

Bullying, health complaints, and self-rated health among school-aged children and adolescents

Journal of International Medical Research

48(2) 1–9

© The Author(s) 2019



Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/0300060519895355

journals.sagepub.com/home/imr



Erika Hansson¹ , Pernilla Garmy^{2,3} ,
Rúnar Vilhjálmsson^{4,5} and
Guðrún Kristjánsdóttir^{4,5}

Abstract

Objective: The aim of the current study was to examine whether health complaints and self-reported health were associated with bullying victimization in a large cohort of Icelandic children and adolescents.

Methods: In this study, we used data from a school-based cross-sectional survey, specifically, the Icelandic contribution to the international research network Health Behavior in School-aged Children (HBSC). The study population included all students throughout Iceland in grades 6, 8, and 10 (mean age 13 years, standard deviation 1.61). The participation rate was 84% (N = 11,018). Participating students completed an anonymous standardized questionnaire in their classrooms.

Results: Bullying victimization was associated with feeling depressed (odds ratio 2.61), having difficulty falling asleep, dizziness, and low self-reported health. No differences were found between sex and age groups.

Conclusions: Children and adolescents who are bullied appear to more often experience depression, difficulties falling asleep, dizziness, and poor health; however, health complaints were also relatively high among non-bullied children and adolescents. Bullying prevention measures must be implemented in children's and adolescents' social environments. In addition to assessing bullying interventions, further research should focus on methods of enhancing resilience in this population.

¹Faculty of Education, Kristianstad University, Kristianstad, Sweden

²Faculty of Health Sciences, Kristianstad University, Kristianstad, Sweden

³Clinical Health Promotion Centre, Medical Faculty, Lund University, Lund, Sweden

⁴Faculty of Nursing, University of Iceland, Reykjavik, Iceland

⁵Landsþítali University Hospital, Reykjavik, Iceland

Corresponding author:

Erika Hansson, Faculty of Education, Kristianstad University, S-291 88 Kristianstad, Sweden.

Email: erika.hansson@hkr.se



Keywords

Bullying, depressive symptoms, sleeping difficulties, dizziness, self-reported health, school-aged children, adolescents

Date received: 22 August 2019; accepted: 26 November 2019

Bullying has numerous detrimental effects, including poorer emotional, social, and physical health both during individual bullying events and in the periods between them.¹ Bullying can also have long-term negative effects, such as a pessimistic future orientation, maladaptation to adult roles, trouble forming lasting relationships, and suicide ideation and attempts later in life.^{2–4} Bullying can negatively affect bullies as well as victims of bullying (including bully–victims, that is, individuals who are the victims of bullying and bullies themselves) in manifold ways.⁵ Researchers have noted that bully–victims tend to view their overall health more negatively than do others and have higher levels of internal difficulties, such as depressive symptoms and suicidal thoughts.^{5–7} Therefore, in the present study, we focused on illuminating the health implications of being bullied.

According to Inchley et al.,⁸ 11% of children aged 11 to 15 years claim to have been bullied at least two times per month within the previous 2 months, based on data collected by the international research network Health Behavior in School-aged Children (HBSC). In Iceland, the self-reported frequency of bullying victimization at least two times per month was much lower, at 5.5%.⁹ The Icelandic study also found that age and sex were important factors to consider when exploring the prevalence of bullying among school-aged children and adolescents; however, questions remain regarding the specific influences of age and sex on the effects of bullying.

Bullying is closely linked to depression,^{10,11} although the relationship is not

completely understood. A longitudinal study of Finnish adolescents revealed that bullying victimization predicted depression among boys whereas among girls, depression predicted victimization.¹⁰ Ivarsson, Broberg, Arvidsson, and Gillberg¹² showed that a substantial proportion of adolescents who were being bullied had psychiatric warning signs, such as depressive and internalizing symptoms, and showed poorer social functioning. Fekkes, Pijpers, Fredriks, Vogels, and Verloove-Vanhorick¹³ showed that bullying victims had a higher risk of developing psychosomatic and psychosocial problems compared with children who were not bullied. Thus, some problems appear to follow bullying victimization whereas other problems seem to precede it.

Sleeping difficulties are also associated with bullying victimization. Difficulties falling asleep might result from thoughts about being bullied. Furthermore, with the extensive use of mobile phones among children and adolescents, there are plenty of opportunities for bullies to continue their harassment, even at night. Indeed, there is now a high degree of overlap between children who are cyberbullied and those bullied in more traditional ways.¹⁴ Recent findings show that many victims of bullying have significantly greater subjective sleep disturbances than do the bullies themselves and those who are not involved in any bullying activity.¹⁵ Furthermore, a lack of sleep and stress are associated with dizziness among adolescents,¹⁶ rendering these variables important to consider in bullying research.

Self-rated health is a subjective indicator of general health. Studies have shown that

this measure is an important index of future morbidity and mortality.^{17,18} Breidablik, Meland, and Lydersen¹⁹ noted that adolescents' self-rated health is influenced by a number of different factors, such as medical, psychological, socioenvironmental, and behavioral factors, as well as contextual factors concerning the family, peers, school, and culture. Consequently, as a contextual factor associated with peer relationships, bullying is likely to affect self-rated health.

Given the sometimes severe problems surrounding bullying and the number of victims, it is important to obtain a better understanding of this problem. Therefore, the aim of this study was to examine the associations of depression, difficulties falling asleep, dizziness, and self-rated health with bullying victimization among school-aged children of both sexes and different age groups in Iceland.

Methods

Data

The study used the Icelandic dataset of the World Health Organization's international research network, the HBSC.²⁰ The HBSC research network is a large-scale, cross-national study of 11-, 13-, and 15-year-olds carried out every 4 years in 43 countries across Europe and North America. The focus of the survey is on health behaviors and their determinants and consequences.⁸

Sample

The sample included all students throughout Iceland in grades 6, 8, and 10 who were attending school on the day of administration of the HBSC's standardized, anonymous questionnaire.

Teachers distributed the questionnaire between November 2013 and January 2014. A single school lesson (45 minutes) was dedicated to completing the survey.

Measures

The HBSC survey comprises a standard mandatory questionnaire, to which individual countries can add optional items that examine a topic in more depth.⁸

Bullying. The question on bullying was preceded by the following explanation: "We say that a student is being bullied when another student, or a group of students, says or does nasty and unpleasant things to him or her. Bullying is also when a student is teased repeatedly in a way that he or she does not like, or when he or she is deliberately left out of things. However, bullying is not when two students of about the same strength or power argue or fight. Bullying is also not when a student is teased in a friendly and playful way." The question on bullying was then presented, as follows: "How often have you been bullied in school during the past month?" Students were given five response options, ranging from *never* to *several times a week*. In this study, the responses were dichotomized, such that never been bullied or bullied a maximum of two times in the previous month were coded as 0, and all other options (up to several times a week) were coded as 1.

Self-rated health. Self-rated health is a subjective indicator of general health. The students were asked "Would you say your health is...?" The response options were *excellent*, *good*, *fair*, and *poor*. Responses were dichotomized, such that excellent and good were coded 0, and fair and poor were coded 1.

Health complaints. The students were asked how often they had experienced the following symptoms in the previous 6 months: feeling depressed, difficulties falling asleep, and feeling dizzy. The response options for each symptom ranged from *about every day*

to rarely or never. The answers were dichotomized, such that having the health complaint less than once per week was coded as 0, and having the health complaint once a week or more was coded as 1.

Analysis

We calculated descriptive statistics for bullying, health complaints, and self-reported health, including frequencies and percentages. The associations between bullying and self-reported health and health complaints were analyzed using chi-squared tests and logistic regression analysis.²¹ The level of significance was set at 5%. The statistical analysis was performed using IBM SPSS Statistics version 21 (IBM Corp., Armonk, NY, USA).

Results

A total of 161 schools with 11,018 students participated in this study. The response rate was 84% because some students ($n = 628$) chose not to answer the questions on bullying. Therefore, the sample consisted of 10,390 students, 50% of which were female; 32.1% of participants were 6th graders (mean age 11 years, $SD = .067$), 34.9% were 8th graders (mean age 12.99 years, $SD = .098$), and 33.0% were 10th graders (mean age 15 years, $SD = .03$).

Comparisons between the study respondents and the total population showed very similar sex, age, and residential compositions (differences were between 0.5 and 1.0%).

As shown in Table 1, respondents of both sexes who had been bullied were more likely than non-bullied students to have feelings of depression, difficulties falling asleep, dizziness, and poorer self-rated health ($p < .001$).

Notably, reported feelings of depression were high for both bullied (72.3%) and non-bullied (31.5%) children and adolescents. The risk ratios for having depressive symptoms when bullied were 2.80 for boys and 2.03 for girls whereas those for low self-rated health were 1.97 for boys and 2.36 for girls.

As shown in Table 2, there were also significant differences in the prevalence of health complaints between non-bullied and bullied students within each of the three age groups ($p < .001$).

Multiple logistic regression analysis (Table 3) revealed that feelings of depression, difficulties falling asleep, dizziness, and low self-reported health were all predicted by bullying victimization when controlling for age and sex. We also tested the interactions between bullying and sex and between bullying and age. However, the interactions were not significant, indicating

Table 1. Percentages of non-bullied and bullied girls and boys reporting feelings of depression, sleep difficulties, dizziness, and general health complaints ($N = 10,626$).

	Total		Girls		Boys	
	Non-bullied ($n = 10,041$)	Bullied ($n = 585$)	Non-bullied ($n = 4914$)	Bullied ($n = 297$)	Non-bullied ($n = 4942$)	Bullied ($n = 270$)
Weekly complaints						
Feeling depressed	31.5%	72.3%*	39.4%	80.1%*	23.5%	65.9%*
Difficulty falling asleep	40.2%	66.7%*	42.9%	70.7%*	37.5%	62.6%*
Dizziness	24.3%	50.6%*	27.8%	58.6%*	20.6%	41.9%*
Health						
Low self-rated health	16.3%	35.4%*	17.0%	40.1%*	15.4%	30.4%*

*Chi-square value showing significant differences between the non-bullied and bullied groups ($p < .001$).

Table 2. Prevalence of health complaints among non-bullied and bullied students aged 11, 13, and 15 years (N = 10,334).

	11-year-olds		13-year-olds		15-year-olds	
	Non-bullied (n = 3072)	Bullied (n = 232)	Non-bullied (n = 3448)	Bullied (n = 201)	Non-bullied (n = 3254)	Bullied (n = 127)
Weekly complaints						
Feeling depressed	27.5%	70.3%*	29.1%	77.1%*	37.5%	74.0%*
Difficulty falling asleep	39.6%	69.8%*	40.7%	63.7%*	40.2%	68.5%*
Dizziness	18.8%	46.6%*	24.8%	53.2%*	28.5%	55.9%*
Health						
Low self-rated health	10.3%	28.0%*	17.1%	39.3%*	20.6%	44.1%*

*Chi-square value showing significant differences between non-bullied and bullied groups ($p < .001$).

Table 3. Logistic regression analysis of factors associated with bullying victimization (N = 10,626).

	Odds ratio
Depressive symptoms	3.84* [3.13, 4.71]
Low self-rated health	1.63* [1.35, 2.0]
Dizziness	1.62* [1.34, 1.96]
Sleeping difficulties	1.44* [1.18, 1.76]
Hosmer–Lemeshow test $p = .05$	
Nagelkerke's $R^2 = .126$	

Note: Numbers in brackets are 95% confidence intervals for odds ratios.

* $p < .001$.

that the effects of bullying on health complaints and self-rated health (in terms of odds ratios) appear to be the same, regardless of age and sex.

Discussion

The aim of the present study was to examine whether bullying victimization was associated with health complaints and self-rated health among children and adolescents in Iceland. The results indicated that victims of bullying are more likely to have compromised health than are children who are not bullied, although there were rather high levels of depression among non-bullied children and adolescents as well. These findings are in line with those of previous

studies^{6,7,13} showing that individuals who experience bullying have a higher risk of developing psychosomatic and psychosocial problems. Similar to bullying, ostracism—exclusion from a group—has been found to be highly stressful and can lead to the development of depression.²² However, it should be noted that depression has also been shown to affect bullying, such as by impairing a person's social skills (thereby making them more prone to victimization) or distorting their experiences of social interactions (e.g., perceiving aggression where there is none).¹⁵

Bullying is a serious public health concern and one of the most common forms of victimization among children and adolescents.^{23,24} Whereas some studies have suggested that the incidence of bullying is decreasing slightly,²⁵ it is noteworthy that one-third of children surveyed report occasional victimization, and one in eight children report chronic victimization.²⁶ When exploring the number of children experiencing bullying victimization, it is important to acknowledge the myriad definitions and interpretations of the term *bullying*. According to the HBSC, an individual is being bullied when “*others say or do nasty and unpleasant things to him or her, tease him or her repeatedly in a way he or she does not like, or when he or she is deliberately left out*

of things".⁸ This definition is broader than that suggested by Olweus,^{26,27} who proposes that bullying has three pillars: (a) *hurtful behavior* that is (b) *repeated* and (c) *difficult for the target to defend against* owing to an imbalance of power. Yet another definition associates the term bullying with severe *physical aggression*.²⁵ These differing interpretations might be a reason that the prevalence of bullying victimization among children differs across studies.

Although there were a substantial number of bullied children and adolescents in our population who reported feelings of depression, we should also take note of the remaining 20% of girls and 34% of boys who reported being bullied but who did not report having depressive symptoms. Few studies have focused on victims of bullying who function "better than expected" and who are therefore defined as "resilient".²⁸ Some studies suggest that children and adolescents with more than three friends and who play sports tend to be less victimized by bullying.¹⁴ Furthermore, bullied children and adolescents who report low levels of depressive symptoms tend to be male, have high self-esteem, feel less socially alienated, experience lower levels of conflict with parents, and are not victimized by siblings.²⁸ However, that being male is considered a resilience factor does not accord with the findings in this study, where sex differences in the effects of bullying were small and not significant. This differing result is a telling example of the difficulties in researching bullying.

In this study, about 70% of bullied girls and 63% of bullied boys experienced difficulties falling asleep, compared with 40% among non-bullied students of both sexes. Studies have shown that difficulty falling asleep generally affects around 25% of young people;²⁹ independent of the cause, this predicts sleep difficulties later in life.³⁰ Difficulties in falling asleep partly overlap with depressive symptoms but are also

related to the bullying situation itself.¹⁵ Dizziness was experienced by a quarter of adolescents in the present study; among those who were bullied, about 50% reported this complaint.

Regression analysis showed that bullied children and adolescents have higher odds of feeling depressed, experiencing difficulties falling asleep, and feeling dizzy. Because stress is a strong risk factor for dizziness¹⁶ and being bullied is a stressful experience, it might be productive to further explore the links between stress, dizziness, and bullying.

Our results showed that bullying also predicted poor self-rated health. The implications of this finding are somewhat complicated because the interpretation of self-reported health is as complex as that of bullying. Nevertheless, given that bullying victimization is accompanied by poorer health and higher rates of depressive symptoms, this result should be considered a definite indicator of the need for preventive action.

As the repercussions of bullying victimization are often long-lasting,^{31,32} it is important to make systematic efforts toward its curtailment. Adults working with children, such as teachers, social workers, and medical personnel, must focus not only on overt verbal, social, and physical forms of bullying but also its internal ramifications, such as depressive symptoms, sleeping difficulties, dizziness, and poor overall health.

Strengths, limitations, and implications

The strengths of this study are the high response rate and representativeness of the sample. Furthermore, we used a standardized anonymous questionnaire, which reduces response bias stemming from social desirability and sensitive items.

Bullying is defined and interpreted in many different ways in different studies, which limits our ability to compare our findings with those of other studies. Indeed, the complexity of the term could account for unexplained variations within and between studies; furthermore, the cross-sectional design precludes definite conclusions about causality. Finally, although the response rate was high, victims of bullying have higher rates of absenteeism than their peers,³³ which might lead to underestimation of the scope of the problem. Another school-related issue is the focus of bullying in school settings whereas cyberbullying can take place anywhere.

Bullying among school-aged children and adolescents is a major public health problem given its scope and often long-lasting effects [e.g., 3, 4]. Systematic interventions are needed to address this problem, such as parent information meetings, firm discipline, and adult supervision at school, as discussed in a review by Ttofi and Farrington.³⁴ Other intervention programs directly aimed at health complaints in school-aged children, such as the Depression in Swedish Adolescents program aimed at reducing depression,³⁵ should also be considered. Moreover, further research on resilience among those who are bullied is necessary.

List of abbreviations

HBSC: Health Behavior in School Children.
WHO: World Health Organization.

Acknowledgements

The authors thank Jason Maurer for his exemplary language editing, as always.

Authors' contributions

EH, PG, RV, and GK participated in the data analysis. EH drafted the manuscript. All authors read, contributed to, and approved the final manuscript.

Availability of data and material

The dataset analyzed during the current study is not publicly available via the authors owing to prior raw data restrictions. For those who are interested in the raw data from the HBSC, the HBSC Data Management Centre coordinates the work with the international data file and the trend data to create the Data Bank for the HBSC study. The center distributes data in accordance with the HBSC data access policy.

Consent for publication

Not applicable.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Ethics approval and consent to participate

The HBSC followed ethical practices according to article 12 of the United Nations Convention on the Rights of the Child, which addresses the rights of children to express their views on all matters that affect them. Furthermore, it is expected that efforts are made to obtain informed consent from the children as well as their parents or guardians. The study followed regulations and requirements concerning research involving human participants as laid out by the formal institutional review board, the Data Protection Authority in Iceland (Persónuvernd, 2013). School authorities and principals at the participating schools approved the study and informed the students that their participation was voluntary and that if they agreed to participate, they could skip questions that they did not want to answer. Parents and guardians were informed about the content and purpose of the survey via school management in advance, and parents could withdraw their child from the study if they wished through an opt-out procedure.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID iDs

Erika Hansson  <https://orcid.org/0000-0002-0823-0164>

Pernilla Garmy  <https://orcid.org/0000-0003-1643-0171>

References

1. Nansel TR, Craig W, Overpeck MD, et al. Cross-national consistency in the relationship between bullying behaviors and psychosocial adjustment. *Arch Pediatr Adolesc Med* 2004; 158: 730–736.
2. Låftman SB, Alm S, Sandahl J, et al. Future orientation among students exposed to school bullying and cyberbullying victimization. *Int J Environ Res Public Health* 2018; 15: E605. doi: 10.3390/ijerph15040605.
3. Kim YS and Leventhal B. Bullying and suicide. A review. *Int J Adolesc Med Health* 2008; 20: 133–154.
4. Wolke D and Lereya ST. Long-term effects of bullying. *Arch Dis Child* 2015; 100: 879–885. doi: 10.1136/archdischild-2014-306667.
5. Rettew DC and Pawlowski S. Bullying. *Child Adolesc Psychiatr Clin N Am* 2016; 25: 235–242. doi: 10.1016/j.chc.2015.12.002.
6. Bond L, Carlin JB, Thomas L, et al. Does bullying cause emotional problems? A prospective study of young teenagers. *BMJ* 2001; 323: 480–484.
7. Kaltiala-Heino R, Rimpelä M, Rantanen P, et al. Bullying at school—an indicator of adolescents at risk for mental disorders. *J Adolesc* 2000; 23: 661–674.
8. Inchley J, Currie D, Young T, et al. *Growing up unequal: gender and socioeconomic differences in young people's health and well-being. Health Behaviour in School-Aged Children (HBSC) Study: International report from the 2013/2014 survey*. Geneva: World Health Organization, 2016. http://www.euro.who.int/__data/assets/pdf_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf?ua=1.
9. Garmy P, Vilhjalmsson R and Kristjansdottir G. Bullying in school-aged children in Iceland: a cross-sectional study. *J Pediatr Nurs* 2018; 38: e30–e34. doi: 10.1016/j.pedn.2017.05.009.
10. Kaltiala-Heino R, Frojd S and Marttunen M. Involvement in bullying and depression in a 2-year follow-up in middle adolescence. *Eur Child Adolesc Psychiatry* 2010; 19: 45–55. doi: 10.1007/s00787-009-0039-2.
11. Klomek AB, Marrocco F, Kleinman M, et al. Bullying, depression, and suicidality in adolescents. *J Am Acad Child Adolesc Psychiatry* 2007; 46: 40–49.
12. Ivarsson T, Broberg AG, Arvidsson T, et al. Bullying in adolescence: psychiatric problems in victims and bullies as measured by the Youth Self Report (YSR) and the Depression Self-Rating Scale (DSRS). *Nord J Psychiatry* 2005; 59: 365–373.
13. Fekkes M, Pijpers FI, Fredriks AM, et al. Do bullied children get ill, or do ill children get bullied? A prospective cohort study on the relationship between bullying and health-related symptoms. *Pediatrics* 2006; 117: 1568–1574.
14. Bjereld Y, Daneback K, Gunnarsdóttir H, et al. Mental health problems and social resource factors among bullied children in the Nordic countries: a population based cross-sectional study. *Child Psychiatry Hum Dev* 2015; 46: 281–288.
15. Kubiszewski V, Fontaine R, Potard C, et al. Bullying, sleep/wake patterns and subjective sleep disorders: findings from a cross-sectional survey. *Chronobiol Int* 2014; 31: 542–553. doi: 10.3109/07420528.2013.877475.
16. Filippopoulos FM, Albers L, Straube A, et al. Vertigo and dizziness in adolescents: risk factors and their population attributable risk. *PLoS One* 2017; 12: e0187819. doi: 10.1371/journal.pone.0187819.
17. Idler EL and Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997; 38: 21–37.
18. Jylhä M. What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Soc Sci Med* 2009; 69: 307–316.
19. Breidablik HJ, Meland E and Lydersen S. Self-rated health in adolescence: a

- multifactorial composite. *Scand J Public Health* 2008; 36: 12–20. doi: 10.1177/1403494807085306.
20. World Health Organization. (2019-10-31) Health Behaviour in School-Aged Children. Retrieved from: <http://www.hbsc.org/>.
 21. Norman GR and Streiner DL. *Biostatistics: the bare essentials*. Raleigh, NC: PMPH USA, 2008.
 22. Williams KD. Ostracism. *Annu Rev Psychol* 2007; 58: 425–442. doi: 10.1146/annurev.psych.58.110405.085641.
 23. Bradshaw CP. Translating research to practice in bullying prevention. *Am Psychol* 2015; 70: 322–332.
 24. Nansel TR, Overpeck M, Pilla RS, et al. Bullying behaviors among US youth: prevalence and association with psychosocial adjustment. *JAMA* 2001; 285: 2094–2100.
 25. Chester KL, Callaghan M, Cosma A, et al. Cross-national time trends in bullying victimization in 33 countries among children aged 11, 13 and 15 from 2002 to 2010. *Eur J Public Health* 2015; 25: 61–64.
 26. Olweus D. *The revised Olweus bully/victim questionnaire*. Bergen: University of Bergen, Research Center for Health Promotion, 1996.
 27. Olweus D. Peer harassment: A critical analysis and some important issues. In: Juvonen J and Graham S (eds) *Peer harassment in school: the plight of the vulnerable and victimized*. New York: Guilford Press, 2001. pp.3–20.
 28. Sapouna M and Wolke D. Resilience to bullying victimization: the role of individual, family and peer characteristics. *Child Abuse Negl* 2013; 37: 997–1006. doi: 10.1016/j.chiabu.2013.05.009.
 29. Hunter SC, Durkin K, Boyle JM, et al. Adolescent bullying and sleep difficulties. *Eur J Psychol* 2014; 10: 740–755.
 30. Armstrong D and Dregan A. A population-based investigation into the self-reported reasons for sleep problems. *PLoS One* 2014; 9: e101368.
 31. Adams FD and Lawrence GJ. Bullying victims: the effects last into college. *Am Second Educ* 2011; 40: 4–13.
 32. Carlisle N and Rofes E. School bullying: do adult survivors perceive long-term effects? *Traumatol* 2007; 13: 16–26.
 33. Dake JA, Price JH and Telljohann SK. The nature and extent of bullying at school. *J Sch Health* 2003; 73: 173–180.
 34. Ttofi MM and Farrington DP. Effectiveness of school-based programs to reduce bullying: a systematic and meta-analytic review. *J Exp Criminol* 2011; 7: 27–56.
 35. Garmy P, Berg A and Clausson EK. A qualitative study exploring adolescents' experiences with a school-based mental health program. *BMC Public Health* 2015; 15: 1074. doi: 10.1186/s12889-015-2368-z.