Timetrends in rates of hospital admission of adolescents for violent, selfinflicted or drug/alcoholrelated injury in England and Scotland, 20052011

Time-trends in rates of hospital admission of adolescents for violent, self-inflicted or drug/alcohol-related injury in England and Scotland, 2005-2011:population-based analysis

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Ethics statement: We received a standard, de-identified data extract from the Health and Social Care Information Centre, which does not require research ethics approval or patient consent (1).

Data access: Extracts of Hospital Episode Statistics© inpatient data can be applied for via the UK Health and Social Care Information Centre (www.hscic.gov.uk/dars). Extracts of Scottish Morbidity record data for research purposes can be applied for via the electronic Data Research and Innovation Service (NSS.edris@NHS.net). Population mid-year estimates that were used to derive population denominators are available here: www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-365199.

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Abbreviations: CI: Confidence Interval, CIRV: Community Initiative to Reduce Violence, ECM: Every Child Matters, GIRFEC: Getting it Right for Every Child, HES: Hospital Episode Statistics,

42 ICD-10: International Classification of Diseases 10th revision, SMR: Scottish Morbidity Record,

43 NHS: National Health Service

ABSTRACT

Background

Incidence of emergency admissions for violent injury in 10-18y olds decreased in England and Scotland between 2005 and 2011, but more steeply in Scotland. To generate hypotheses about causes of these differences, we determined whether trends were consistent across admissions for three common types of adversity-related injury (violent, self-inflicted, drug/alcohol-related).

Methods

Emergency admissions to NHS hospitals were captured using Hospital Episode Statistics and Scottish Morbidity Records. Adversity-related injury was defined using ICD-10 codes. Analyses were stratified by sex/age-groups (10-12, 13-15, 16-18y) and adjusted for background trends in admissions for injury.

Results

During 2005-2011, rates declined in all sex/age-groups in Scotland (reductions adjusted for background trends ranged from -22.0 to -103.7/100,000) and in girls and boys aged <16-18y in England (adjusted reductions -12.0 to -49.9/100,000). However these rates increased in England for both sexes aged 16-18y (adjusted increases, girls 71.8/100,000; boys 28.0/100,000). In Scotland, trends declined across all types of adversity-related injury in both sexes, but in England trends varied by type of injury and sex.

Conclusions

A greater decline in rates of emergency admissions for adversity-related injury for adolescents in Scotland compared with England could signal more effective policies in Scotland for reducing violence, self-harm, drug/alcohol misuse in adolescents.

66 **Key words (MesH terms):** Violence, Self-injurious Behaviour, Drug/alcohol-related Disorders,
67 Adolescent

BACKGROUND

In England, approximately 1 in 25 adolescents have at least one emergency admission to hospital between 10 and 19 years of age for injury related to adversity (2). By 'adversity', we mean violence, self-harm, or drug or alcohol misuse. Adolescents discharged after adversity-related injury have twice the risk of death or emergency re-admission in the subsequent ten years compared with adolescents discharged after accident-related injury (3). Effective preventive policies to reduce the incidence of admissions for adversity-related injury could improve health and wellbeing of adolescents and young adults, and reduce societal burden and costs due to violence, self-harm and drug and alcohol misuse (4-6). However, prevention strategies need to address a range of risk factors related to socioeconomic disparities, lack of social support, and availability of drugs and alcohol. Preventive interventions may be delivered through societal, judicial and health service responses to violence, drugs and alcohol, and mental health needs (7).

Comparisons between countries in the incidence of hospitalisation for adversity-related injury can offer insights into the potential impact of policies and policy context (societal landscape, e.g. cultures, levels of inequalities or unemployment) on the occurrence of adversity and related injury. We previously showed steeper declines in rates of admissions for violent injury in 11-18 year olds in Scotland compared with England between 2005 and 2011 (8). These different declines may reflect different policy interventions and organisational approaches for vulnerable children and adolescents. This explanation is supported by evidence from community surveys that weekly alcohol consumption increased for 15 year olds in England between 2005 and 2010 (by 10 percentage points) but declined in Scotland (by 10-11 percentage points) (Table A1) (9, 10). Another potential explanation could be shifts in recognition, i.e. labelling or coding of admissions for different types of adversity-related injury. These shifts might differ by country and by sex and age (11). Injuries related to violence, self-harm, or drug or alcohol misuse often occur for the same individual and reflect

92 similar psychosocial risk factors (2, 12-15). Hence a shift in favour of labelling violent injury as being
93 related to drug or alcohol misuse, for example, could lead to spurious declines in admissions for
94 violent injury.

95 In this report, we compared time-trends between England and Scotland, two countries with similar
96 policy contexts (16), in the incidence of emergency admissions for any adversity-related injury
97 between 2005 and 2011, with separate analyses for girls, boys and adolescent age-groups. We also
98 compared these trends for each type of adversity-related injury (violent, self-inflicted or drug or
99 alcohol). We used administrative data for all admissions for injury to NHS hospitals, in each country.
100 The aim was to inform policymakers about varying trends between countries in order to generate
101 hypotheses about the extent to which any differences might be related to preventive policies.

METHODS

Study population

We used Hospital Episode Statistics (HES) for England and Scottish Morbidity Records (SMR01) to identify all emergency admissions for injury to the NHS in adolescents (10-18 year olds) between January 2005 and December 2011 (17, 18), and to determine time-trends of these admissions for each country. We chose to study the time period 2005-2011 because it followed the launch of two key government initiatives: Every Child Matters (ECM) in England and Getting it Right for Every Child (GIRFEC) in Scotland.(19, 20) Both initiatives aimed at earlier intervention and better integration of services for vulnerable children. This period also covered the introduction of policies in Scotland to tackle high rates of violence, and drug and alcohol misuse. Key policies are summarised in Box 1.

We received standard, de-identified data extracts of HES from the Health and Social Care Information Centre and SMR01 from the Information Services Division in Scotland, which did not require research ethics approval or patient consent (1). As the two datasets contained the majority of our population of interest, that is, adolescents admitted to hospital as an emergency with injury, we did not carry out a sample size calculation.

Identifying admissions for adversity-related injury

Methods for identifying emergency admissions for injury have been reported elsewhere (8). In brief, we used the method of admission field to identify emergency admissions ('admimeth' in HES, 'Admission type' in SMR01), and International Classification of Diseases 10th revision (ICD-10) 'S' or 'T' codes (i.e., ICD-10 Chapter XIX) to identify injury. Mutually exclusive clusters of codes indicated whether an injury was related to adversity (violent, self-inflicted or drug/alcohol-related) (2). We counted all admissions within two days of a previous discharge as the same admission (including day cases).

Population denominators were derived from national mid-year population estimates by age year and calendar year (21, 22).

Analyses

All analyses were carried out by sex and age-groups (10-12, 13-15, 16-18 years) to reflect transitional stages in socialisation, e.g. drinking behaviours (23). As thresholds of admission for injury may vary over time, and vary differently between countries, primary analyses determined trends within countries in admissions for any adversity-related injury adjusted for background trends in admissions for injury (i.e. that was not adversity-related). Secondary analyses determined these adjusted trends for each type of adversity-related injury separately (violent, self-inflicted, drug/alcohol-related). Individuals admitted for multiple types of adversity-related injury contributed to each of these separate secondary analyses but only once in primary analyses.

We plotted monthly crude (observed) incidence rates of adversity-related injury (with mid-year population estimates as denominators), and three-monthly rolling (smoothed) average rates. We also plotted background trends in admissions for injury for each sex and age-group in England and Scotland (Figure A1).

We compared crude absolute differences in yearly incidence between 2005 and 2011 within each country-sex-age combination, with 95% confidence intervals (CIs). As power was limited to test for the interaction between time-trends and country, we fitted separate negative-binomial models, per country (and by sex and age-group), with monthly admissions for adversity-related injury as the dependent variable, time (in year) as the independent variable, and population size as an offset (Equation A1). We adjusted for trends in other types of injury by including number of admissions for injury that were not adversity-related as

another independent variable. We also adjusted for season (January-March, April-June, July-September, October-December). We used the adjusted January 2005 rate (model intercept) and adjusted gradient (time coefficient) to estimate adjusted absolute differences in rates between 2005 and 2011.

For each multivariable negative-binomial model we fitted a corresponding Poisson model. For each country-sex-age combination, the negative-binomial model gave a superior fit for the data according to the log-likelihood ratio test and thus we present these results. All calculations, plots and regressions were carried out in R (R V.2.14.2 (http://www.R-project.org). Rates of admissions for adversity-related injury in 2005 and 2011, and observed and adjusted gradients and differences are presented for each type of adversity-related injury in Tables A1-A3.

RESULTS

The incidence of emergency admissions for adversity-related injury in England and Scotland across the period 2005-2011 ranged from 48.9/100,000 for 10-12 year old girls to 978.2/100,000 for 16-18 year old boys, with the highest rates in Scotland (Table 1). Admissions for adversity-related injury accounted for 4.3% to 65.7% of all admissions for injury between different sex-age groups. Drug/alcohol-related injury was the most prevalent type of adversity-related injury, particularly among 16-18 year old girls, and was recorded in 46.3% to 92.4% of admissions for adversity-related injury.

Trends in admissions for injury from 2005-2011

Figure A1 shows that background rates in admissions for injury that was not adversity-related had a strong seasonal pattern, with higher rates in summer. In all age-groups in both countries, rates of injury that was not adversity-related remained stable in girls and declined in boys, but were always higher in Scotland than in England. Trends in admissions for adversity-related injury had a similar seasonal pattern to those for injury that was not adversity-related (Figure 1). Unadjusted rates of admissions for adversity-related injury declined in all age-groups in both sexes and in both countries, apart from an increase in 16-18 year old girls in England (Figure 1, Table 2). Figures A2-A4 show observed and smoothed monthly trends separately for violent, self-inflicted, and drug/alcohol-related injury.

Analyses of incidence trends in admissions for adversity-related injury, adjusted for background trends in injury not related to adversity, showed decreasing rates for all groups in Scotland and in England for those younger than 16 years (Table 2). However, in England rates increased for girls and boys aged 16-18 years. The annual increase in adjusted incidence for 16-18 year old girls was 2.46/100 000/year (95% CI: 1.24, 3.70) but was much smaller for 16-18 year old boys (0.25/100 000/year; 0.09, 0.41). Estimated absolute differences in

184 adjusted rates of admissions for adversity-related injury revealed significant reductions
185 between 2005 and 2011 (at the 5% level) for girls and boys younger than 16 years in England
186 and all sex and age-groups in Scotland, and significant increases for 16-18 year olds of both
187 sexes in England (Table 2).

188 Adjusted analyses of admissions, by each type of adversity-related injury separately, showed
189 varied incidence trends for girls and boys in England (Figure 2; Tables A2-A4). For girls in
190 England, adjusted rates of admissions for violent injury increased across all age-groups. Rates
191 decreased for self-inflicted injury in girls aged younger than 13 years and for drug/alcohol-
192 related injury in girls aged younger than 16 years. For boys in England, adjusted rates of
193 admissions for violent injury decreased in all age-groups, but rates for self-inflicted and
194 drug/alcohol-related injury increased in 16-18 year olds. In Scotland, there were consistent
195 declines across all types of adversity-related injury for both sexes in all age-groups.

DISCUSSION

Main finding of the study

Rates of admission for any adversity-related injury, adjusted for background rates in admissions for other types of injury, declined for adolescents younger than 16 years in England and Scotland, with the largest reductions in Scotland. Trends were opposing between countries for 16-18 year olds, increasing in England and declining in Scotland.

In England, trends varied by type of adversity-related injury: rates of admissions for violent injury increased in girls, but those for self-inflicted and drug/alcohol-related injury decreased. In boys, rates of admissions for violent injury decreased but those for self-inflicted and drug/alcohol-related injury increased. In Scotland, incidence rates declined for all types of adversity-related injury in both sexes and in all age-groups.

What is already known on this topic

We previously reported trends in admissions to hospitals in England and Scotland for injury sustained through maltreatment or violence, in children of all ages (8). We reported decreasing rates of admissions for violent injury between 2005 and 2011 for adolescents aged 11-18 years in England, with a steeper decline in Scotland. Community surveys of alcohol use in 15 year olds in England and Scotland have indicated diverging rates of weekly alcohol consumption with a 10 percentage point increase in England between 2005 and 2010, coinciding with a decrease of 10-11 percentage points in Scotland (Table A1) (9, 10).

What this study adds

This is the first study to report trends in admissions of adolescents for all three types of adversity-related injury, within the same sample. Our study confirms that declining trends in admissions for *any* adversity-related injury were steeper in Scotland than in England, and that these trends actually increased for older adolescents in England. These findings strengthen

the argument that the previously reported steeper declines in admissions of 11-18 year olds for violent injury in Scotland when compared with England were not driven by coding shift (8), i.e. a trend in labelling admissions for violent injury as admissions for other types of adversity-related injury instead.

Although policy contexts were similar in England and Scotland (16), our study raises questions about whether preventive policies in Scotland, for example, those described in Box 1, were more effective than in England at reducing the incidence of adversity-related injury among 16-18 year olds. Most importantly, our findings suggest that rates of admissions to hospital for adversity-related injury can be reduced, over and above background trends in admissions for other types of injury.

Limitations of this study

England and Scotland operate similar systems of universal access to healthcare, free at the point of use, and have similar emergency and primary care services. As thresholds for injury admission may vary over time and between countries, we estimated adjusted trends and absolute risk differences, taking into account rates in admissions for injury not related to adversity. However, we cannot rule out the possibility of changes in admission thresholds specifically for adversity-related injury, contributing to the differences over time and between countries. We cannot estimate the magnitude of these thresholds without linked data from other health services, e.g. Accident & Emergency. Such analyses may be possible as recording of adversity and linkage between administrative datasets improve (24-26).

In Scotland, rates declined across all types of adversity-related injury, but in England trends in rates of admissions within sex and age-groups were inconsistent between different types of adversity-related injury, particularly in the oldest age-group. The variation in England may

reflect true differences in trends of admissions for different types of adversity-related injury. However, these opposing trends may also reflect coding shifts over time. Although the monthly trends do not suggest any sudden changes that might reflect adoption of different coding practices, we cannot rule out a gradual shift in the use of codes between violent, drug/alcohol-related or both types of adversity-related injury. Further research is needed to examine regional variations in trends, and how changes related to socioeconomic status (27).

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Table 1. Numbers of emergency admissions for injury in 10-18 year olds in England and Scotland between 2005 and 2011 (inclusive), by adversity-related, violent, self-inflicted, and drug/alcohol-related injury, sex and age-group

			Emergency admissions for injury									
Country	Sex	Age group (years)	Total, N	Non-adversity-related, N (% of Total)		Adversity-related, N (% of Total)		Violent, N (% of Adversity-related)		Self-inflicted, N (% of Adversity-related)		Drug/alcohol-related, N (% of Adversity-related)	
England	Girls	10-12	36 334	32 576	(89.7)	3 758	(10.3)	1 092	(29.1)	2 016	(53.6)	2 819	(75.0)
		13-15	67 213	25 242	(37.6)	41 971	(62.4)	7 607	(18.1)	32 822	(78.2)	37 261	(88.8)
		16-18	70 437	24 146	(34.3)	46 291	(65.7)	5 990	(12.9)	36 356	(78.5)	42 323	(91.4)
	Boys	10-12	65 942	62 526	(94.8)	3 416	(5.2)	1 777	(2.7)	715	(20.9)	1 581	(46.3)
		13-15	95 554	79 669	(83.4)	15 885	(16.6)	7 172	(7.5)	5 547	(34.9)	9 268	(58.3)
		16-18	108 459	66 885	(61.7)	41 574	(38.3)	19 267	(17.8)	13 231	(31.8)	26 113	(62.8)
Scotland	Girls	10-12	4 361	4 104	(94.1)	257	(5.9)	81	(31.5)	128	(49.8)	199	(77.4)
		13-15	6 444	2 942	(45.7)	3 502	(54.3)	665	(19.0)	2 760	(78.8)	3 168	(90.5)
		16-18	9 044	3 213	(35.5)	5 831	(64.5)	851	(14.6)	4 728	(81.1)	5 388	(92.4)
	Boys	10-12	8 507	8 142	(95.7)	365	(4.3)	190	(2.2)	66	(18.1)	191	(52.3)
		13-15	11 207	9 061	(80.9)	2 146	(19.1)	1 169	(10.4)	565	(26.3)	1 176	(54.8)
		16-18	15 802	8 929	(56.5)	6 873	(43.5)	3 586	(22.7)	1 906	(27.7)	4 114	(59.9)

Table 2. Observed and adjusted[a] incidence rates (per 100 000 population, per year) of emergency admissions for **adversity-related injury** in 2005 and 2011, and their differences (calculated as 2011 rate-2005 rate).

Country	Sex	Age group (years)	Observed rate, 2005	Observed rate, 2011	Observed annual gradient, %	Adjusted annual gradient[b], (95% CI)	Observed difference, 2011-2005	Adjusted difference[b], (95% CI)
England	Girls	10-12	72.4	47.6	-8.31	**-7.61 (-9.94, -5.22)**	-24.8	**-20.4 (-21.3, -19.6)**
		13-15	655.8	567.4	-2.69	-1.54 (-3.30, 0.25)	-88.4	**-40.9 (-42.5, -39.2)**
		16-18	588.6	667.7	1.72	**2.46 (1.24, 3.70)**	79.1	**71.8 (68.9, 74.7)**
	Boys	10-12	67.5	44.3	-7.68	**-6.06 (-7.81, -4.27)**	-23.2	**-12.0 (-12.5, -11.5)**
		13-15	262.0	178.2	-6.99	**-5.21 (-6.34, -4.07)**	-83.8	**-49.9 (-52.0, -47.9)**
		16-18	578.1	524.4	-2.52	**0.25 (0.09, 0.41)**	-53.7	**28.0 (26.9, 29.2)**
Scotland	Girls	10-12	48.9	29.9	-10.52	**-9.96 (-15.21, -4.38)**	-19.0	**-22.2 (-23.2, -21.3)**
		13-15	549.9	434.6	-4.05	**-3.25 (-5.58, -0.86)**	-115.4	**-88.0 (-91.6, -84.5)**
		16-18	821.9	761.7	-1.67	-1.48 (-3.14, 0.21)	-60.2	**-61.2 (-63.7, -58.8)**
	Boys	10-12	75.5	52.0	-10.88	**-9.29 (-14.75, -3.49)**	-23.5	**-23.6 (-24.6, -22.6)**
		13-15	339.0	206.8	-8.20	**-7.03 (-9.59, -4.39)**	-132.3	**-103.7 (-108.0, -99.4)**
		16-18	974.2	737.9	-5.90	**-2.81 (-4.48, -1.10)**	-236.3	**-89.4 (-93.0, -85.8)**

a. Bolded values represent estimates with statistically significant confidence intervals

b. Adjusted for background trends in admissions for injury not related to adversity, using negative-binomial model described in Equation A1

Figure 1

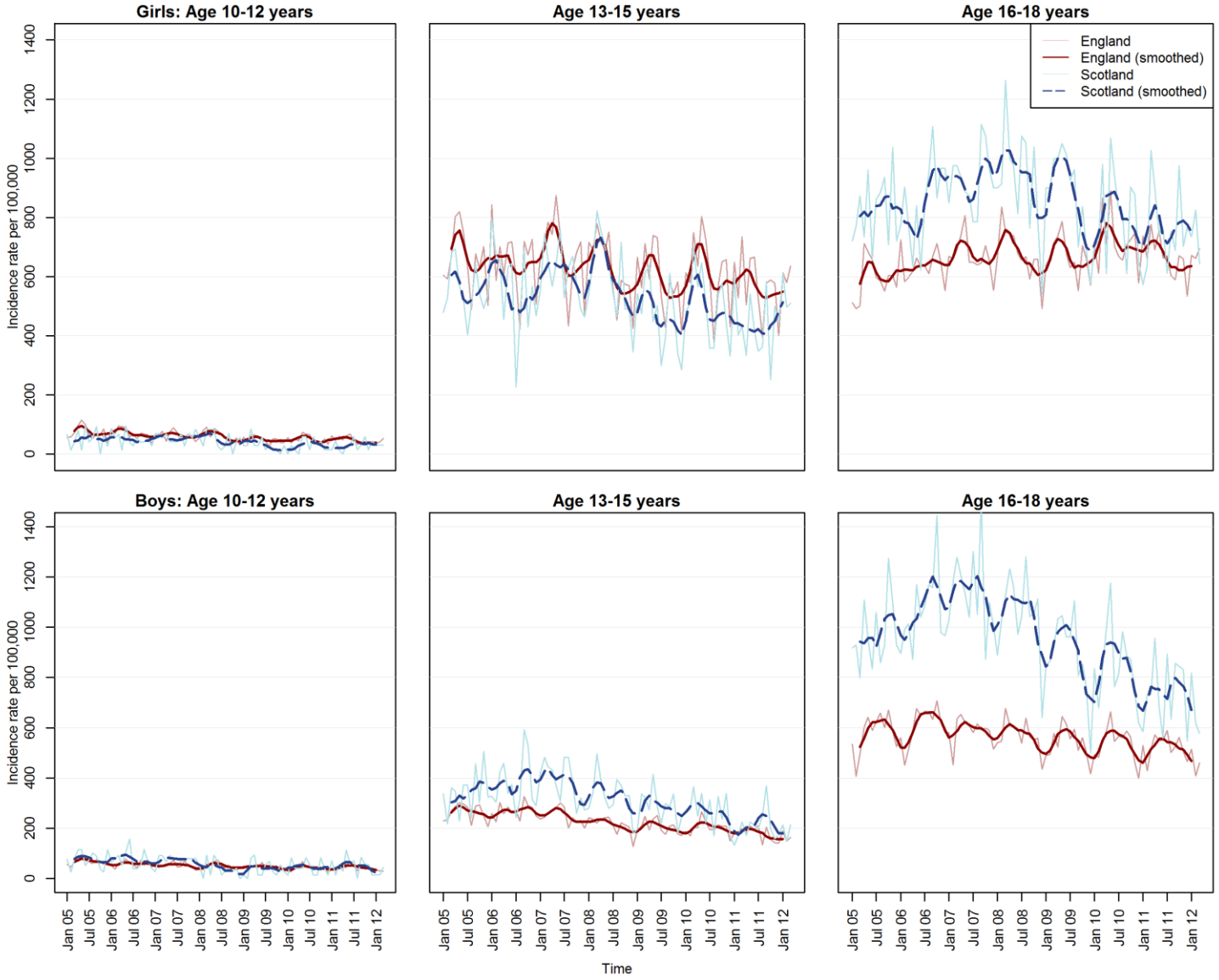
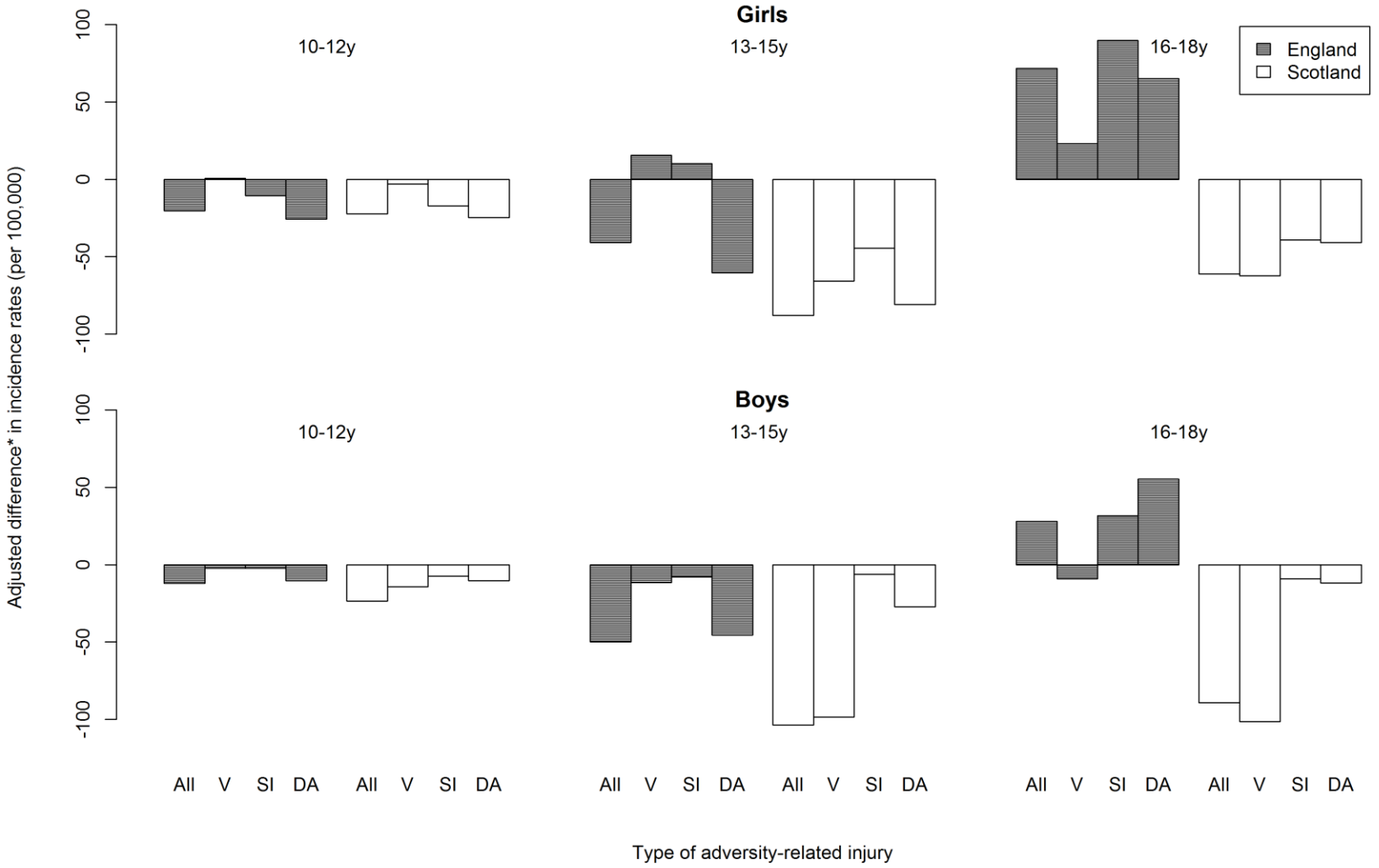

Girls: Age 10-12 years
Age 13-15 years
Age 16-18 years
Boys: Age 10-12 years
Age 13-15 years
Age 16-18 years
England
England (smoothed)
Scotland
Scotland (smoothed)
Incidence rate per 100,000
0
200
400
600
800
1000
1200
1400
Jan 05
Jul 05
Jan 06
Jul 06
Jan 07
Jul 07
Jan 08
Jul 08
Jan 09
Jul 09
Jan 10
Jul 10
Jan 11
Jul 11
Jan 12
Time

Figure 2



V = Violent, SI = Self-inflicted, DA = Drug/alcohol-related
*Adjusted for background trends in admissions for injury not related to adversity, using negative-binomial model described in Equation A1

Box 1. National policies in England and Scotland for reducing the incidence of violence, self-harm, drug/alcohol misuse or other psychosocial problems

National policies in Scotland have been implemented to reduce gang violence, anti-social behaviour, and drug or alcohol misuse.(1-3) In 2005, the Scottish government included promotion of public health related to reduced drinking as part of their Licensing Act.(4) In the same year, they introduced 'Intensive Support and Monitoring Services' for young offenders (a system which had already been in place for four years in England) to improve education and training opportunities, provide crisis support, and ultimately prevent re-offending.(5, 6) In 2008, police forces in Scotland set up contracts with gangs as a whole, exchanging a so-called 'clean slate' for individualised psychosocial support.(1) The Scottish government also launched a new strategy on drug misuse which shifted emphasis from harm reduction through substitute medication, to complete recovery through a person-centred approach.(7) This strategy also included prevention through education (of children and parents) and addressed broader elements of deprivation and access to wider public services. The English government established Alcohol Misuse Enforcement Campaigns and Tackling Violent Crime Programmes in 2004,(8, 9) which targeted high-crime and disorderly areas for higher levels of policing. Both countries have introduced legislation or policies to tackle disorderly behaviour and under-age selling of alcohol during 2005-2011.(4, 10) For example, both countries enforced increased penalties for bar and shop staff for selling alcohol to minors, and fixed closing times of bars and clubs.

Both England and Scotland introduced programmes which attempted to improve mental health and tackle deprivation. The Scottish government launched the National Programme for Improving Mental Health and Well-Being in 2002.(11) This programme's actions included the 'See Me' campaign programme to raise awareness about mental health issues and reduce

related stigma,(12) ‘Choose Life’ which engaged with the media on suicide reporting and which aimed to reduce the suicide rate by 20%,(13) and the ‘Breathing Space’ hotline, which aimed to provide support and promote recovery from mental health problems (14), particularly for young men. England launched similar initiatives to See Me, Choose Life and Breathing Space, four years later.(15, 16). The Scottish government introduced ‘More Choices, More Chances’ in 2006, a strategy that aimed to reduce the proportion of young people Not in Education, Employment or Training (‘NEET’) within the next two years,(17) and ‘Cashback for Communities’ in 2008, which redirected seized money through criminal activity to fund activities for local youth.(18) Meanwhile, the English government introduced ‘Activity Agreement’ and ‘Entry to Learning’ pilots,(19) which provided personal advisers and sometimes financial allowances also in an attempt to reduce the proportion of young people with NEET status.

Introduction of organisational changes in services for vulnerable children occurred around 2005 in England and Scotland. Every Child Matters (ECM; in 2003) and the Children Act 2004 introduced new services such as Sure Start and children’s centres to provide a one-stop shop for services for young children. In Scotland, Getting it Right for Every Child (GIFREC; 2005) focussed on improving coordination of existing services.(20-22)

Policies that aim to reduce risk-taking behaviours in parents may also have a bearing on the drug or alcohol use by adolescents.(23-25) The ‘Hidden Harm’ report in 2003, which summarised findings from a three-year enquiry into the effect of parental substance abuse on children, triggered reforms in England and the three other devolved UK nations (24). Both England and Scotland responded by integrating actions for these children into the ECM and GIFREC programmes. Scotland also established a cross-government implementation group and published ‘Getting Our Priorities Right’, guidance for health professionals on how to

respond to parents who misuse substances, and how to respond to their children.(25) An evaluation of the responses to Hidden Harm, 'Hidden Harm: Three Years On', recommended that other UK nations should consider following Scotland's lead on their approach to tackling parental drug misuse.(26)

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