only on direct traffic victims. Adolescents who merely witnessed, but were not involved in a MVA (21.3% of the total sample) were included in the control group. The traumatic impact on witnesses will be described in more detail in another manuscript.

Measures
Demographic and MVA Characteristics
An ad hoc self-report instrument was developed to assess demographic and MVA characteristics. MVA items concerned “Time since MVA” (<1, 1–6, 6–12 months, and >1 year), “type of road user” (pedestrian, driver of a bicycle or another vehicle, passenger), “type of injury” (no injury, injury, consult in hospital, >48 hr in hospital, intensive care), and “type of injury in others” (no injury, nonfatal injury, fatal injury). Injury was defined as any physical damage to the body caused by the MVA. “Type of injury” was a combination of the presence of personal injury of the adolescent victim and the time spent in the hospital as the indicator of injury severity. “Type of injury in others” assessed the injuries of other people in the MVA, in three categories with increasing severity.

Other Stressful Events
A questionnaire based on the checklist for stressful events of the Clinician-Administered PTSD scale for Children and Adolescents (CAPS-CA) (Nader, 1997; Dutch translation by Bal, 1998, unpublished data) was presented with two response categories (experienced, not experienced). As a pilot study with 16 adolescents revealed that 3 of the 17 items representing stressful events (number 5 “being near to chemicals, leaking gas, or radiation; being made sick from poison”; 11 “being near dying, hungry, or homeless people; being around kids without any parents to take care of them”; and 14 “violent dead or dead bodies”) gave rise to equivocal interpretations, these items were removed from the questionnaire (Bal, Crombez, Van Oost, & Debourdeaudhuij, 2003).

Negative Appraisals
The Appraisal Scale (Stallard & Smith, 2007, translated in Dutch using back and forth translation, by Tierens & Bal, 2008, unpublished) assesses MVA-related appraisals during the past week (e.g., negative interpretations of symptoms, injustice, permanent change, and heightened future danger). Twelve items had to be answered on a
6-point scale (‘‘not at all” to “all the time’’). The original version showed good internal reliability (Stallard & Smith, 2007). Cronbach’s α’s for the subscales in this study were .51 (negative interpretations), .69 (permanent change), and .59 (future danger). Because the subscale “Injustice” contains only one item, Cronbach’s α could not be computed.

Social Support
The Crisis Support Scale (CSS; Joseph, Andrews, Williams, & Yule, 1992; Dutch translation by Bal, 1998, unpublished data) is a 7-item questionnaire which assesses received social support on a 7-point Likert-type scale (‘‘never’’ to “always”). High scores indicate high levels of support. The Dutch version of the scale showed adequate psychometric properties (Bal et al., 2009). For this study, Cronbach’s α was .68 for support immediately after the MVA as well as support related to the MVA at time of the assessment.

Avoidant Coping
The How I Cope Under Pressure Scale (HICUPS; Ayers, Sandler, West, & Roosa, 1996; Dutch translation by Bal, 1998, unpublished data) assesses coping strategies that children and adolescents use when having a specific problem, in this case the MVA. On a 4-point scale (“never” to “usually”) adolescents indicated how often they used a particular strategy in the past month. For the purpose of this study, only the subscale “Avoidant Coping” was used, which consisted of 12 items that refer to “Avoidant Actions,” “Repression,” and “Wishful Thinking.” The translated version of the HICUPS showed good to sufficient internal consistency (Bal et al., 2003). Within this research, the Cronbach’s α for the subscales was .70 (avoidant actions), .55 (repression), and .75 (wishful thinking).

Trauma Symptoms
The Trauma Symptom Checklist for Children (TSCC; Briere, 1996; Dutch translation by Bal, 1998, unpublished data) assesses trauma symptoms during the past month. Students answered the 54 items on a 4-point scale (“never” to “almost all of the time”), while thinking about the MVA. Only four of the six subscales were used: Fear, Depression, Posttraumatic stress, and Dissociation. The translated version of the TSCC showed good psychometric qualities (Bal, Van Oost, et al., 2003). In this study, Cronbach’s α’s were .83 (fear), .87 (depression), .87 (posttraumatic stress), and .83 (dissociation).

Posttraumatic Stress Symptoms
The Children’s Revised Impact of Events Scale (CRIES-13; Dillen, 2004; Perrin, Meiser-Stedman, & Smith, 2005) consists of 13 items and 3 subscales: intrusion, avoidance, and arousal. On a 4-point scale (“none” to “a lot”) adolescents indicated how often a thought, behavior, or feeling related to the MVA occurred in the past week. Total scores range from 0 to 65, with a cutoff at 30 to indicate the children who are at risk for PTSD (Perrin et al., 2005). Research showed a satisfactory internal consistency (Smith, Perrin, Dyregrov, & Yule, 2003). Within this sample, Cronbach’s α’s were .73 (avoidance), .84 (intrusion), .76 (arousal), and .88 (total score).

Emotional and Behavioral Problems
The Youth Self-Report (YSR/11-18; Achenbach & Rescorla, 2001; Verhulst, van der Ende, & Koot, 1997) assesses general emotional and behavioral problems during the past 6 months. Hundred and twelve items were answered on a 3-point Likert scale (“not true for me” to “very true for me”). The Internalizing score consists of the syndrome scales “Anxious/Depressed”, “Somatic complaints,” and “Withdrawn/Depressed”. The Externalizing score includes “Aggressive behavior” and “Rule taking behavior”. The YSR has shown excellent reliability and validity (Achenbach & Edelbrock, 1981). Within this research, Cronbach’s α’s were .88 (internalizing problems) and .86 (externalizing problems).

Data Analysis
Statistical analyses were performed with PASW Statistics version 18 and Mplus version 6.1 (Muthén & Muthén, 2010). Pearson chi-squares and analyses of variance were used to test the significance of, respectively, categorical and continuous relations of demographic and MVA characteristics between groups. Effect sizes were reported in terms of Cohen’s d (small ≥ .20, medium ≥ .50, large ≥ .80) for group comparison (Cohen, 1988).

The proposed model was tested with Structural Equation Modeling (SEM). Several types of indices for determining overall fit were used (Hu & Bentler, 1999). The Chi-square Goodness-of-Fit (χ²) statistics tested the null hypothesis that the model is correct, with a nonsignificant p-value indicating an excellent fit. The root mean square error of approximation (RMSEA) is an absolute fit index with values close to .06 indicating a fair model fit. The Comparative-Fit Index (CFI) is an incremental fit index with values > .90 representing a good fit. The standardized root mean square residual (SRMR) represents a standardized summary of the average difference in residuals, with values < .08 indicating a good fit.
Results

Objective 1: MVAs in High School Students

Of all adolescents, 22.4% reported that they experienced at least one MVA during their life. In most cases (55.7%), the accident occurred more than 1 year prior to assessment of the questionnaire. Most adolescents were a passenger (57.2%) or a driver of a bicycle or other vehicle (37.3%) during the accident, 5.5% was a pedestrian. Table I represents the distribution of type of injury, type of injury in others and other stressful events.

Based on those adolescents who were injured in experienced a MVA over the past year (6.2%), the year prevalence for adolescents injured in traffic was 2.7%, additional 3.5% adolescents were not injured in the accident. Thirty-one students (1.3% from the total sample) consulted a hospital after having had a MVA in the past year.

Objective 2: Trauma Symptoms after MVAs

Scores on the CRIES (PTSS) and TSCC (other trauma symptoms) were not normally distributed (positive kurtosis) and were log-transformed for further analyses.

The MVA and control group differed in age \( F(1,2888) = 26.10, p < .001; \ d = 0.23 \), type of education \( \chi^2(3) = 17.73, p < .001; \ d = 0.15 \), and stressful events \( \chi^2(1) = 37.99, p < .001; \ d = 0.23 \). Mean age in the MVA group was 14.94 (SD = 1.79) compared to 14.53 (SD = 1.83) in the control group. The control group reported higher levels of education. About 41.5% adolescents in the MVA group, compared to 29.0% in the control group, described other stressful events in their life: disaster (2.2%; 1.1%, respectively), fire or explosion (3.7%; 3.4%), serious accident (9.5%; 3.4%), being attacked (3.3%; 1.7%), sexual abuse (5.8%; 2.3%), living in a neighborhood with street fights or war (3.7%; 1.7%), physical neglect (0.3%; 0.4%), abduction (0.4%; 0.3%), serious disease (5.8%; 2.4%), death of someone close (25.1%; 17.6%), seriously injured someone (2.4%; 1.5%), other (10.6%; 8.2%). No differences were found for gender \( \chi^2(1) = 2.87, p = .090 \) and SES \( \chi^2(3) = 4.35, p = .226 \).

Multivariate analyses (MANOVA) revealed differences in behavior problems (YSR) between the MVA and the control group when witnesses of a MVA were included \( F(2,2926) = 19.53, p < .001 \) or excluded from the control group \( F(2,2300) = 28.58, p < .001 \). Univariate analyses (ANOVAs) showed small significant effects for internalizing \( F(1,2927) = 14.18, p < .001, d = .17; F(1,2301) = 17.52, p < .001, d = .19 \) and externalizing problems \( F(1,2927) = 35.58, p < .001, d = .27; F(1,2301) = 54.16, p < .001, d = .34 \). The MVA group reported more internalizing (M = 13.31, SD = 8.44) and externalizing problems (M = 12.59, SD = 7.51) compared to the control group with (M = 11.94, SD = 7.83 and M = 10.74, SD = 6.81, respectively) or without witnesses (M = 11.77, SD = 7.79 and M = 10.27, SD = 6.55, respectively). MANCOVAs, including age, type of education, or other stressful events as covariates did not yield different results \( F(2,2797) = 5.68, p < .01 \).

The prevalence rates of PTSS (CRIES) and other trauma symptoms (TSCC) indicated that 11.0% of the adolescents in the MVA group described significant PTSS (4.2%), other

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<th>Type of injurya</th>
<th>N</th>
<th>CRIES PTSS, M (SD)</th>
<th>TSCC</th>
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<tbody>
<tr>
<td>No injury (64.3%)</td>
<td>411</td>
<td>10.37 (10.52)</td>
<td>4.30 (3.62)</td>
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<tr>
<td>Injury, no hospital (18.2%)</td>
<td>116</td>
<td>12.33 (10.85)</td>
<td>5.16 (4.03)</td>
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<td>&lt;48 hr in hospital (12.8%)</td>
<td>82</td>
<td>13.58 (13.06)</td>
<td>5.15 (4.25)</td>
</tr>
<tr>
<td>&gt;48 hr in hospital (2.3%)</td>
<td>16</td>
<td>24.07 (21.69)</td>
<td>5.07 (4.31)</td>
</tr>
<tr>
<td>Intensive care (2.2%)</td>
<td>14</td>
<td>20.35 (18.25)</td>
<td>3.79 (4.68)</td>
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| Type of injury in othersb | N     | CRIES PTSS, M (SD) | TSCC                  |
| No injury (73.7%) | 443   | 10.40 (10.23)     | 4.17 (3.52)           |
| Nonfatal injury (23.8%) | 143   | 14.26 (13.85)     | 5.15 (3.94)           |
| Fatal injury (2.5%) | 15    | 30.22 (20.89)     | 8.49 (7.00)           |

| Other stressful eventsb | N     | CRIES PTSS, M (SD) | TSCC                  |
| No (58.5%) | 393   | 9.85 (9.80)       | 4.04 (3.31)           |
| Yes (41.5%) | 279   | 14.51 (13.84)     | 5.41 (4.41)           |

Note. There were no differences for type of road user and time since MVA

a

b

p < .001 for PTSS

p < .001 for other trauma symptoms.
trauma symptoms (4.3%) or both (2.5%). The reported other trauma symptoms were depressive feelings (3.7%), fear (3.1%), dissociation (3.1%) and posttraumatic stress (2.5%). Means and SDs are presented in Table II.

Next, the effect of type of injury amongst MVA victims was explored. Although results showed an univariate effect for PTSS \(F(4,598) = 4.21, p < .01\), pairwise comparisons of PTSS between groups revealed no significant differences. A MANOVA showed no effect of type of injury on other trauma symptoms \(F(16,627) = 1.23, p = .234\). However, analyses showed significant differences in PTSS \(F(2,567) = 9.42, p < .001\] and other trauma symptoms \(F(4,591) = 3.35, p < .01\] when groups were defined as a function of the type of injury in others. Especially victims of MVAs in which someone was fatally injured reported high scores for trauma symptoms. Analyses also revealed significantly different PTSS \(F(1,612) = 18.40, p < .001\] and other trauma symptoms \(F(4,657) = 8.28, p < .001\] between victims who did or did not reported other stressful events. The report of at least one other stressful event was related with more trauma symptoms. The report of PTSS and other trauma symptoms did not differ according to type of road user \(F(3,606) = 0.50, p = .682; F(16,643) = 0.86, p = .623\), respectively] or time since the MVA \(F(3,527) = 1.62, p = .184; F(12,548) = 1.08, p = .372\), respectively]. Untransformed means and standard deviations for the subgroups are shown in Table I.

### Objective 3: A Model of Risk and Protective Factors for Trauma Symptoms

Table II presents the means, SDs, and correlations among observed variables. The Mplus MLR estimator was used (Muthén & Muthén, 2010) to obtain robust estimates with missing data. This estimation method uses Full Information Maximum Likelihood (FIML) to estimate the parameters of the model and produces sandwich-type standard errors that are robust to nonnormality and a scaled test statistic that is asymptotically equivalent to the Yuan-Bentler T2* test statistic. About 0.1% of the data was missing, but all cases were included in the analysis. The standard coefficients and the goodness-of-fit indices \(\chi^2(83) = 308.95, p < .001, \text{RMSEA} = .064; \text{CFI} = .94; \text{SRMR} = .060\] suggested that the theoretical model of Bal et al., (2009) provided a satisfactory fit to the data. The standardized measurement loadings and structural results are presented in Figure 2.

With regard to the measurement model, all standardized parameter estimates were significant \(p < .001\). Two indicators were used to assess Objective Severity of the MVA: adolescents’ self reported injury severity (.38) and

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<tr>
<td>M (SD)</td>
<td>0.60 (0.95)</td>
<td>0.29 (0.51)</td>
<td>0.45 (1.28)</td>
<td>1.94 (3.45)</td>
<td>3.79 (3.24)</td>
<td>0.99 (1.49)</td>
<td>29.91 (7.93)</td>
<td>29.41 (7.28)</td>
<td>8.57 (2.96)</td>
<td>7.47 (2.92)</td>
<td>7.73 (3.10)</td>
<td>4.61 (3.80)</td>
<td>8.57 (2.96)</td>
<td>7.47 (2.92)</td>
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<td></td>
<td>1.53***</td>
<td>.15***</td>
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<td>.25***</td>
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<td>.80***</td>
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<td>.08***</td>
<td>.45***</td>
<td>.41***</td>
<td>.84***</td>
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injury severity of others (.40). Negative Appraisals was assessed with four indicators (i.e., negative interpretation of symptoms = .63; permanent change = .71; heightened future danger = .66; injustice = .62). Three indicators assessed Avoidant Coping: repression (.48), avoidant actions (.84), and wishful thinking (.76). Crisis support after the MVA (.83) and support at time of the survey (.97) were used as indicators of Social Support from the family. Four indicators (subscales TSCC) were used to assess Trauma Symptoms: anxiety = .88; depression = .86; posttraumatic stress = .90; and dissociation = .83.

Inspection of the standardized residuals and the modification indices showed no particular signs of model misfit. As shown in Figure 2, objective severity was associated with more negative appraisals (.62, p < .001) which, in turn, were positive related with avoidant coping (.41, p < .001) and trauma symptoms (.48, p < .001). The report of avoidant coping was also associated with more trauma symptoms (.27, p < .001). Social support was negatively related with negative appraisals (−.14, p < .05) and positively with avoidant coping (.16, p < .01). The standardized indirect effect was −.04 [(−.14) × .41 × .27 + (−.14) × .48 + .16 × .27] between family support and trauma symptoms, and .37 between MVA severity and trauma symptoms.

An alternative model with an additional direct effect of objective severity on trauma symptoms was tested [$\chi^2(83) = 308.95 (p < .001)$, RMSEA = .064, 90% RMSEA CI = .056-.071, CFI = .94, SRMR = .060], but the standardized coefficient for this additional effect was not significant (−.06, p = .863).

### Discussion

First, our results suggest that every year about 6,220 per 100,000 Flemish adolescents are confronted with a nonfatal MVA. Comparing these results to the official statistics (Federal Public Service Economy of Belgium, 2008), which only include accidents with injury, showed that our year prevalence rates are about three times higher (2,730 per 100,000). The estimated rate of adolescents who consulted a hospital after a MVA (1,300 per 100,000) was similar to the results of a Belgian population-based study (Van de Voorde et al., 2008). In line with conclusions of the World Health Organization (2009), our data suggest that official figures underestimate the problem of MVA in adolescents and that better registration methods are needed to obtain reliable data on MVAs.

Second, our results showed that adolescents who personally experienced a MVA in their life reported more psychological problems than those who had not, albeit that these effects had a small effect size. The reported symptoms could not be explained by the fact that victims were older, reported more stressful events, or had a lower education. In line with previous research (Keppel-Benson et al., 2002; Landolt et al., 2005), clinical PTSS or other trauma symptoms (e.g., depressive feelings, anxiety, dissociation) were reported by 11% of the MVA group. Results showed only small differences in trauma symptoms between adolescents with different degrees of injury. These findings are similar to previous...
research reporting no relation between injury severity and trauma symptoms (Bryant et al., 2004; Landolt et al., 2005; Stallard & Smith, 2007). Adolescents who experienced a MVA in which other people were (fatally) injured reported more psychological problems than those in which no one else was injured. Furthermore, adolescents who experienced a MVA as well as other stressful events reported more symptoms. In contrast to other studies in young traffic victims in which a decrease in PTSS is suggested during the first year after the accident (Olofsson et al., 2009), our results showed no relation between time passed since the accident and trauma symptoms. As expected, the type of road user was not related with the report of trauma symptoms (Olofsson et al., 2009). Longitudinal research in subgroups of traffic victims is needed to identify those with the greatest risk for negative psychological outcomes.

Third, the theoretical model of Bal et al. (2009) showed a reasonable fit in adolescents who experienced a MVA. Our results showed an indirect relation between MVA severity and trauma symptoms. Adolescents who described the MVA as more severe also reported more negative appraisals. After controlling for these appraisals (and avoidant coping), no direct relation between MVA severity and trauma symptoms was found. This finding corroborates with previous research in which the relation between injury severity and PTSS disappeared when threat appraisals were included (Bryant et al., 2004; Ehlers et al., 2003).

Consistent with other research in young traffic victims, there was a positive relation between the reported negative appraisals and trauma symptoms (Ehlers et al., 2003; Meiser-Stedman et al., 2009). However, this association was partially mediated by the use of avoidant coping. In a study including 75 young traffic victims, Stallard and Smith (2007) suggested that children try to control the distress caused by negative appraisals by using dysfunctional coping strategies which can offer temporary relief.

In addition, our results confirmed a positive association between avoidant coping and trauma symptoms (Ehlers et al., 2003; Stallard et al., 2001). The higher correlation between avoidant coping and posttraumatic stress compared to the correlations between avoidant coping and other trauma symptoms might indicate an overlap between both constructs. Indeed, avoidance may be considered a constituent of posttraumatic stress. However, it is important to note that our measures of the other trauma symptoms did not include items with a content referring to avoidance.

More received family support was related to less negative appraisals. It has been suggested that supportive reactions after a traumatic event may be protective as they diminish perceptions of threat (Bal et al., 2009). Surprisingly, family support was also related with more avoidant coping. No study investigated the interrelation of support and coping in young traffic victims, but studies in sexually abused adolescents (Bal, Crombez, et al., 2003) and adults (Ben-Zur, 2002) found either no or the opposite relation. An explanation might be that some parents, who give adequate support, may accept or stimulate avoidant coping in their children due to their own worry related to the MVA. In line with this hypothesis, Meiser-Stedman et al. (2006) concluded that parental endorsement of worry was related to more PTSS in children who experienced an assault or a MVA.

This study has some limitations. First, our study was cross-sectional, and we should be careful in making causal inferences (even though Figure 2 seems to be representing causal relations). Second, our study relied exclusively on retrospective self-reports which are sensitive to memory and report biases. Third, the definition of injury severity was based on the adolescents’ self-reported hospital admission which may defer from the actual severity. Fourth, the low internal consistencies for some indicators of negative appraisals, avoidant coping, and social support may indicate a poor reliability. This may have influenced the results. Finally, the assessments took place in large groups which made it difficult to avoid missing, incomplete, or invalid data. Drop-out and estimations of missing values may have an effect on the representativeness of the sample.

Notwithstanding these limitations, this study adds to the understanding of processes related to the development of trauma symptoms in adolescents who experience an MVA. First, our results advocate for a better registration of young traffic victims in order to optimize screening for adverse psychological consequences. Our findings also suggest that negative appraisals and avoidant coping seem more directly related to the variability in trauma symptoms than the objective severity of the MVA. Social support from the family seems to indirectly affect these appraisals and coping mechanisms. Clinicians might therefore need to expand their assessment focus beyond injury severity to appraisals, coping, and social support when they screen young traffic victims. Further in-depth and longitudinal research is needed to investigate whether negative appraisals, avoidant coping, and social support act as causal factors in the development of trauma symptoms. Insight into these causal relations can offer suggestions for prevention and treatment of posttraumatic reactions.
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References


