Bad boys?!

Adolescent school injuries and class sex compositions in German secondary schools

Extended abstract

Andreas Filser[1], Robert Lipp[2], Richard Preetz[1], Sven Stadtmüller[2]

[1] Institute for Social Sciences, University of Oldenburg

[2] Research Centre of Demographic Change (FZDW), Frankfurt University of Applied Sciences

Key words: School injury, gender composition, sex ratio, adolescent health

Background

School injuries are an important public health problem (DGUV 2018; Kaldahl and Blair 2005; Ozkan 2016; Salminen et al. 2014). Injuries are a main cause for both adolescent morbidity and mortality, and schools are an important context for adolescent health (Linakis et al. 2006; Sosnowska and Kostka 2003; Vorko and Jović 2000). In particular, school injuries accounted for 30% of all injuries among students aged 14 to 15, exceeding those suffered from road accidents or at home (Mytton et al. 2009). In Germany, the national German Social Accident Insurance reports that in 2017, over 1.3 million students sustained school injuries that required medical treatment (DGUV 2018). School injuries have a number of detrimental consequences for the students, such as restrictions of daily activities, temporary or permanent disablement and, rarely, death (DGUV 2018; Ozkan 2016; Peterson 2002; Scherer et al. 2006). These consequences entail a deterioration in quality of life and absence from school, potentially resulting in lower academic achievement and an increased likelihood of early school dropout (Gottfried 2009; Schoeneberger 2012; Silverman 2013).

Previous studies have emphasized a need to pay more attention to school injuries among adolescents (Park et al. 2018). As they grow, students' activity levels rises and the impulsive nature of adolescents contributes to increased injury hazards in this age group. This is particularly true among adolescent men. The surplus in mortality, known as “mortality hump”, due to risk-taking, violence and health-detrimental behavior during adolescence is well established in the demographic literature (cf. Goldstein 2011). Moreover, adolescence coincides with an increase in (violent) criminal offending (Hirschi and Gottfredson 1983; Loeber and Farrington 2014). For school injuries, a previous study reported that injuries from violence account for approximately 11% of all school-based injuries (Linakis et al. 2006). Both aspects, maxima in risk-taking as well as violence during adolescence are generally attributed to peak male hormone production at around the same age (Goldstein 2011; Heligman and Pollard 1980; Parkes 1976).

The social composition of school classes are a major factor for adolescent health. Adolescent students spend up to 50% of their waking hours in school (Kraus et al. 2006). At the same time, school class contexts vary in terms of their social composition and these variations have profound consequences on student’s lives. An extensive literature documents class room peer effects on behaviors detrimental to health, including drug consumption, risk-taking and violence (Clark and Lohéac 2007; Gaviria and Raphael 2001; Gommans et al. 2016; Kooreman 2007; Lorant and Tranmer 2019). So far, the literature has mainly focused on potential effects of the social composition of school classes in terms of socio-economic and

cultural dimensions. Here, we argue that the classroom sex composition should be considered as another important contextual factor for students' behavior.

The sex composition of students is an important contextual factor for students' lives, including their health behavior and injury risks. Sex ratios have been found to shape behavior, including health outcomes. In Sweden, male-biased work place sex ratios have been shown to be associated with increased mortality risks (Barclay 2013). These findings suggest that a more male-biased social environment may be related to more frequent risky health behaviors and increased levels of psychosocial stress. In particular, testosterone and cortisol reactions to status threats and competition vary by group sex ratios (Chesser 2013; Miller et al. 2012; Taylor 2014). In line with these findings, a body of literature suggests that the sex composition (sex ratio) of students constitutes an influential contextual factor for their lives. For instance, students report a less sexually permissive normative climate and less casual sex when girls outnumber boys at US high schools (Harknett and Cranney 2017). A number of studies find that students sex ratios affect educational attainment and trajectories in New York (Hoxby 2000), Chile (Cabezas 2010), Austria (Schneeweis and Zweimüller 2012), and Norway (Black et al. 2013; but see Gustavsen 2018 for null results). Moreover, Lavy and Schlosser (2011) report positive effects of the share of female students on academic performance and these gains are mediated through lower levels of classroom disruption and violence. Similarly, Agnich and Miyazaki (2013) report a negative association of the share of female students with the level of reported violence in their cross-national sample.

The reasons for school injuries remain poorly understood. Previous studies have relied on cross-sectional data, limiting their inferential potential. Moreover, the literature has focused on generating an epidemiological risk profile (Mattila et al. 2003; Ozkan 2016; Pickett et al. 2002; Yu and Kim 2016). There are some studies analyzing individual-level risk factors (cf. Mytton et al. 2009 for a review), however, our understanding of school and class contexts for students' injury risks remains limited (Salminen et al. 2014; Stadtmüller et al. 2018). In this paper, we use two waves from a German large-scale longitudinal injury and health survey to explore the association between classroom sex ratios and students' injuries.

Data and Methods

Data for our study comes from the German study Health Behavior and Injuries in School Age (GUS, www.fzdw.de/gus). GUS is a nation-wide, large-scale panel survey of children and adolescents, funded by the German Social Accident Insurance (DGUV). Starting in 2014, GUS tracks students from the fifth grade (at age 10-12) until they reach the tenth grade (at ages 15-17). GUS relies on a stratified random sample using the state, county, type and size of school

as well as the urbanity of the school's location as strata. In the participating schools, all students from the relevant grade were surveyed using a CASI survey, yet an interviewer introduced the study and solved questions.

For this study, we limit our analytical sample to adolescent age stages in waves 4 and 5 of GUS. Students in our data set are aged 13-15 (8^{th} grade) and 14-16 (in grade 9). In total, 9,120 (8,426) students from 133 (124) schools and 525 (489) classes were surveyed in wave 4 (wave 5). Our key dependent variable is the individual prevalence of injuries at school. Students reported injuries sustained in the school environment within the last 12 months. Moreover, students report whether someone else was responsible for the injury. This distinction allows us to explore whether patterns of injuries are due to risk-taking or aggression. We limit our analyses to injuries occurred on the school premises, i.e. we exclude those injuries from physical education or on the way to school. In Germany, physical education is often taking place in gender-specific groups of students from different classes. Situational sex ratios during these lessons might deviate from classroom sex ratios, and we are unable to establish group compositions during physical education lessons. Furthermore, we exclude injuries occurring on students' way to school since they occur outside the school- and class context. Our focal independent variable is the classroom sex ratio.

We use multilevel logistic regression models to analyze the association of the sex ratio with the individual likelihood of suffering from at least one injury occurring on the school premises. Our models include random intercepts for individuals (level 2) and school classes (level 3). On the individual level, controls include migrant background, family affluence, reported physical activity and risk behavior, self-assessment of health, sleep duration on school days, and gender. Moreover, models adjust for the region of school (East/West Germany), urbanity, type of school (higher secondary), the class mean of family affluence, and the number of students in the class.

Results

Results reveal that overall at-school injuries are significantly and positively associated with classroom percentages of male students. As the share of boys in a class increases, so does the risk of reporting an injury. When restricting our sample to only those injuries due to risk-taking we do not find a similar association. Instead, we find that injuries caused by someone else are significantly associated with classroom sex ratios. When splitting our data by gender, this association remains significant for boys, but not for girls. In conclusion, we interpret our findings in the way that high shares of male students in class are associated with increased levels of injuries due to aggression among adolescent boys.

References

Agnich, L. E., & Miyazaki, Y. (2013). A Cross-National Analysis of Principals' Reports of School Violence. *International Criminal Justice Review*, *23*(4), 378–400. https://doi.org/10.1177/1057567713515273

Barclay, K. J. (2013). Sex composition of the workplace and mortality risk. *Journal of biosocial science*, *45*(06), 807–821. https://doi.org/10.1017/S002193201200079X

Black, S. E., Devereux, P. J., & Salvanes, K. G. (2013). Under pressure? The effect of peers on outcomes of young adults. *Journal of Labor Economics*, *31*(1), 119–153. https://doi.org/10.1086/666872

Cabezas, V. (2010). *Gender peer effects in school: Does the gender of school peers affect student achievement?* Columbia University, New York.

Chesser, S. (2013). *Cortisol response to the presence of same and opposite sex individuals in various social environments* (PhD Thesis). Auburn University, Auburn, Alabama. Retrieved from https://etd.auburn.edu/bitstream/handle/10415/3926/Dissertation.pdf?sequence=2&ts=1467045164024

Clark, A. E., & Lohéac, Y. (2007). "It wasn't me, it was them!" Social influence in risky behavior by adolescents. *Journal of Health Economics*, *26*(4), 763–784. https://doi.org/10.1016/j.jhealeco.2006.11.005

DGUV, U. e.V. (2018). *Schülerunfallgeschehen 2017* (No. 12725). https://publikationen.dguv.de/zahlen-fakten/schwerpunkt-themen/3472/statistik-zum-schuelerunfallgeschehen-2017

Gaviria, A., & Raphael, S. (2001). School-based peer effects and juvenile behavior. *Review of Economics and Statistics*, *83*(2), 257–268. https://doi.org/10.1162/00346530151143798

Goldstein, J. R. (2011). A Secular Trend toward Earlier Male Sexual Maturity: Evidence from Shifting Ages of Male Young Adult Mortality. *PLOS ONE*, *6*(8), e14826. https://doi.org/10.1371/journal.pone.0014826

Gommans, R., Stevens, G. W. J. M., Bogt, T. F. M. ter, & Cillessen, A. H. N. (2016). Adolescent Substance Use, Aggressive Behaviors, and Peer Context Behavioral Norms. *Journal of Cognitive Education and Psychology*, *15*(2), 185–205. https://doi.org/10.1891/1945-8959.15.2.185

Gottfried, M. A. (2009). Excused versus unexcused: How student absences in elementary school affect academic achievement. *Educational Evaluation and Policy Analysis*, *31*(4), 392–415. https://doi.org/10.3102/0162373709342467

Gustavsen, A. M. (2018). Gender differences in academic achievement: A matter of contextual classroom influence? *International Journal of Research Studies in Education*, *8*(1). https://doi.org/10.5861/ijrse.2018.2013

Harknett, K., & Cranney, S. (2017). Majority Rules: Gender Composition and Sexual Norms and Behavior in High Schools. *Population Research and Policy Review*, *36*(4), 469–500. https://doi.org/10.1007/s11113-017-9436-2

Heligman, L., & Pollard, J. H. (1980). The age pattern of mortality. *Journal of the Institute of Actuaries*, *107*(1), 49–80.

Hirschi, T., & Gottfredson, M. (1983). Age and the Explanation of Crime. *American Journal of Sociology*, *89*(3), 552–584.

Hoxby, C. (2000). *Peer effects in the classroom: Learning from gender and race variation*. National Bureau of Economic Research. 10.3386/w7867

Kaldahl, M. A., & Blair, E. H. (2005). Student Injury Rates in Public Schools. *The Journal of School Health; Kent*, *75*(1), 38–40. http://dx.doi.org/10.1111/j.1746-1561.2005.tb00008.x

Kooreman, P. (2007). Time, money, peers, and parents; some data and theories on teenage behavior. *Journal of Population Economics*, *20*(1), 9–33. https://doi.org/10.1007/s00148-006-0121-8

Kraus, R., Heiss, C., Alt, V., & Schnettler, R. (2006). Schulunfälle - eine Analyse von Verletzungsmustern und Behandlungsaufwand. *Zentralblatt für Chirurgie*, *131*(5), 411–416. https://doi.org/10.1055/s-2006-949534

Lavy, V., & Schlosser, A. (2011). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, *3*(2), 1–33. https://doi.org/10.1257/app.3.2.1

Linakis, J. G., Amanullah, S., & Mello, M. J. (2006). Emergency department visits for injury in school-aged children in the United States: a comparison of nonfatal injuries occurring within and outside of the school environment. *Academic emergency medicine*, *13*(5), 567–570. https://doi.org/10.1197/j.aem.2005.11.073

Loeber, R., & Farrington, D. P. (2014). Age-Crime Curve. In G. Bruinsma & D. Weisburd (Eds.), *Encyclopedia of Criminology and Criminal Justice* (pp. 12–18). New York, NY: Springer. https://doi.org/10.1007/978-1-4614-5690-2_474

Lorant, V., & Tranmer, M. (2019). Peer, school, and country variations in adolescents' health behaviour: A multilevel analysis of binary response variables in six European cities. *Social Networks*, *59*, 31–40. https://doi.org/10.1016/j.socnet.2019.05.004

Mattila, V., Parkkari, J., Kannus, P., & Rimpelä, A. (2003). Occurrence and Risk Factors of Unintentional Injuries among 12- to 18-Year-Old Finns – A Survey of 8219 Adolescents. *European Journal of Epidemiology*, *19*(5), 437–444. https://doi.org/10.1023/B:EJEP.0000027355.85493.cb

Miller, S. L., Maner, J. K., & McNulty, J. K. (2012). Adaptive attunement to the sex of individuals at a competition: the ratio of opposite- to same-sex individuals correlates with changes in competitors' testosterone levels. *Evolution and Human Behavior*, *33*(1), 57–63. https://doi.org/10.1016/j.evolhumbehav.2011.05.006

Mytton, J., Towner, E., Brussoni, M., & Gray, S. (2009). Unintentional injuries in school-aged children and adolescents: lessons from a systematic review of cohort studies. *Injury Prevention*, *15*(2), 111–124. https://doi.org/10.1136/ip.2008.019471

Ozkan, O. (2016). Incidence and outcomes of school-based injuries during four academic years in Kocaeli, Turkey: Incidence and outcome of school injuries. *Pediatrics International*, *58*(8), 732–739. https://doi.org/10.1111/ped.12909

Park, H. A., Ahn, K. O., Park, J. O., Kim, J., Jeong, S., & Kim, M. (2018). Epidemiologic Characteristics of Injured School-age Patients Transported via Emergency Medical Services in Korea. *Journal of Korean Medical Science*, *33*(10), e73. https://doi.org/10.3346/jkms.2018.33.e73

Parkes, A. S. (1976). *Patterns of sexuality and reproduction*. London: Oxford University Press.

Peterson, B. B. (2002). School injury trends. *The Journal of School Nursing*, *18*(4), 219–225. https://doi.org/10.1177/10598405020180041501

Pickett, W., Garner, M. J., Boyce, W. F., & King, M. A. (2002). Gradients in risk for youth injury associated with multiple-risk behaviours: a study of 11,329 Canadian adolescents. *Social Science & Medicine*, *55*(6), 1055–1068. https://doi.org/10.1016/S0277-9536(01)00224-6

Salminen, S., Kurenniemi, M., Råback, M., Markkula, J., & Lounamaa, A. (2014). School Environment and School Injuries. *Frontiers in Public Health*, *1*. https://doi.org/10.3389/fpubh.2013.00076

Scherer, K., Mausner-Dorsch, H., & Kemény, P. (2006). Surveillance-based injury epidemiology in schools in Germany. *International journal of injury control and safety promotion*, *13*(3), 159–169. https://doi.org/10.1080/17457300600725317

Schneeweis, N., & Zweimüller, M. (2012). Girls, girls, girls: Gender composition and female school choice. *Economics of Education Review*, *31*(4), 482–500. https://doi.org/10.1016/j.econedurev.2011.11.002

Schoeneberger, J. A. (2012). Longitudinal attendance patterns: Developing high school dropouts. *The clearing house: a journal of educational strategies, issues and ideas*, *85*(1), 7–14. https://doi.org/10.1080/00098655.2011.603766

Silverman, R. M. (2013). Making waves or treading water? An analysis of charter schools in New York State. *Urban Education*, *48*(2), 257–288. https://doi.org/10.1080/00098655.2011.603766

Sosnowska, S., & Kostka, T. (2003). Epidemiology of school accidents during a six school-year period in one region in Poland. *European journal of epidemiology*, *18*(10), 977–982. https://doi.org/10.1023/A:1025802203726

Stadtmüller, S., Klocke, A., Giersiefen, A., & Lipp, R. (2018). Verletzungen auf dem Schulhof – Eine Analyse individueller und kontextueller Faktoren. *Das Gesundheitswesen*, *80*(02), 183–190. https://doi.org/10.1055/s-0043-112743

Taylor, C. J. (2014). Physiological stress response to loss of social influence and threats to masculinity. *Social Science & Medicine*, *103*, 51–59. https://doi.org/10.1016/j.socscimed.2013.07.036

Vorko, A., & Jović, F. (2000). Multiple attribute entropy classification of school-age injuries. *Accident Analysis & Prevention*, *32*(3), 445–454. https://doi.org/10.1016/S0001-4575(99)00069-X

Yu, J.-O., & Kim, M.-S. (2016). Factors associated with Unintentional Injuries to Korean Adolescents at School: A Multilevel Study. *Journal of Korean Academy of Community Health Nursing*, *27*(4), 337–345. https://doi.org/10.12799/jkachn.2016.27.4.337