



# BMJ Open Self-harm among in-school and street-connected adolescents in Ghana: a cross-sectional survey in the Greater Accra region

Emmanuel Nii-Boye Quarshie <sup>1,2</sup>, Farag Shuweihdi,<sup>3</sup> Mitch Waterman,<sup>2</sup> Allan House <sup>3</sup>

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<sup>1</sup>Department of Psychology, University of Ghana, Accra, Ghana

<sup>2</sup>School of Psychology, University of Leeds, Leeds, UK

<sup>3</sup>Leeds Institute of Health Sciences, University of Leeds, Leeds, UK

## Correspondence to

Dr Emmanuel Nii-Boye Quarshie;  
enquarshie@ug.edu.gh

## ABSTRACT

**Objectives** To identify the prevalence, methods, associations and reported reasons for self-harm among in-school and street-connected adolescents in Ghana.

**Design** A cross-sectional survey. We applied multi-level regression models and model-based cluster analysis to the data.

**Setting** Three contexts in the Greater Accra region were used: second cycle schools, facilities of charity organisations and street census enumeration areas (sleeping places of street-connected adolescents, street corners, quiet spots of restaurants, markets, train and bus stations, and lorry and car parks).

**Participants** A regionally representative sample of 2107 (1723 in-school and 384 street-connected) adolescents aged 13–21 years.

**Outcome measures** Participants responded to a structured self-report anonymous questionnaire describing their experience of self-harm and eliciting demographic information and social and personal adversities.

**Results** The lifetime prevalence of self-harm was 20.2% (95% CI 19.0% to 22.0%), 12-month prevalence was 16.6% (95% CI 15.0% to 18.0%) and 1-month prevalence was 3.1% (95% CI 2.0% to 4.0%). Self-injury alone accounted for 54.5% episodes and self-poisoning alone for 16.2% episodes, with more than one method used in 26% of episodes. Self-cutting (38.7%) was the most common form of self-injury, whereas alcohol (39.2%) and medications (27.7%) were the most commonly reported means of self-poisoning. The factors associated with self-harm were interpersonal: conflict with parents (adjusted OR (aOR)=1.87, 95% CI 1.24 to 2.81), physical abuse victimisation (aOR=1.69, 95% CI 1.16 to 2.47), difficulty in making and keeping friends (aOR=1.24, 95% CI 0.85 to 1.80), sexual abuse victimisation (aOR=1.21, 95% CI 0.78 to 1.87) and conflict between parents (aOR=1.07, 95% CI 0.73 to 1.56).

**Conclusions** Self-harm is a significant public health problem among in-school and street-connected adolescents in the Greater Accra region of Ghana. Its origins are very largely in social and familial adversity, and therefore prevention and treatment measures need to be focused in these areas.

## Strengths and limitations of this study

- A larger sample of greater diversity and more heterogeneity in exposures than any previous study related to self-harm in Ghana.
- First primary study from Africa to include in-school and street-connected adolescents in an integrated way.
- We measured self-harm using a single item on the questionnaire, and its associated risks were similarly unelaborated.
- Over-representation of the school sample (81.8%) compared with the street-connected sample (18.2), is likely to have skewed the findings of the statistical modelling.
- Cross-sectional design precluded causal interpretation of findings.

## INTRODUCTION

There is no universally accepted definition of self-harm. This study follows the WHO's definition:

‘an act with non-fatal outcome in which an individual deliberately initiates a non-habitual behaviour, that without intervention from others will cause self-harm, or deliberately ingests a substance in excess of the prescribed or generally recognised therapeutic dosage, and which is aimed at realising changes that the person desires via the actual or expected physical consequences’.<sup>1,2</sup>

Self-harm among adolescents has received little research attention in low-income and middle-income countries<sup>3–5</sup>; much of our understanding comes from research in high-income contexts (the UK, the Oceania and North America), where self-harm is associated with many negative health outcomes including suicide.<sup>6,7</sup> Recent reports of Global Burden of Disease have underscored



self-harm as an emerging non-communicable disorder with a strong link to suicide in low-income and middle-income countries, including those in Africa.<sup>8</sup>

Our recent systematic review found a 12-month prevalence of 16.9% for self-reported self-harm among adolescents in sub-Saharan Africa.<sup>5</sup> Factors associated with self-harm were depression, hopelessness, psychiatric illness, conflict with parents, physical and emotional abuse in the family, academic failure, romantic relationship problems and lack of social support. Although adolescents generally reported diverse methods of self-harm, clinical samples of adolescents predominantly reported overdose of medication whereas adolescents in the community mostly reported self-cutting. However, the majority of the studies reviewed were conducted in South Africa: we found no study on self-harm in non-clinical adolescent samples from Ghana.<sup>5</sup> The present study describes a cross-sectional self-report questionnaire survey that is novel in reporting results from in-school and street-connected adolescents in the Greater Accra region of Ghana.

### Aim and research questions

We wanted to estimate the self-reported prevalence and describe some of the common sociodemographic factors and life events associated with self-harm in two non-clinical adolescent populations (in-school and street-connected adolescents: the present study adopts the definition of street-connected adolescents provided by Ghana's Department Social Welfare and collaborators: a young person who is aged between 10 and 25 years, is born on the street and lives with parent(s) on the street; migrated to the street or is an urban poor child or street mother who survives working in the street. Department of Social Welfare (DSW), Ricerca e Cooperazione, Catholic Action for Street Children, *et al.* Census on street children in the Greater Accra region, Ghana. Accra, Ghana: DSW, 2011.) in the Greater Accra region of Ghana. Our research questions were, for these populations:

1. What is the self-reported lifetime, 12-month and 1-month prevalence of self-harm?
2. What are the methods of self-harm?
3. What reasons do adolescents report for their self-harm?
4. Which sociodemographic factors and life events are associated with self-harm?
5. Are adolescents (in this study, we define adolescents as young persons aged between 10 and 25 years) who self-harm a homogenous group, in terms of certain common sociodemographic factors and negative life events?

## METHODS

We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations to design, conduct and report this cross-sectional study.<sup>9</sup>

## Design

Cross-sectional survey design involving the use of an anonymous self-report questionnaire.<sup>10</sup>

## Setting

Three contexts in the Greater Accra region were used: selected second cycle schools (the system of education in Ghana is organised in three progressive levels: basic education, second cycle education and tertiary education. Basic education comprises basic schools—kindergarten, primary schools and junior high schools; second cycle education takes place in second cycle schools (i.e., senior high schools, technical and vocational schools and business schools) and tertiary education involves universities, polytechnics and training colleges. Ghana Education Act: Act 778 of Ghana, 2008. Accra, Ghana: Assembly Press; 2008), facilities of charity organisations, and selected street census enumeration areas where the survey was administered at the work and sleeping places of street-connected adolescents, on street corners, in quiet spots of restaurants, markets, train and bus stations, and in lorry and car parks.

## Population and study sample

For a priori study sample size determination, the total size of the population of interest in the Greater Accra region was taken as the sum of second cycle school students (n=79 297) reported by the Ghana Education Service, and the total number of street-connected children and youth reported in the latest official census report for the Greater Accra region (n=61 482).<sup>11 12</sup> We used a formula by Krejcie and Morgan to derive a sample size of 2360, plus 5% (n=118) to provide for non-response or missing data.<sup>13 14</sup> This sample size (n=2478) was large enough to allow for reasonable precision in prevalence estimates and logistic regression modelling.<sup>15 16</sup>

## Sampling and procedure

Stratified random sampling was used to identify a school-based sample, with random sampling within facilities for the homeless and street connected adolescents. Details of sampling and questionnaire administration are provided in online supplemental eAppendix 1, eFigure 1 and eTable 1. The completion of the questionnaire lasted between 22 and 45 min. The data collection took place between May and September 2017.

## Measures

### Exposures

#### *Sociodemographic variables and lifestyle factors*

Participants were asked 19 questions assessing their social and demographic backgrounds and lifestyles factors, for example, age, sex (female or male), living arrangement, alcohol use, family structure and sexual orientation (see online supplemental eTable 2).

#### *Negative life events*

Participants were asked categorical questions (24 items) about negative life events and social adversities occurring

during the previous 12 months—in the family and school contexts and within other interpersonal relationships outside the family and school environment. The items were mainly adapted from the Child and Adolescent Self-harm in Europe (CASE) studies,<sup>17</sup> and the 2012 WHO–Global School-based Student Health Survey in Ghana.<sup>18</sup> For example, conflict with parents, parental divorce, bullying victimisation, sexual abuse victimisation, breakup and knowledge about a friend's suicide (online supplemental eTable 2 provides the list of all exposure variables and specific survey questions asked).

## Outcomes

### Self-harm prevalence

For lifetime self-harm prevalence, we asked participants a binary response-rated question (coded No (0) or Yes (1)): “Have you ever, actually, intentionally harmed yourself (eg, cutting, burning or poisoning yourself, or tried to harm yourself in some other way, for example, hanging, jumping from height, etc)”. Similarly, to assess 12-month self-harm prevalence, participants were asked a dichotomous response-rated question (coded No (0) or Yes (1)): “Have you, actually, intentionally harmed yourself (eg, cutting, burning or poisoning yourself, or tried to harm yourself in some other way, for example, hanging, jumping from height, etc) during the past 12 months?”

### Self-harm methods

Participants responded to a checklist of 16 frequently reported methods of self-injury and self-poisoning methods adopted from various sources—the CASE studies<sup>17</sup>; the Self-Injurious Thoughts and Behaviors Interview<sup>19</sup> and the Suicide Attempt Self-Injury Interview.<sup>20</sup> For example, medications, drugs, burning, cutting, stabbing, suffocating, jumping from a height and so on. Notably, in keeping with the principle of parsimony and for ease of readership and interpretability of results, we dichotomised reported reasons for self-harm into self-injury and self-poisoning.

### Reported reasons/motivations for last episode of self-harm

As shown in the ‘Results’ section (‘Stated Reasons for last Episode of Self-Harm’), we also provided a checklist of 15 frequently reported reasons/motivations for self-harm, adopted from the CASE studies<sup>17</sup> and the WHO/EURO Multicentre Study on Suicidal Behaviour.<sup>21 22</sup> The last section of the questionnaire had one project-specific open-ended question regarding the adolescents’ opinions about what roles young people, families, friends, schools, organisations and government could play to prevent self-harm among adolescents in Ghana.

### Repetition/frequency of self-harm in the previous 12 months

Participants were asked to provide their best estimate in response to the question, “During the past 12 months how many times have you, actually, intentionally harmed yourself (eg, cutting, burning or poisoning yourself, or tried to harm yourself in some other way, for example, hanging, jumping from height, etc)?”

The questionnaire was in English, the lingua franca, language of instructions in schools and official language in Ghana. The questionnaire was expert-reviewed in Ghana prior to administration to the participants.

## Statistical tools and analysis procedure

Analyses were performed in SPSS V.25 and the R Statistical Package (V.4.0.0). We used the listwise deletion approach to deal with missing data,<sup>23</sup> since missing data were <5% of observations which implies that biases and loss of power are both likely to be inconsequential, particularly, for regression models.<sup>23 24</sup> Online supplemental eTable 2 shows the list of variables included in the analysis, proportions of missing data and the coding and re-coding of variables for the analyses.

Agings 15 and 17 years were used as cut-off points to re-categorise ‘age’ into three groups: 13–15 years, 16–17 years and 18–21 years. In Ghana, persons aged 16 years or older can give sexual consent,<sup>25</sup> whereas persons aged 18 years or older are legally considered adults who can marry and qualify to vote in national elections.

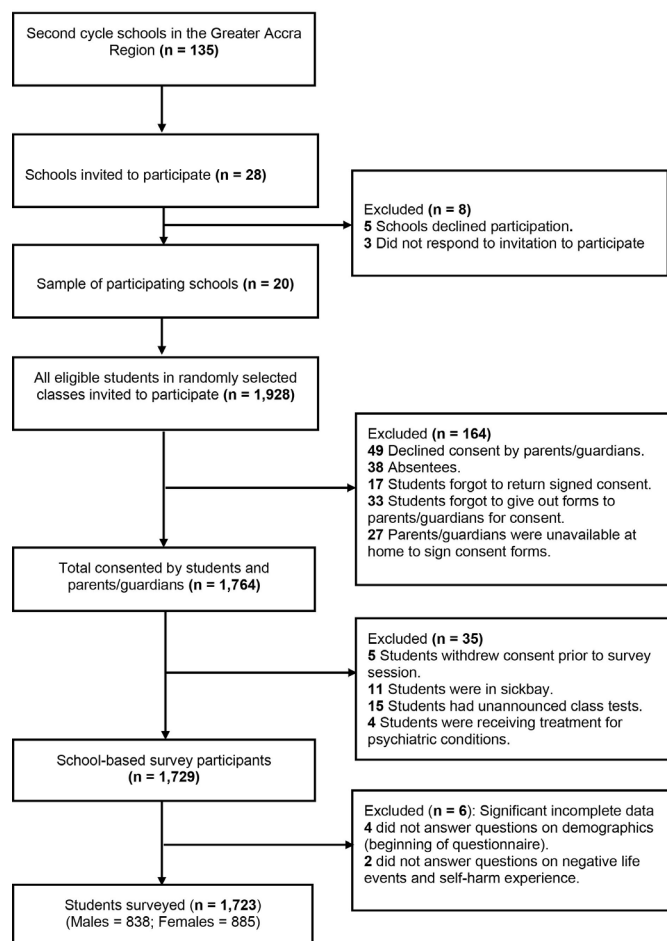
In all, there were 24 negative events included in the study. Since self-harm in adolescents has been associated with the combination of multiple negative life events,<sup>26–28</sup> an additional variable, ‘total negative life events’ was created by taking the sum of all individual negative life events endorsed by each participant to obtain an index of the total negative life events experienced during the past year. This was further placed into three categories: ≤5 negative events (coded 0), 6–10 negative events (coded 1) and >10 negative events (coded 2); for ease of interpretation of the results.

After initial univariate and bivariate analyses (see bivariate results in online supplemental eTable 3), multilevel logistic regression was used to build models examining the associations between occurrence of self-harm (binary outcome) and the exposure variables. Negative binomial regression and multilevel negative binomial regression analyses were used to assess the associations between the exposure variables and frequency of self-harm during the past 12 months.<sup>29 30</sup>

## Multilevel modelling with random intercept

The data in this study were nested: basically, the in-school adolescents were nested within schools, and the street-connected adolescents were nested in the street context. Thus, each of the multilevel analyses (multilevel logistic regression and multilevel negative binomial regression) focused on two levels—the context (school/street) and individual level factors. The strength of multilevel analysis lies in accounting for data nested within clusters,<sup>31</sup> thereby reducing the likelihood of overstating statistically significant results, as SEs of regression coefficients are not underestimated.<sup>31 32</sup> Negative binomial analyses were deemed appropriate because the outcome variable (frequency of self-harm) was overdispersed, with inflated zeros—higher than the mean of the counts within the distribution.<sup>29 33</sup> Over 80% of the participants in the





**Figure 1** Summary of participant recruitment process for school-based questionnaire survey.

overall sample of this study reported no self-harm during the past 12 months, a situation which satisfies the key assumption of negative binomial regression.<sup>29,33</sup> Statistical significance in the regression models was determined using the  $p < 0.05$  threshold; we cautiously chose this criterion in order to avoid reporting multiple possible but rather weak associations when the interpretation of the results is based on CIs.<sup>34,35</sup>

To determine whether the participants could be differentiated based on profiles of sociodemographic variables, negative events and self-harm, cluster analysis was used. Clustering helped to identify distinct profiles to which participants might belong, hence we may be able to develop appropriate interventions for each cluster. Model-based (in model-based clustering, it is assumed that the dataset of interest contains various clusters with different distributions) and non-model-based clustering algorithms, where each cluster is described by a density function, were used to explore various cluster solutions from very few simple two-cluster solutions to a more complex six-cluster arrangements, describing further the associations between exposures and self-harm.<sup>36</sup> Model-based and non-model-based clustering algorithms are represented through a finite mixture of probability distributions to estimate parameters for each cluster using the

expectation-maximisation (EM) algorithm.<sup>37</sup> Then each observation is assigned to the corresponding cluster using the maximum a posteriori probability. This approach is applied till no further reduction in Akaike Information Criterion (AIC) is achieved. Variables possessing clustering information (showing different relative distribution between clusters) were used in the detection of the group structure.

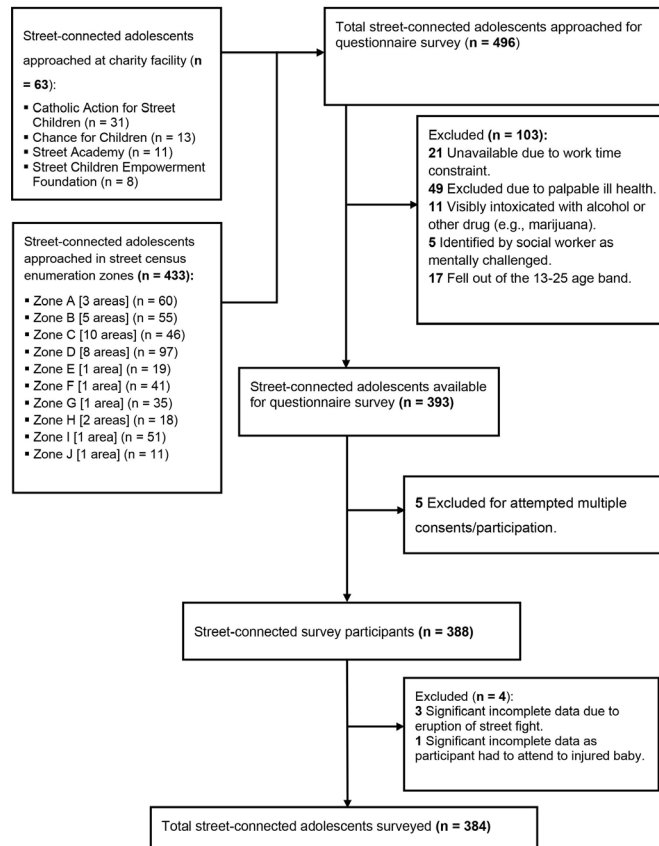
## RESULTS

### Demographic and background characteristics of participants

In all, 2424 adolescents were invited to participate in the survey (see figures 1–2), with 2107 completed questionnaires included in the final analyses, representing an overall response rate of 87%. Of the 2107 participants, 82% ( $n=1723$ ) were adolescents in school and 18% ( $n=384$ ) were street-connected adolescents. The majority of the street-connected adolescents (53%) had been in the street situation for  $>1$  year.

It was not one of the aims of our study to compare in-school and street-connected adolescents, but rather to include both in our sample as a way of reducing bias. Differences between the two groups illustrate the likelihood of such bias, and are shown in online supplemental eTable 3.

Table 1 presents the demographic and background characteristics of the study participants. More street-connected



**Figure 2** Summary of participant recruitment process for street-connected questionnaire survey.

**Table 1** Demographic and background characteristics of participants

Characteristic	Overall n=2107 n (%)	Adolescent groups		Sex		Age groups (mean=16.81 years; SD=1.33)		
		In-school n=1723 n (%)	Street-connected n=384 n (%)	Male n=1034 n (%)	Female n=1073 n (%)	13– 15 n=312 n (%)	16– 17 n=1210 n (%)	18– 21 n=585 n (%)
<b>Adolescent groups</b>								
In-school	1723 (81.8)	1723 (100)	–	838 (81.0)	885 (82.5)	186 (59.6)	1060 (87.6)	477 (81.5)
Street-connected	384 (18.2)	–	348 (100)	196 (19.0)	188 (17.5)	126 (40.4)	150 (12.4)	108 (18.5)
<b>Sex</b>								
Male	1034 (49.1)	838 (48.6)	196 (51.0)	1034 (100)	–	164 (52.6)	576 (47.6)	294 (50.3)
Female	1073 (50.9)	885 (51.4)	188 (49.0)	–	1073 (100)	148 (47.4)	634 (52.4)	291 (49.7)
<b>Age groups (years)</b>								
13–15	312 (14.8)	186 (10.8)	126 (32.8)	164 (15.9)	148 (13.8)	312 (100)	–	–
16–17	1210 (57.4)	1060 (61.5)	150 (39.1)	576 (55.7)	634 (59.1)	–	1210 (100)	–
18–21	585 (27.8)	477 (27.7)	108 (28.1)	294 (28.4)	291 (27.1)	–	–	585 (100)
Mean age	16.81	16.91	16.36	16.79	16.83	14.71	16.55	18.48
SD	1.33	1.22	1.67	1.38	1.28	0.59	0.49	0.64
<b>Sexual orientation</b>								
Heterosexual	2030 (96.5)	1672 (97.2)	358 (93.2)	1004 (97.2)	1026 (95.8)	305 (97.8)	1174 (97.0)	551 (94.7)
Non-heterosexual	74 (3.5)	48 (2.8)	26 (6.8)	29 (2.8)	45 (4.2)	7 (2.2)	36 (3.0)	31 (5.3)
<b>In romantic relationship</b>								
No	1317 (62.5)	1078 (62.6)	239 (62.2)	699 (67.6)	618 (57.6)	248 (79.5)	784 (64.8)	285 (48.7)
Yes	790 (37.5)	645 (37.4)	145 (37.8)	335 (32.4)	455 (42.4)	64 (20.5)	426 (35.2)	300 (51.3)
<b>Religious group</b>								
Christian	1811 (86.9)	1578 (91.9)	233 (63.7)	904 (88.6)	907 (85.3)	254 (83.0)	1055 (87.9)	502 (87.0)
Muslim	272 (13.1)	139 (8.1)	133 (36.3)	116 (11.4)	156 (14.7)	52 (17.0)	145 (12.1)	75 (13.0)
<b>Employment status</b>								
Unemployed	1708 (81.2)	1656 (96.1)	52 (13.6)	825 (79.9)	883 (82.4)	208 (66.7)	1051 (87.0)	449 (76.9)
Employed	396 (18.8)	67 (3.9)	329 (86.4)	208 (20.1)	188 (17.6)	104 (33.3)	157 (13.0)	135 (23.1)
<b>Family structure</b>								
Father has one wife	1448 (68.8)	1283 (74.5)	165 (43.0)	718 (69.5)	730 (68.0)	228 (73.1)	860 (71.1)	360 (61.5)
Father has more than one wife	658 (31.2)	439 (25.5)	219 (57.0)	315 (30.5)	343 (32.0)	84 (26.9)	349 (28.9)	225 (38.5)
<b>Sibling size</b>								
0–4	1472 (69.9)	1295 (75.2)	177 (46.1)	725 (70.1)	747 (69.6)	226 (72.4)	892 (73.7)	354 (60.5)
>4	635 (30.1)	428 (24.8)	207 (53.9)	309 (29.9)	326 (30.4)	86 (27.6)	318 (26.3)	231 (39.5)
<b>Living arrangement</b>								
Live with one or both parents	1419 (67.3)	1332 (77.3)	87 (22.7)	700 (67.7)	719 (67.0)	214 (68.6)	876 (72.4)	329 (56.2)
Live with other relative	414 (19.6)	297 (17.2)	117 (30.5)	199 (19.2)	215 (20.0)	55 (17.6)	219 (18.1)	140 (23.9)
Live alone or with other person	274 (13.0)	94 (5.5)	180 (46.9)	135 (13.1)	139 (13.0)	43 (13.8)	115 (9.5)	116 (19.8)
<b>Street life age (street-connected only)</b>								
6 months–1 year	181 (47.1)	–	181 (47.1)	87 (44.4)	94 (50.0)	66 (52.4)	68 (45.3)	47 (43.5)
>1 year	203 (52.9)	–	203 (52.9)	109 (55.6)	94 (50.0)	60 (47.6)	82 (54.7)	61 (56.5)
<b>Still have contact with family (street-connected only)</b>								
No	81 (21.1)	–	81 (21.1)	43 (21.9)	38 (20.2)	17 (13.5)	35 (23.3)	29 (26.9)
Yes	303 (78.9)	–	303 (78.9)	153 (78.1)	150 (79.8)	109 (86.5)	115 (76.7)	79 (73.1)

Continued

Table 1 Continued

Characteristic	Overall n=2107 n (%)	Adolescent groups		Sex		Age groups (mean=16.81 years; SD=1.33)		
		In-school n=1723 n (%)	Street-connected n=384 n (%)	Male n=1034 n (%)	Female n=1073 n (%)	13– 15 n=312 n (%)	16– 17 n=1210 n (%)	18– 21 n=585 n (%)
<b>Primary caretaker</b>								
One or both parents	1544 (73.3)	1447 (84.0)	97 (25.3)	768 (74.3)	776 (72.3)	232 (74.4)	966 (79.8)	346 (59.1)
Other relative	251 (11.9)	180 (10.4)	71 (18.5)	111 (10.7)	140 (13.0)	39 (12.5)	121 (10.0)	91 (15.6)
Myself or other person	312 (14.8)	96 (5.6)	216 (56.3)	155 (15.0)	157 (14.6)	41 (13.1)	123 (10.2)	148 (25.3)
<b>Primary caretaker's employment status</b>								
Unemployed	178 (8.9)	125 (7.3)	53 (18.3)	81 (8.2)	97 (9.5)	24 (8.0)	76 (6.5)	78 (14.3)
Employed	1833 (91.1)	1597 (92.7)	236 (81.7)	906 (91.8)	927 (90.5)	275 (92.0)	1090 (93.5)	468 (85.7)
<b>Educational background (street-connected only)</b>								
No formal education	35 (9.1)	–	35 (9.1)	12 (6.1)	23 (12.2)	9 (7.1)	15 (10.0)	11 (10.2)
Primary or junior high school	349 (90.9)	–	349 (90.9)	184 (93.9)	165 (87.8)	117 (92.9)	135 (90.0)	97 (89.8)
<b>Still in school (street-connected only)</b>								
No	335 (15.9)	–	335 (87.2)	167 (85.2)	168 (89.4)	100 (79.4)	136 (90.7)	99 (91.7)
Yes	49 (12.8)	–	49 (12.8)	29 (14.8)	20 (10.6)	26 (20.6)	14 (9.3)	9 (8.3)
<b>School residential status</b>								
Boarding	376 (21.2)	376 (21.8)	0	227 (26.2)	149 (16.5)	66 (31.1)	269 (25.0)	41 (8.4)
Day student	1396 (78.8)	1347 (78.2)	49 (100)	640 (73.8)	756 (83.5)	146 (68.9)	805 (75.0)	445 (91.6)
<b>Weekly cigarettes smoked</b>								
Never/Stopped	2051 (97.3)	1713 (99.4)	338 (88.0)	998 (96.5)	1053 (98.1)	300 (96.2)	1188 (98.2)	563 (96.2)
One or more cigarettes	56 (2.7)	10 (0.6)	46 (12.0)	36 (3.5)	20 (1.9)	12 (3.8)	22 (1.8)	22 (3.8)
<b>Weekly alcoholic drinks</b>								
Never drink	1741 (82.6)	1493 (86.7)	248 (64.6)	819 (79.2)	922 (85.9)	265 (84.9)	1033 (85.4)	443 (75.7)
One or more drinks	366 (17.4)	230 (13.3)	136 (35.4)	215 (20.8)	151 (14.1)	47 (15.1)	177 (14.6)	142 (24.3)
<b>Drugs used in the past year</b>								
Never take illicit drugs	1993 (94.6)	1677 (97.4)	316 (82.3)	964 (93.2)	1029 (96.0)	293 (93.9)	1158 (95.8)	542 (92.6)
Took illicit drug	113 (5.4)	45 (2.6)	68 (17.7)	70 (6.8)	43 (4.0)	19 (6.1)	51 (4.2)	43 (7.4)

than in-school adolescents self-identified as employed and Muslim and reported that their father had more than one wife and they had more than four siblings. Nearly half of the street-connected adolescents reported that they lived alone or with another person and they endorsed 'myself or other person' as their primary caretaker.

### Prevalence estimates of self-harm

Table 2 shows the lifetime, 12-month and 1-month prevalence estimates of self-harm as reported by the adolescents in this study. For in-school adolescents the prevalences (15%–20% 12 months and lifetime) were similar to those reported from high-income countries, with a predominance of girls and young women. Lower prevalences were reported by street-connected adolescents (lifetime=12.2% (95% CI 9.0% to 15.0%), 12-month=9.4% (95% CI 6.0% to 12.0%) and 1-month=1.0% (95% CI 0.0 to 3.0%)), than by in-school adolescents (lifetime=22.0% (95% CI 20.0% to 24.0%), 12-month=18.2% (95% CI 16.0% to

20.0%) and 1-month=3.5% (95% CI 3.0% to 5.0%)). An age gradient for 12-month and lifetime prevalence was noticeable for the in-school but not the street-connected adolescents.

For the total sample, the age at first onset of self-harm varied between 8 and 20 years, with a mean age of 14.4 years (SD: 1.93) and a modal age of 14 years. The minimum ages at first onset of self-harm among the age groups were 9 years (13–15 years old), 8 years (16–17 years old) and 10 years (among the 18–21 years old). There were no differences in age at onset according to gender.

### Methods of self-harm

The methods of self-harm as reported by the participants were categorised into 'self-injury only', 'self-poisoning only', 'other methods only' and 'multiple methods'. Results are provided in table 3. Self-injury (54.5%) was commoner than self-poisoning (16.2%). More adolescents in school (58.8%) than street-connected

**Table 2** Prevalence of self-harm

	Overall sample			School adolescent sample			Street-connected adolescent sample		
	Sample	Frequency	% (95% CI)	Sample	Frequency	% (95% CI)	Sample	Frequency	% (95% CI)
Lifetime self-harm	2107	426	20.2 (0.19 to 0.22)	1723	379	22.0 (0.20 to 0.24)	384	47	12.2 (0.09 to 0.15)
Sex									
Male	1034	169	16.3 (0.14 to 0.18)	838	151	18.0 (0.15 to 0.20)	196	18	9.2 (0.05 to 0.14)
Female	1073	257	24.0 (0.21 to 0.26)	885	228	25.8 (0.22 to 0.28)	188	29	15.4 (0.10 to 0.21)
Age (years)									
13–15	312	51	16.3 (0.12 to 0.20)	186	35	18.8 (0.13 to 0.25)	126	16	12.7 (0.07 to 0.19)
16–17	1210	249	20.6 (0.18 to 0.23)	1060	228	21.5 (0.19 to 0.24)	150	21	14.0 (0.08 to 0.20)
18–21	585	126	21.5 (0.18 to 0.25)	477	116	24.3 (0.20 to 0.28)	108	10	9.3 (0.04 to 0.16)
Self-harm during the past 12 months	2107	350	16.6 (0.15 to 0.18)	1723	314	18.2 (0.16 to 0.20)	384	36	9.4 (0.06 to 0.12)
Sex									
Male	1034	134	13.0 (0.11 to 0.15)	838	122	14.6 (0.12 to 0.17)	196	12	6.1 (0.03 to 0.10)
Female	1073	216	20.1 (0.17 to 0.22)	885	192	21.7 (0.19 to 0.24)	188	24	12.8 (0.08 to 0.18)
Age (years)									
13–15	312	39	12.5 (0.09 to 0.16)	186	27	14.5 (0.09 to 0.20)	126	12	9.5 (0.05 to 0.16)
16–17	1210	210	17.4 (0.15 to 0.19)	1060	192	18.1 (0.15 to 0.20)	150	18	12.0 (0.07 to 0.18)
18–21	585	101	17.3 (0.14 to 0.20)	477	95	19.9 (0.16 to 0.23)	108	6	5.6 (0.02 to 0.11)
Self-harm during the past 1 month	2107	65	3.1 (0.02 to 0.04)	1723	61	3.5 (0.03 to 0.05)	384	4	1.0 (0.00 to 0.03)
Sex									
Male	1034	22	2.1 (0.01 to 0.03)	838	20	2.4 (0.02 to 0.04)	196	2	1.0 (0.00 to 0.04)
Female	1073	43	4.0 (0.03 to 0.05)	885	41	4.6 (0.03 to 0.06)	188	2	1.1 (0.00 to 0.04)
Age									
13–15	312	9	2.9 (0.01 to 0.05)	186	8	4.3 (0.02 to 0.08)	126	1	0.8 (0.00 to 0.04)
16–17	1210	34	2.8 (0.02 to 0.04)	1060	33	3.1 (0.02 to 0.04)	150	1	0.7 (0.00 to 0.04)
18–21	585	22	3.8 (0.02 to 0.06)	477	20	4.2 (0.03 to 0.06)	108	2	1.9 (0.00 to 0.06)
Self-harm prior to the past 12 months	2107	269	12.8 (0.11 to 0.14)	1723	238	13.8 (0.12 to 0.15)	384	31	8.1 (0.05 to 0.11)
Sex									
Male	1034	111	10.7 (0.08 to 0.12)	838	96	11.5 (0.09 to 0.13)	196	15	7.7 (0.04 to 0.12)
Female	1073	158	14.7 (0.12 to 0.17)	885	142	16.0 (0.13 to 0.18)	188	16	8.5 (0.04 to 0.13)
Age (years)									
13–15	312	30	9.6 (0.06 to 0.13)	186	20	10.8 (0.06 to 0.16)	126	10	7.9 (0.03 to 0.14)
16–17	1210	147	12.1 (0.10 to 0.14)	1060	135	12.7 (0.10 to 0.14)	150	12	8.0 (0.04 to 0.13)
18–21	585	92	15.7 (0.12 to 0.18)	477	83	17.4 (0.14 to 0.21)	108	9	8.3 (0.04 to 0.15)

**Table 3** Methods of self-harm ever used

Variable	Overall	Adolescent groups		Sex		Age groups (years)		
	n=426*	In-school n=379*	Street-connected n=47*	Male *n=169*	Female n=257*	13–15 n=51*	16–17 n=249*	18–21 n=126*
Method of self-harm ever used:	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Self-injury (only)	232 (54.5)	223 (58.8)	9 (19.1)	102 (60.3)	130 (50.6)	28 (54.9)	149 (59.8)	55 (43.7)
Self-poisoning (only)	69 (16.2)	62 (16.4)	7 (14.9)	26 (15.4)	43 (16.7)	3 (5.9)	37 (14.9)	29 (23.0)
Other method (only)	14 (3.3)	14 (3.7)	–	5 (3.0)	9 (3.5)	2 (3.9)	8 (3.2)	4 (3.2)
Multiple methods of self-harm	111 (26.0)	80 (21.1)	31 (66.0)	36 (21.3)	75 (29.2)	18 (35.3)	55 (22.1)	38 (30.1)

Self-injury (only): any one of: burning, cutting, stabbing, gun/firearm, hanging, jumping, hitting body, strangling, suffocating, stepped into traffic.

Self-poisoning (only): any one of: alcohol, medications, illicit drugs, poison/caustic substances.

Other method (only): any one of: drowning, stopped required medication/treatment, ingestion of foreign object, starvation, non-reporting of ill health, indiscriminate unprotected sex.

Multiple methods of self-harm: simultaneous use of self-injury and self-poisoning and/or other method.

\*Denominator for computation=lifetime self-harm frequency.

adolescents (19.1%) reported self-injury, but self-poisoning was comparable between females (16.7%) and males (15.4%), and similar between in-school (16.4%) and street-connected (14.9%) adolescents. However, more street-connected adolescents (38.5%) than adolescents in school (24.4%) and more females (35.8%) than males (12.3%) reported that they used medications as a means of self-poisoning. Alcohol (39.2%) and medications (27.7%) were the commonly reported means of self-poisoning. Results of the specific means of self-injury and self-poisoning are presented in online supplemental eTables 4, 5 and 6.

### Stated reasons for last episode of self-harm

Reported reasons for the last episode of self-harm were categorised into intrapersonal reasons such as own thoughts, and interpersonal reasons such as family disputes (see table 4). More street-connected adolescents than adolescents in school indicated intrapersonal reasons, while more females than males reported interpersonal reasons for the last episode of self-harm. The total negative life events endorsed by the participants ranged from 0 to 22 (overall sample (mean=6.6, SD=4.1, median=6), school sample (mean=6.1, SD=3.9, median=6), street-connected sample (mean=9.0, SD=3.6, median=9)).

Notably, 32% of the overall sample reporting a self-harm history indicated “I wanted to die” as at least one of the reasons for the last episode of self-harm (28% in-school adolescents and 64% street-connected adolescents), with 13% of the participants (11% adolescents in school, 24% street-connected adolescents) reported “I wanted to die” as the sole reason for the last episode of self-harm.

### Factors associated with self-harm: multilevel logistic regression analysis

Only the multilevel logistic regression analyses are reported here.<sup>31 32</sup> The participants were clustered by school and street contexts. To test the significance of the clusters' effects, a likelihood ratio test (LR) compared

the null multilevel model with a null single-level model; the results showed strong evidence that variation between clusters in terms of self-harm was significantly not zero (LR=61.33,  $p<0.001$ )—see also caterpillar plot online supplemental eFigure 2. In the next step, all the potential exposure variables were entered into two models: model 1 assessed the associations between adolescents' sociodemographic characteristics and individual negative events, and self-harm during the past 12 months; model 2 examined the associations between adolescents' sociodemographic characteristics and total number of negative events, and self-harm during the past 12 months (see table 5).

Model 1 showed that history of self-harm prior to the past 12 months, non-heterosexual orientation, knowledge about a friend's attempted suicide, having knowledge about a family member's attempted suicide, having conflict with parents, being physically abused, being in a romantic relationship, weekly alcohol use and reporting schoolwork problems were more likely to be associated with self-harm. However, having more than four siblings, having relationship problems and primary caretaker being myself or other person were associated with lower risk of self-harm. In model 2, adolescents with non-heterosexual orientation, and with any weekly alcohol use, were more likely to report self-harm during the previous 12 months.

In both model 1 and model 2, having a history of self-harm prior to the past 12 months increases the odds of self-harm by 28 times, whereas gender and age showed no statistically significant associations with self-harm during the previous 12 months.

### Associations between exposure variables and frequency of occurrence of self-harm during the past 12 months: multilevel negative binomial regression analysis

A LR test comparing the null multilevel model with a null single-level model showed that the variation between clusters, in terms of the counts of self-harm during the



**Table 4** Stated reasons for last episode of self-harm

Reason	Overall	Adolescent groups		Sex		Age groups (years)		
		In-school	Street-connected	Male	Female	13–15	16–17	18–21
	n=426*	n=379*	n=47*	n=169*	n=257*	n=51*	n=249*	n=126*
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
My thoughts were so unbearable, I could not endure them any longer	196 (46.0)	170 (44.9)	26 (55.3)	69 (40.8)	127 (49.4)	22 (43.1)	112 (45.0)	62 (49.2)
It seemed that I lost control of myself, and I do not know why I did it	102 (23.9)	98 (25.9)	4 (8.5)	48 (28.4)	54 (21.0)	8 (15.7)	65 (26.1)	29 (23.0)
The situation was so unbearable that I could not think of any other alternative	137 (32.2)	112 (29.6)	25 (53.2)	48 (28.4)	89 (34.6)	17 (33.3)	79 (31.7)	41 (32.5)
I wanted to get away for a while from an unacceptable situation	118 (27.7)	107 (28.2)	11 (23.4)	47 (27.8)	71 (27.6)	10 (19.6)	59 (23.7)	49 (38.9)
I wanted to sleep for a while	33 (7.7)	27 (7.1)	6 (12.8)	11 (6.5)	22 (8.6)	4 (7.8)	15 (6.0)	14 (11.1)
I wanted to punish myself	8 (1.9)	8 (2.1)	0	4 (2.4)	4 (1.6)	1 (2.0)	3 (1.2)	4 (3.2)
I wanted to die	137 (32.2)	107 (28.2)	30 (63.8)	36 (21.3)	101 (39.3)	14 (27.5)	72 (28.9)	51 (40.5)
I wanted to show someone how much I loved him/her	64 (15.0)	59 (15.6)	5 (10.6)	24 (14.2)	40 (15.6)	4 (7.8)	34 (13.7)	26 (20.6)
I wanted others to know how desperate I felt	58 (13.6)	52 (13.7)	6 (12.8)	18 (10.7)	40 (15.6)	6 (11.8)	37 (14.9)	15 (11.9)
I wanted to get help from someone	73 (17.1)	65 (17.2)	8 (17.0)	31 (18.3)	42 (16.3)	7 (13.7)	38 (15.3)	28 (22.2)
I wanted to know if someone really cared about me	145 (34.0)	137 (36.1)	8 (17.0)	46 (27.2)	99 (38.5)	18 (35.3)	81 (32.5)	46 (36.5)
I wanted others to pay for the way they treated me	69 (16.2)	64 (16.9)	5 (10.6)	30 (17.8)	39 (15.2)	5 (9.8)	46 (18.5)	18 (14.3)
I wanted to make someone feel guilty	77 (18.1)	70 (18.5)	7 (14.9)	27 (16.0)	50 (19.5)	13 (25.5)	45 (18.1)	19 (15.1)
I wanted to persuade someone to change his/her mind	57 (13.4)	53 (14.0)	4 (8.5)	26 (15.4)	31 (12.1)	10 (19.6)	27 (10.8)	20 (15.9)
I wanted to make things easier for others	67 (15.7)	58 (15.3)	9 (19.1)	24 (14.2)	43 (16.7)	11 (21.6)	38 (15.3)	18 (14.3)
It was the work of the devil	27 (6.3)	25 (6.6)	2 (4.3)	16 (9.5)	11 (4.3)	3 (5.9)	14 (5.6)	10 (7.9)
Reporting at least one type of reason								
Intrapersonal	346 (81.2)	302 (79.7)	44 (93.6)	136 (80.5)	210 (81.7)	38 (74.5)	195 (78.3)	113 (89.7)
Interpersonal	276 (64.8)	246 (64.9)	30 (63.8)	101 (59.8)	175 (68.1)	34 (66.7)	156 (62.7)	86 (68.3)
Other	27 (6.3)	25 (6.6)	2 (4.3)	16 (9.5)	11 (4.3)	3 (5.9)	14 (5.6)	10 (7.9)

Similar to the findings from the Child & Adolescent Self-harm in Europe (CASE) Study<sup>17</sup>:

“My thoughts were so unbearable, I could not endure them any longer”, “It seemed that I lost control of myself, and I do not know why I did it”, “The situation was so unbearable that I could not think of any other alternative”, “I wanted to get away for a while from an unacceptable situation”, “I wanted to sleep for a while”, “I wanted to punish myself” and “I wanted to die” are categorised as ‘intrapersonal reasons’.

“I wanted to show someone how much I loved him/her”, “I wanted others to know how desperate I felt”, “I wanted to get help from someone”, “I wanted to know if someone really cared about me”, “I wanted others to pay for the way they treated me”, “I wanted to make someone feel guilty”, “I wanted to persuade someone to change his/her mind” and “I wanted to make things easier for others” are categorised as ‘interpersonal reasons’.

‘It was the work of the devil’ was categorised as ‘other’ reason.

\*Denominator (n) for computation of proportion is lifetime self-harm frequency.

previous 12 months, was significantly non-zero (LR=12.76,  $p<0.001$ )—see also caterpillar plot (online supplemental eFigure 3).

All potential exposure variables were entered into two models: model 1 assessed the associations between adolescents’ sociodemographic characteristics and individual

**Table 5** Multilevel logistic regression assessing the associations between sociodemographic characteristics and negative events during the past 12 months, and self-harm during the past 12 months

Variable	Model 1			Model 2		
	Adjusted OR	95% CI	P value	Adjusted OR	95% CI	P value
Sex (female)	1.24	0.84 to 1.83	0.277	1.43	0.99 to 2.04	0.053
Age group (years)						
13–15	Reference			Reference		
16–17	0.89	0.50 to 1.67	0.682	1.02	0.58 to 1.79	0.939
18–21	0.62	0.32 to 1.21	0.162	0.62	0.32 to 1.19	0.148
Religious group (Muslim)	0.81	0.40 to 1.65	0.567	0.92	0.49 to 1.73	0.794
Employment status (employed)	0.54	0.22 to 1.32	0.180	0.52	0.22 to 1.24	0.141
Living arrangement						
One or both parents	Reference			Reference		
Other relative	1.02	0.59 to 1.74	0.952	0.92	0.55 to 1.52	0.740
Alone or with other person	1.89	0.89 to 3.98	0.095	1.47	0.72 to 3.02	0.289
Primary caretaker						
One or both parents	Reference			Reference		
Other relative	1.14	0.59 to 2.19	0.692	0.98	0.53 to 1.81	0.961
Myself or other person	0.46	0.20 to 1.06	0.069	0.58	0.27 to 1.26	0.171
Primary caretaker's employment status (employed)	0.56	0.31 to 1.03	0.063	0.59	0.34 to 1.04	0.071
Sexual orientation (non-heterosexual)	3.81	1.57 to 9.24	0.003	3.29	1.42 to 7.63	0.006
Weekly cigarettes (one or more cigarettes)	1.36	0.19 to 9.84	0.758	2.45	0.42 to 14.21	0.319
Weekly alcohol use (one or more drinks)	1.64	1.01 to 2.65	0.043	1.83	1.16 to 2.90	0.009
Illicit drug use (took illicit drug)	1.55	0.56 to 4.23	0.396	1.41	0.54 to 3.68	0.479
Family structure (father more than one wife)	1.13	0.73 to 1.74	0.585	1.18	0.81 to 1.72	0.387
Sibling size (>4 siblings)	0.89	0.59 to 1.35	0.587	0.88	0.59 to 1.30	0.527
School residential status (day student)	1.04	0.61 to 1.77	0.881	1.04	0.62 to 1.75	0.882
In romantic relationship (yes)	1.53	1.00 to 2.33	0.048	1.29	0.91 to 1.85	0.151
Self-harm prior to the past 12 months (yes)	28.01	18.34 to 42.80	0.000	28.21	18.88 to 42.16	0.000
Total negative events during the past 12 months						
≤5				Reference		
6–10				3.19	2.13 to 4.77	0.000
>10				6.13	3.69 to 10.18	0.000
Sexual orientation worries (yes)	1.48	0.78 to 2.81	0.229			
Parental separation/divorce (yes)	1.17	0.77 to 1.78	0.445			
Conflict with parents (yes)	1.87	1.24 to 2.81	0.003			
Conflict between parents (yes)	1.07	0.73 to 1.56	0.724			
Serious accident or illness of family member (yes)	0.73	0.50 to 1.08	0.113			
Death of family member (yes)	0.77	0.51 to 1.18	0.233			
Knowledge about a family member's suicide (yes)	0.53	0.21 to 1.32	0.171			
Knowledge about a family member's attempted suicide (yes)	2.48	1.46 to 4.22	0.000			
Schoolwork problems (yes)	1.55	1.06 to 2.25	0.022			
Truancy (>5 days)	0.55	0.29 to 1.02	0.059			
Sacked from school (yes)	0.94	0.64 to 1.37	0.749			
Serious romantic relationship problems (yes)	0.87	0.52 to 1.48	0.621			
Breakup (yes)	1.21	0.77 to 1.92	0.405			
Difficulty making/keeping friends (yes)	1.24	0.85 to 1.80	0.262			
Conflict with friends (yes)	1.07	0.73 to 1.57	0.724			
Serious accident or illness of close friend (yes)	1.17	0.79 to 1.71	0.423			

Continued

Table 5 Continued

Variable	Model 1			Model 2		
	Adjusted OR	95% CI	P value	Adjusted OR	95% CI	P value
Death of friend (yes)	1.20	0.81 to 1.79	0.362			
Knowledge about a friend's suicide (yes)	0.79	0.29 to 2.19	0.654			
Knowledge about a friend's attempted suicide (yes)	2.61	1.57 to 4.34	0.000			
Bullying victimisation (yes)	1.45	0.99 to 2.13	0.055			
Physical abuse victimisation (yes)	1.69	1.16 to 2.47	0.007			
Sexual abuse victimisation (yes)	1.21	0.78 to 1.87	0.392			
Trouble with police (yes)	1.43	0.59 to 3.43	0.424			
Other negative events during the past 12 months (yes)	1.16	0.77 to 1.75	0.462			
Random effect (intercept)	0.041	0.02 to 0.11	0.000	0.046	0.02 to 0.12	0.000

negative events, and frequency of self-harm during the past 12 months, and model 2 examined the associations between adolescents' sociodemographic characteristics and total negative events, and the frequency of self-harm during the past 12 months.

In model 1, as shown in table 6, having a history of self-harm prior to the past 12 months, living alone or with another person, knowledge about a friend's attempted suicide, having one or more alcoholic drinks weekly, experiencing other negative events, being in a romantic relationship, experiencing conflict between parents and having difficulty making/keeping friends were associated with higher frequency of self-harm during the past 12 months. In model 2, female gender and having one or more alcoholic drinks weekly were associated with a higher frequency of self-harm during the past 12 months.

In both model 1 and model 2, weekly alcohol use and having a history of self-harm before the previous 12 months showed a statistically significant association with higher frequency of self-harm during the past 12 months.

### Clustering of adolescents

From the various cluster solutions identified in the R statistical package, the model-based three-cluster solution showed the lowest AIC (the AIC asymptotically selects a model that minimises mean squared error of prediction, hence, minimises maximum plausible risk in fixed sample sizes). Lower AIC value suggests better model fit.<sup>37 38</sup> The final three-cluster solution included 14 sociodemographic variables (adolescent groups, gender, age groups, religious groups, employment status, living arrangement, primary caretaker, primary caretaker's employment status, sexual orientation, family structure, sibling size, school residential status, in romantic relationship and weekly alcohol use), eight negative events (the eight negative events during the previous 12 months were conflict with parents, knowledge about a family member's attempted suicide, schoolwork problems, conflict with friends, knowledge about a friend's attempted suicide, bullied, physically abused and sexually abused) and self-harm 'before', and 'during' the past 12 months.

Inspection of the final three-cluster solution showed that these 24 variables had higher density and as such provided a clear descriptive separation within the three clusters. Table 7 provides a summary of the characteristics of the three clusters.

#### Cluster 1 (n=837)

All the adolescents were in-school and cared for by one or both parents, who were employed. Most of the adolescents were males, aged 16–17 years, not involved in any paid work. They were not in romantic relationships, never drank alcohol and self-identified as Christian and heterosexual. Fewer than 10% of the adolescents in this cluster responded 'yes' to four or more of the eight negative events enquired about during the previous 12 months.

Four per cent of the adolescents in this cluster reported a history of self-harm prior to the past 12 months, and 5% reported self-harm during the past 12 months. Cluster 1 is thus described as a low adversity cluster with low self-harm prevalence.

#### Cluster 2 (n=481)

Predominantly, adolescents in this cluster were in-school, aged between 18 and 21 years, self-identified as Christian, heterosexual and the majority never drank alcohol. Seven per cent identified as street-connected, 1 in 10 lived alone or with another non-family member. Regarding negative events experienced during the previous 12 months, >10% reported: bullying victimisation, conflict with parents or sexual abuse victimisation; 30%–50% reported conflict with friends, schoolwork problems and having been physically abused in the last 12 months.

Fewer than 10% of the adolescents in this cluster reported a history of self-harm during the past 12 months (6%) or self-harm prior to the past 12 months (5%). Thus, cluster 2 is described as a moderate adversity group with low self-harm prevalence.

#### Cluster 3 (n=413)

The majority of the adolescents in cluster 3 were in-school, female, aged 16–17 years, self-identified as

**Table 6** Multilevel negative binomial regression assessing associations between characteristics of adolescents (sociodemographics and negative events) and frequency of self-harm during the past 12 months

Variable	Category	Model 1			Model 2		
		Adjusted IRR	95% CI	P value	Adjusted IRR	95% CI	P value
Sex	Male	Reference			Reference		
	Female	1.17	0.91–1.50	0.223	1.30	1.01–1.65	0.035
Age group (years)	13–15	Reference			Reference		
	16–17	0.82	0.56–1.19	0.288	0.80	0.54–1.16	0.237
	18–21	0.73	0.47–1.12	0.149	0.65	0.43–0.99	0.046
Religious group	Christian	Reference			Reference		
	Muslim	0.72	0.45–1.16	0.179	0.73	0.46–1.17	0.189
Employment status	Unemployed	Reference			Reference		
	Employed	0.63	0.36–1.10	0.106	0.66	0.39–1.13	0.129
Living arrangement	One or both parents	Reference			Reference		
	Other relative	1.13	0.78–1.63	0.519	1.06	0.75–1.52	0.716
	Alone or with other person	1.82	1.12–3.00	0.016	1.49	0.92–2.41	0.106
Primary caretaker	One or both parents	Reference			Reference		
	Other relative	1.00	0.65–1.53	0.998	0.92	0.61–1.40	0.711
	Myself or other person	0.59	0.36–0.97	0.038	0.72	0.45–1.16	0.181
Primary caretaker's employment status	Unemployed	Reference			Reference		
	Employed	0.91	0.61–1.36	0.649	0.86	0.59–1.26	0.437
Sexual orientation	Heterosexual	Reference			Reference		
	Non-heterosexual	1.22	0.74–2.02	0.430	1.25	0.76–2.06	0.376
Weekly cigarettes	Never/stopped smoking	Reference			Reference		
	≥1 cigarette	1.31	0.42–4.06	0.637	2.14	0.75–6.08	0.153
Weekly alcohol use	Never drink	Reference			Reference		
	One or more drinks	1.51	1.11–2.04	0.008	1.68	1.24–2.27	0.001
Illicit drug use	Never take drugs	Reference			Reference		
	Took illicit drug	0.92	0.54–1.55	0.746	1.07	0.63–1.81	0.799
Family structure	Father has one wife	Reference			Reference		
	Father has more than one wife	1.00	0.76–1.34	0.952	1.07	0.83–1.37	0.624
Sibling size	0–4	Reference			Reference		
	>4	0.75	0.56–0.99	0.041	0.76	0.58–1.00	0.051
School residential status	Boarding	Reference			Reference		
	Day student	1.10	0.79–1.52	0.579	1.10	0.78–1.53	0.582
In romantic relationship	No	Reference			Reference		
	Yes	1.44	1.08–1.90	0.011	1.16	0.90–1.48	0.240
Self-harm prior to the past 12 months	No	Reference			Reference		
	Yes	10.32	8.13–13.09	0.000	11.36	8.96–14.40	0.000
Total negative events during the past 12 months	≤5				Reference		
	6–10				2.40	1.78–3.24	0.000
	>10				3.55	2.50–5.05	0.000
Sexual orientation worries	No	Reference					
	Yes	1.31	0.90–1.91	0.159			
Parental separation divorce	No	Reference					
	Yes	1.01	0.77–1.32	0.941			
Conflict with parents	No	Reference					

Continued



Table 6 Continued

Variable	Category	Model 1			Model 2		
		Adjusted IRR	95% CI	P value	Adjusted IRR	95% CI	P value
Conflict between parents	Yes	1.30	0.99–1.71	0.057			
	No	Reference					
Serious accident or illness of family member	Yes	1.32	1.02–1.70	0.034			
	No	Reference					
Death of family member	Yes	1.04	0.80–1.34	0.769			
	No	Reference					
Knowledge about a family member's suicide	Yes	0.91	0.70–1.19	0.503			
	No	Reference					
Knowledge about a family member's attempted suicide	Yes	0.69	0.40–1.18	0.175			
	No	Reference					
Schoolwork problems	Yes	1.13	0.81–1.57	0.479			
	No	Reference					
Truancy	Yes	1.25	0.97–1.60	0.081			
	0–5 days	Reference					
	>5 days	0.80	0.56–1.15	0.228			
Sacked from school	No	Reference					
	Yes	1.04	0.80–1.33	0.783			
Serious romantic relationship problems	No	Reference					
	Yes	0.70	0.49–0.99	0.044			
Breakup	No	Reference					
	Yes	1.20	0.89–1.61	0.224			
Difficulty making/keeping friends	No	Reference					
	Yes	1.32	1.03–1.68	0.027			
Conflict with friends	No	Reference					
	Yes	0.99	0.76–1.29	0.946			
Serious accident or illness of close friend	No	Reference					
	Yes	0.89	0.70–1.15	0.379			
Death of friend	No	Reference					
	Yes	1.05	0.81–1.36	0.710			
Knowledge about a friend's suicide	No	Reference					
	Yes	1.56	0.93–1.59	0.090			
Knowledge about a friend's attempted suicide	No	Reference					
	Yes	1.74	1.26–2.39	0.001			
Bullying victimisation	No	Reference					
	Yes	1.25	0.97–1.50	0.081			
Physical abuse victimisation	No	Reference					
	Yes	1.21	0.94–1.56	0.148			
Sexual abuse victimisation	No	Reference					

Continued

Table 6 Continued

Variable	Category	Model 1			Model 2		
		Adjusted IRR	95% CI	P value	Adjusted IRR	95% CI	P value
Trouble with police	Yes	1.13	0.85–1.49	0.410			
	No	Reference					
Other negative events	Yes	1.51	0.88–2.59	0.134			
	No	Reference					
Random effect (intercept)	Yes	1.45	1.12–1.87	0.004	0.074	0.04–0.14	0.000
		0.058	0.03–0.11	0.000			

IRR, incidence rate ratio.

Christian and heterosexual and not involved in any paid work. Three-quarters lived with one or both parents, who were employed. Over 25% of this cluster reported that they had one or more alcoholic drinks weekly and more than half were in a romantic relationship. With regard to the negative events experienced during the previous 12 months, more than half reported conflict with friends, being physically or sexually abused, schoolwork problems, bullying victimisation and conflict with parents.

In this cluster, half reported self-harm during the past 12 months. Cluster 3 is therefore described as a high adversity group with high self-harm prevalence.

## DISCUSSION

To the best of our knowledge, this is the first study of self-harm (defined without regard to purpose) in a regionally representative non-clinical sample of both in-school and street-connected adolescents from Ghana. Overall, one in five adolescents reported having self-harmed in their lifetime—approximately 1 out of 5 in-school, and 1 in 8 street-connected adolescents. Similarly, 1 in 6 adolescents reported an episode of self-harm during the previous 12 months—approximately 1 out of 5 in-school, and 1 in 11 street-connected adolescents. The reported prevalence of self-harm increased with age, at least among the in-school adolescents.

These prevalence estimates are comparable to those reported by recent systematic reviews of the global literature and add to the evidence that self-harm is an important global public health problem among adolescents.<sup>39–43</sup> As has been found in other populations, the prevalence estimates were higher among females and older adolescents.<sup>44</sup> However, a striking finding was the low prevalence among the street-connected adolescents, especially given their experience of high rates of social adversity.

Although self-injury and self-poisoning were the common methods of self-harm reported, self-injury, typically self-cutting, was the most frequently used method; alcohol and medication were the main methods of self-poisoning, with males reporting use of drugs and alcohol, and females using medication. Street-connected

adolescents in this study tended to report methods of self-harm that involved higher risk of death, and though self-harm frequency was lower in this group they were also much more likely to report that their last episode of self-harm was associated with a wish to die.

We found many associations with self-harm in the previous 12 months, mainly in the sphere of interpersonal adversity, although intrapersonal reasons for self-harm (primarily seeking relief from unbearable thoughts) also featured, particularly for street-connected adolescents. This difference might reflect greater relative levels of distress, as evidenced by the wish to die, coupled with the looser social network (family) structures experienced by street-connected young people compared with those by in-school adolescents, where often the interpersonal reasons focused on the family. Female adolescents reported more of both intrapersonal and interpersonal reasons for their self-harm, possibly a reflection of greater emotional literacy and an inclination towards the need to explain and communicate their self-harm behaviour.<sup>45–47</sup>

Modelling revealed that having a history of self-harm in the preceding 12 months, knowledge about a friend's or a family member's attempted suicide, non-heterosexual orientation and experience of multiple negative life events were associated with reports of self-harm and more frequent self-harm. One possibility is that direct experience of others attempting to manage distress through self-harm provided a viable but worrying model for young people experiencing difficult circumstances.<sup>48 49</sup> Frequency of self-harm was associated with problems in romantic and friendship relationships, suggesting that difficulties in these areas make adolescents especially vulnerable to self-harm.

Cluster analysis suggested three groups of adolescents. The largest group was characterised by low adversity and low prevalence of self-harm. An intermediate group had moderate levels of adversity and low prevalence of self-harm. This cluster included the highest proportion of street-associated adolescents, who reported a high frequency of wish to die associated with their last self-harm episode. It is plausible that street-connected adolescents are more resilient, but when coping fails the impact

**Table 7** Characteristics of adolescents in cluster analysis (sociodemographics, negative events and self-harm)

Variable	Category	Cluster 1	Cluster 2	Cluster 3
		n=837	n=481	n=413
<b>Sociodemographics</b>				
Adolescent groups	School adolescents	100%	93%	98%
	Street-connected adolescents	0	7%	2%
Sex	Male	54%	51%	40%
	Female	46%	49%	60%
Age group (years)	13–15	16%	7%	8%
	16–17	70%	44%	60%
	18–21	14%	49%	32%
Religious group	Christian	91%	91%	93%
	Muslim	9%	9%	7%
Employment status	Unemployed	99%	85%	95%
	Employed	1%	15%	5%
Living arrangement	One or both parents	93%	45%	76%
	Other relative	5%	43%	18%
	Alone or with other person	2%	12%	6%
Primary caretaker	One or both parents	100%	54%	81%
	Other relative	0	32%	10%
	Myself or other person	0	14%	9%
Primary caretaker's employment status	Unemployed	3%	13%	10%
	Employed	97%	87%	90%
Sexual orientation	Heterosexual	99%	98%	94%
	Non-heterosexual	1%	2%	6%
Family structure	Father has one wife	89%	57%	64%
	Father has more than one wife	11%	43%	36%
Sibling size	0–4	85%	54%	75%
	>4	15%	46%	25%
School residential status	Boarding	30%	5%	21%
	Day student	70%	95%	79%
In romantic relationship	No	79%	56%	41%
	Yes	21%	44%	59%
Weekly alcohol use	Never drink	95%	86%	72%
	One or more drinks	5%	14%	28%
<b>Negative events</b>				
Conflict with parents	No	91%	86%	47%
	Yes	9%	14%	53%
Knowledge about a family member's attempted suicide	No	97%	95%	77%
	Yes	3%	5%	23%
Schoolwork problems	No	81%	62%	37%
	Yes	19%	38%	63%
Conflict with friends	No	70%	59%	24%
	Yes	30%	41%	76%
Knowledge about a friend's attempted suicide	No	96%	96%	75%
	Yes	4%	4%	25%
Bullying victimisation	No	81%	76%	44%
	Yes	19%	24%	56%
Physical abuse victimisation	No	86%	67%	37%

Continued



Table 7 Continued

Variable	Category	Cluster 1	Cluster 2	Cluster 3
		n=837	n=481	n=413
Sexual abuse victimisation	Yes	14%	33%	63%
	No	95%	87%	54%
	Yes	5%	13%	46%
<b>Self-harm</b>				
Self-harm prior to the past 12 months	No	96%	95%	62%
	Yes	4%	5%	38%
Self-harm during the past 12 months	No	95%	94%	49%
	Yes	5%	6%	51%

is relatively greater.<sup>50</sup> The cluster with the highest prevalence of adversity and self-harm contained more in-school older females who experienced multiple negative events, were in romantic relationships, used alcohol weekly and had a history of self-harm prior to the previous 12 months. The use of alcohol may reflect an additional means by which to cope with their circumstances.<sup>51</sup>

### Strengths of the study

With a larger and more varied sample than previous surveys and in securing street-connected participants from charity facilities and across census enumeration zones, our study has a sample of greater diversity and more heterogeneity in exposures than any previous study related to self-destructive behaviours in Ghana.<sup>52 53</sup> In this study, we did not aim to compare the in-school and street-connected adolescents, but to obtain a comprehensive or unbiased sample and therefore less biased view of the problem of self-harm among adolescents in Ghana. Comparisons are designed to show the bias that results if you only study the easily accessible. For example, as shown in table 2, the prevalence estimates of self-harm were substantially higher among in-school adolescents (lifetime=22.0%, 12-month=18.2% and 1-month=3.5%) than among street-connected adolescents (lifetime=12.2%, 12-month=9.4% and 1-month=1.0%). This result (and others shown elsewhere in this study under *methods of self-harm, reported reasons and associations*) illustrate the bias that would have ensued by excluding the street-connected adolescent sample. Given that knowledge and practices related to value systems and sociocultural norms, education, family life and street living are more similar than different in countries within sub-Saharan Africa,<sup>5 54</sup> our results can be applicable to both the context of Ghana and the situation in other countries within sub-Saharan Africa.

### Limitations of the study

We measured self-harm through the use of a single item on the questionnaire, and any items about risks were similarly unelaborated. Non-disclosure of self-harm behaviours in anonymous self-report surveys has been reported among young people.<sup>55</sup> In Ghana, non-heterosexual orientation,

illicit drug use and self-harming behaviours are culturally proscribed and criminalised which might have led some participants to provide guarded or socially desirable responses to some of the survey questions.<sup>25</sup> The over-representation of the school sample compared with the street-connected sample, with more adolescents in public than private second cycle schools, is likely to have skewed the findings of the multivariable modelling.

The cross-sectional nature of this study does not permit causal interpretation of the findings.<sup>10</sup>

The structured questionnaire did not allow for detailed exploration of the reasons for self-harm and especially more socially or culturally specific reasons that might lie behind the rather high-level categories represented in the survey. More detailed exploration of the experience of self-harm in Ghana as compared with other countries would be likely to reveal differences that are concealed by the similarities indicated by our findings. Similarly, we could not explore why the adolescents chose self-harm as an appropriate response rather than another behaviour, such as seeking help. Also, we did not assess the mental states of our participants (e.g., depressive and anxiety symptoms or disorders), which have been found to be associated with self-harm in young people.<sup>26</sup>

The design of the current study does not readily allow for further exploration of a number of our findings. Friend/family member suicide, which is known to be a strong risk factor for self-harm in high-income countries, was not found to be associated with self-harm in this study. CIs around these estimates were wide, indicating limited power to answer the question, but risk estimates were for the most part not in the expected direction. Also, having more than four siblings, having relationship problems and primary caretaker being myself or other person were associated with lower risk of self-harm in this study. Future research using more robust approaches, including carefully designed qualitative studies, may be useful in exploring personal and meaningful explanations for these findings.

The high response rate in our study is within the range of response rates reported by previous school-based health surveys from Ghana,<sup>42 52</sup> however, the 'captive'



nature of school sampling and the Ghanaian (and the general African) mores that young people must submit to and obey their parents and respect their elders might have created a sense of compulsion to participate, despite emphasis that participation was voluntary.<sup>54</sup>

## CONCLUSION

Self-harm is a significant public health problem among in-school and street-connected adolescents in the Greater Accra region of Ghana. The prevalence estimates of self-harm are higher among females and in-school adolescents than in males and (surprisingly) street-connected adolescents. At the level of abstraction represented in the questions asked, the reported reasons for self-harm are very similar to those found in other countries.<sup>45 46</sup> The implications for prevention and treatment is that specialist mental healthcare alone is less a priority than interventions aimed at ameliorating social and familial adversity—mental healthcare services need to be supplemented with family/social interventions. Further studies are needed to explore the individual, social and cultural meanings of self-harm—to inform evidence-based intervention and prevention efforts aimed more specifically at young people in Ghana.

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## ORCID iDs

Emmanuel Nii-Boye Quarshie <http://orcid.org/0000-0002-8720-2355>

Allan House <http://orcid.org/0000-0001-8721-8026>

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