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Research Paper

Global risks of suicidal behaviours and being bullied and their association in adolescents: School-based health survey in 83 countries

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ABSTRACT

Background: Global risks of suicidal behaviours (SB) and being bullied as well as their association among adolescents have been poorly understood. We aimed to determine the risks of suicidal ideation (SI), suicide planning (SP), suicide attempt (SA) and being bullied in adolescents and their related associations across gender, countries and different WHO regions.

Methods: We examined data from the Global School-based Health Survey (GSHS), which recorded health behaviours among adolescents aged 12 to 15 years from 83 countries. We computed prevalence rates of SB and being bullied and their 95% confidence intervals (CIs). Multilevel models were employed to examine the association of being bullied with risks of SI, SP and SA.

Results: The overall prevalence of SI was 16·5%, SP 16·5%, SA 16·4%, and being bullied 35·3%. The highest risks of SB and being bullied were in Africa (SI 19·9%, SP 23·2%, SA 20·8%, being bullied 48·0%). Compared to boys, girls had an increased risk for SI (18·2%) and SP (17·3%) but similar risk for SA (16·7%) and being bullied (33·3%). Being bullied was associated with SA (adjusted odds ratio – aOR 2·14, 95%CI 2·06–2·23), more strongly than SI (1·83, 1·78–1·89) and SP (1·70, 1·65–1·76). The strongest association with SA was in the Western Pacific (2·68, 2·45–2·92) and with SI (2·04, 1·74–2·39) and SP (1·81, 1·68–1·95) were in Southeast Asia. There were no gender differences in aOR for SI and SP, but the aOR for SA among boys (2·28, 2·14–2·42) was significantly greater than among girls (2·04, 1·93–2·15), ratio of two odds ratios was 1.12 ($P = 0.008$).

Interpretation: SB and being bullied were common among adolescents worldwide. The findings of gender differences in SB, being bullied and their association could inform the design of prevention programmes to reduce the risks of SI, SP and SA in adolescents worldwide.

1. Introduction

Worldwide each year approximately 800,000 people die by suicide [1]. Suicide is the second leading cause of death among adolescents aged 10–24 years [2], which accounts for more than a quarter of suicides in the world [3]. While nonfatal suicidal behaviours (SB) are associated with increased suicide and being bullied is associated with SB in adolescents [4,5], the global risks of adolescent SB and being bullied are difficult to obtain as many countries do not have registration systems. The risks for SB and being bullied are influenced by population and individual level factors. There have been only a few studies that assessed the global prevalence of suicidal ideation (SI), suicide planning (SP), suicide attempt (SA) and being bullied among adolescents [6,7]. Inadequate investigation has been done to examine country and regional variations of the risks of SI, SP, SA and being bullied in adolescents [6–8]. Little is known about gender differences in the risks of adolescent SB and being bullied worldwide [9,10]. Although there are some knowledge of the association between being bullied and increased risk for SB [4,5], they are predominantly derived from studies undertaken in Western

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Research in context

Evidence before this study

To identify publications on the risk of suicidal behaviours (SB) and the association of being bullied with SB in adolescents, we systematically searched literature up to 1st October 2019 through Pubmed, Embase and Web of Science. We used various combinations of terms including: ("suicidal behaviour" or "suicidal ideation" [SI] or "suicide planning" [SP] or "suicide attempt" [SA] or "suicidal thought") and ("being bullied" or "bullying victim") and ("adolescents" or "youths"), with no language restrictions. Data on the risk of SB and the association of being bullied with SB were reported in several countries or regions, but data on global risks of SB and being bullied in young adolescent were scarce. No study has examined the association of being bullied with SB in adolescents across gender, countries and WHO regions.

Added value of this study

Our study examined the data of Global School-based Health Survey of 1st Jan 2003 to 31st Dec 2014 from 83 countries and demonstrated that the global risk of SI in adolescents was 16·5%, SP 16·5%, SA 16·4%, and of being bullied 35·3% respectively. The risk of SB varied across WHO regions and the highest risk of suicidal behaviours was in Africa (SI 19·9%, SP 23·2%, SA 20·8%). Girls had a significant higher risk of SI and SP than boys. There were significant associations of being bullied with SI, SP and SA in boys and girls, and the assoication with SA was stronger in boys than girls. The association of being bullied with SB also showed regional variations; the strongest association for SI was found in Southern Asia, and for SP and SA were found in Western Pacific.

Implications of all the available evidence

SB among adolescents is major public health issues in the world. Our findings address the need to strengthen bullying control interventions to decrease SB among adolescents globally. The multi-face prevention programmes should take region and gender differences into account.

countries, the findings of which should not necessarily be generalized to other countries, especially low and middle income countries (LMICs), where 79% of worldwide adolescent suicides occur [1]. Few studies have examined the association of being bullied with SI, SP and SA among the same study population [11–14]. No study has been conducted to assess the extent of the association of being bullied with SB in adolescents between gender groups across countries/regions. Comprehensive analysis of global data of SB and being bullied in adolescents and their association are needed to improve our understanding of the nature of their global public health problems, provide ministries of health with information about risk profiles, target for preventive interventions, and help develop decisions on promising prevention goals.

In this study, we examined data from Global School-based Student Health Survey (GSHS) to determine the prevalence of SI, SP, SA and being bullied in adolescents, to investigate the association of being bullied with SI, SP and SA, and to identify their gender differences and WHO regional variations.

2. Methods

2.1. GSHS data and study population

In August 2018 we contacted the USA Center for Disease Control and Prevention to use the full data of GSHS [15] for this study. The purpose of GSHS is to provide accurate data on health behaviours among adolescents to help countries develop priorities, establish programmes, and advocate for resources for school programmes and policies. Project-related design, organization, and implementation have been described elsewhere [15]. In brief, ten core questionnaire modules that addressed the leading causes of morbidity and mortality among adolescents form the framework of the GSHS, which included tobacco use, alcohol use, drug use, dietary behaviours, hygiene, physical activity, sexual behaviours, unintentional injury and violence, and mental health. Core questionnaire modules cannot be altered although countries could choose core expanded questions and country specific questions they wanted to incorporate into their GSHS, so that the findings are comparable between countries and over repeated surveys. All GSHS surveys were approved in each country, by both the national government administration, usually by the Ministry of Health or Education, and an institutional review board or ethics committee. Written informed consent was obtained from the participants or their guardians before survey.

By the end of August 2018, we downloaded GSHS data of 86 countries, of which three countries did not measure any of SI, SP, SA and being bullied and thus were excluded in this study. We used the most recent data for countries that have surveyed in multiple waves. The current study included data of 220,310 adolescents aged 12–15 years from 83 countries for analysis. Of 83 countries, 82 had collected data on being bullied, 71 on SI, 70 on SP and 41 on SA.

2.2. Measurements and definitions of being bullied, SI, SP, and SA

Being bullied was measured by the question of "*During the past 30 days, on how many days you were bullied?*" The students were given a statement in the questionnaire about what being bullied was, and those who answered with >= one day in the past 30 days were taken as being bullied.

SI was measured by the question of "*During the past 12 months, did you ever seriously consider attempting suicide?*" with SI defined as an affirmative answer to this question. SP was measured by the question of "*During the past 12 months, did you make a plan about how you would attempt suicide?*" with SP defined as affirmative answer to this question. SA was measured by the question of "*During the past 12 months, how many times did you actually attempt suicide?*" with SA defined as once or over.

2.3. Co-variables

Previous studies have reported that a wide range of socioeconomic, sociocultural and personal psychological factors contribute to SB [16]. Therefore, other variables collected in GSHS were used when examining association of being bullied with SB, which include age, gender, grade, cigarette smoking, alcohol use, number of close friends, loneliness, anxiety, parental support and the proxy of socioeconomic status. Cigarette smoking was measured by the question: "*During the past 30 days, on how many days did you smoke cigarettes*?" with smoking defined as smoking on at least 1 day during the past 30 days. Alcohol use was measured by the question: "*During the past 30 days, on how many days did you have at least one drink containing alcohol?*" with alcohol use defined as having had at least 1 glass of wine, a bottle of beer, a small glass of liquor, or a mixed drink. Close friendship was measured by the question "*How many close friends do you have?*" with having close friends defined as having at least 1 close friend. Parental support was measured by the question: "*During the past 30 days, how often did your parents or guardians understand your problems and worries?*" with parental support defined as "*most of the time*" or "*always*". Loneliness was measured by the question "*During the past 12 months, how often have you felt lonely?*" with loneliness defined as "*most of the time*" or "*always*". Anxiety was measured by the question "*During the past 12 months, how often have you been so worried about something that you could not sleep at night?*" with anxiety defined as "*most of the time*" or "*always*". With regards to

socioeconomic status of each adolescent, we took the question "*During the past 30 days, how often did you go hungry because there was not enough food in your home?*" for their proxy, with low socioeconomic status defined as "*most of the time*" or "*always*". Although previous study suggested drug use was associated with SB, we did not use the variables in this study as the majority of countries participated GSHS did not collect data on drug use.

Gross National Income (GNI) per capita is an indicator that often used for classify countries. We used income classification for each country, corresponding to the survey year as listed in the World Bank list of economies by income group. We extracted gender specified age-standardized suicide rate from WHO website for most countries [1], and from a national survey report for the few countries that gender-standardized suicide rates were not available in the WHO website.

2.4. Statistical analysis

All data were weighted according to the cluster sampling design of the surveys that used strata and primary sampling units at the country level to allow the sample to be nationally representative. Weighted prevalence estimates (with corresponding 95% CIs) were calculated by country and sex. Chi-square tests were employed to examine differences in prevalence by gender in each country. The overall, WHO regional [15] and gender specified prevalence of being bullied, SI, SP and SA were estimated with meta-analysis using a random effects model since there was significant heterogeneity among countries ($I^2 > 75\%$).

Multilevel mixed-effects models (include individual, country and WHO region level) were used to examine the associations of being bullied with SI, SP or SA, respectively. Different co-variates were adjusted in three models to examine the robustness of our findings. In model 1, we adjusted for age (12 years, 13 years, 14 years or 15 years), gender (female or male), grade (grade 7, grade 8, grade 9 or grade 10), socioeconomic status (low or not low), country income classification (high, upper middle, lower middle or low) and survey year (categories). In model 2, we additionally adjusted for cigarette smoking (yes or no), alcohol use (yes or no), number of friends (have at least one or none), and parental support (yes or no). In model 3, we additionally adjusted for loneliness (yes or no), anxiety (yes or no), and gender specified age-standardized suicide rates (continuous data). We assessed regional variations and gender differences among the associations via calculating a ratio of two odds ratios (RORs) [17], as we did before [18]. All data analyses were performed during the period of 1st September 2018 to 1st February 2019 and in statistical package STATA version 14.0.

2.5. Role of the funding source

The funders of the present study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

3. Results

Supplemental Table 1 shows the survey characteristic of GSHS and prevalence of SI, SP, SA and being bullied according to country. Of the 83 countries in the study, 9 were low income, 26 were low-middle income, 39 were upper-middle income and 18 were high income. In the total of 220,310 participants, the average age was 13·9 years old (± 0·9 years) and 50·7% were girls.

3.1. Prevalence of SI, SP and SA, and their differences across gender and WHO regions

The prevalence and 95% CIs of SI, SP and SA in each country are seen in Supplemental Table 1. The overall prevalence of SI was 16·5% (95%CI 15·2%–17·8%) (Table 1), and the highest was 34·5% (33·2%–35·8%) in Kiribati and the lowest was 1·1% (0·9%–1·3%) in Myanmar (Fig. 1 & Supplemental Table 1). The matched figure for SP was 16·5% (15·4%–17·7%), and the highest was 40·0% (38·8%–41·2%) in Samoa and the lowest was 0·05% (0·05%–0·05%) in Myanmar (Fig. 2 and Supplemental Table 1). The overall prevalence of SA was 16·4% (14·9%–17·9%), and the highest was 60·7% (59·6%–61·8%) in Samoa and the lowest was 5·2% (4·9%–5·5%) in Brunei (Fig. 3 & Supplemental Table 1).

Table 1
Prevalence of suicidal ideation, suicide planning, suicide attempt and being bullied among adolescents aged 12–15 years by WHO region and gender, 2003–14.

Region	Suicidal ideation (%)[a]	Suicide planning (%)[b]	Suicide attempt (%)[c]	Being bullied (%)[d]
Total	***16·5 (15·2–17·8)***	***16·5 (15·4–17·7)***	***16·4 (14·9–17·9)***	***35·3 (31·2–39·5)***
Boys	14·6 (13·6–15·6)	15·3 (14·2–16·3)	15·8 (14·3–17·2)	37·4 (32·6–42·3)
Girls	18·2 (16·7–19·7)*	17·3 (16·1–18·6)*	16·7 (15·1–18·4)	33·3 (29·1–37·4)
Africa	***19·9 (16·1–23·8)***	***23·2 (18·9–27·4)***	***20·8 (13·3–28·4)***	***48·0 (43·4–52·6)***
Boys	19·2 (15·0–23·3)	22·8 (18·3–27·3)	21·6 (14·0–29·2)	49·1 (44·3–53·9)
Girls	20·3 (16·7–23·9)	23·3 (19·0–27·5)	19·8 (11·8–27·7)	46·9 (42·0–51·8)
Americas	***16·7 (15·2–18·1)***	***15·3 (13·9–16·8)***	***13·8 (12·0–15·6)***	***26·7 (22·9–30·6)***
Boys	12·8 (11·8–13·7)	11·9 (10·9–12·9)	11·3 (9·7–12·8)	27·6 (23·2–31·9)
Girls	20·2 (18·6–21·8)*	18·5 (16·4–20·5)*	16·1 (13·8–18·4)*	26·0 (21·7–30·3)
Eastern Mediterranean	***15·5 (11·8–19·2)***	***13·6 (10·9–16·2)***	***14·7 (12·8–16·6)***	***37·4 (26·4–48·4)***
Boys	14·4 (11·2–17·6)	13·0 (10·7–15·3)	14·6 (12·1–17·1)	41·8 (31·1–52·5)
Girls	16·7 (12·3–21·2)	13·8 (10·6–16·9)	14·8 (13·3–16·2)	32·5 (20·8–44·2)
Europe	***10·1 (5·4–14·8)***	***8·5 (1·1–15·9)***	***N/A***	***8·7 (6·7–10·8)***
Boys	9·6 (1·2–17·9)	8·3 (1·1–17·6)	N/A	8·5 (5·7–11·4)
Girls	10·2 (9·8–10·6)	8·4 (3·5–13·3)	N/A	9·0 (7·4–10·6)
Southeast Asia	***8·2 (5·0–11·4)***	***11·4 (6·2–16·5)***	***N/A***	***34·4 (22·3–46·5)***
Boys	8·3 (5·0–11·7)	11·1 (5·1–17·0)	N/A	39·9 (27·1–52·7)
Girls	8·0 (4·9–11·2)	9·2 (5·2–13·3)	N/A	29·2 (17·9–40·6)
Western Pacific	***17·5 (15·1–19·8)***	***17·4 (15·8–19·0)***	***19·3 (16·9–21·7)***	***40·0 (33·5–46·5)***
Boys	16·6 (14·8–18·4)	17·3 (15·9–18·9)	20·4 (18·2–22·6)	42·2 (36·1–48·3)
Girls	18·2 (15·1–21·3)	16·5 (14·5–18·4)	17·8 (15·3–20·4)	38·0 (31·0–45·0)

Data are prevalence (95%CI).
Bold digits were the overall prevalence of SI, SP, SA and being bullied for total sample, or for WHO regional sample.
* $P < 0.05$ for the difference between gender.
[a] data from 71 countries.
[b] data from 70 countries.
[c] data from 41 countries.
[d] data from 82 countries.

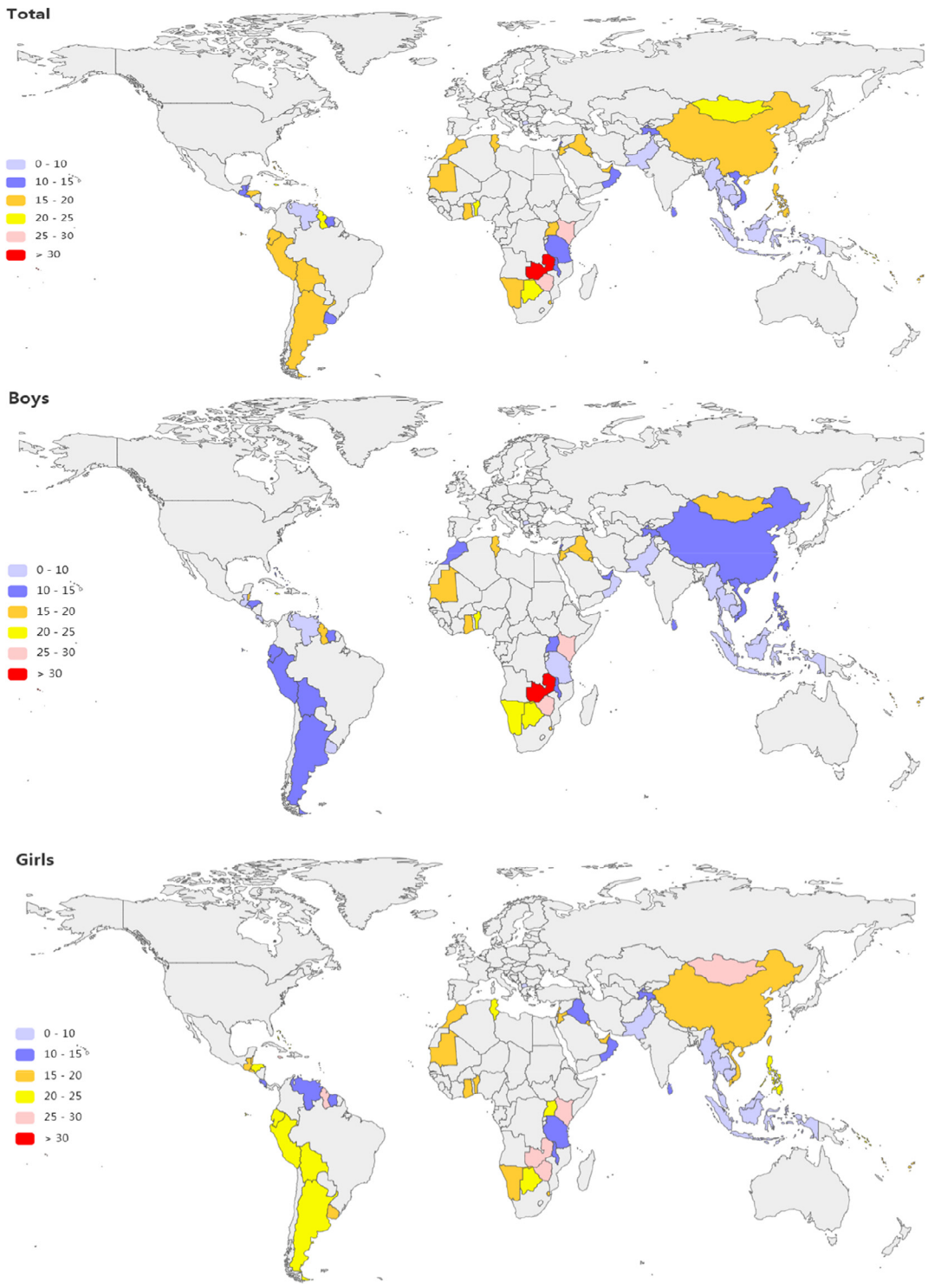

Fig. 1. Prevalence of suicidal ideation among adolescents aged 12–15 years in 71 countries (%). Data are from the Global school-based Students Health Survey, 2003–14.

Table 1 shows the prevalence and 95%CIs of SI, SP and SA by WHO regions and gender. The prevalence of SI significantly varied from the highest 19·9% (16·1%–23·8%) in Africa to the lowest 8·2% (5·0%–11·4%) in Southeast Asia. The matched figures for SP were 23·2% (18·9%–27·4%) in Africa and 8·5% (1·1%–15·9%) in Europe, and for SA were 20·8% (13·3%–28·4%) in Africa and 13·8% (12·0%–15·6%) in the Americas. Details of multiple comparisons of WHO regional prevalence of SI, SP and SA are in Supplemental Table 2.

The prevalence of SI, SP and SA were significantly higher in girls than boys in most of countries (Supplemental Table 3). Overall, girls have significantly higher prevalence of SI and SP than that of boys, but there were no gender differences in the prevalence of SA (Table 1, top part). Data from different WHO regions demonstrated that in most regions there was a higher prevalence of SI, SP and SA in girls than boys, however, only the Americas had significant gender differences in these prevalence (Table 1, six region parts).

3.2. Prevalence of being bullied, and the differences across gender and WHO regions

The overall prevalence of being bullied was 35·3% (31·2%–39·5%) (Table 1, top part), and the highest was 74·1% (73·0%–75·2%) in

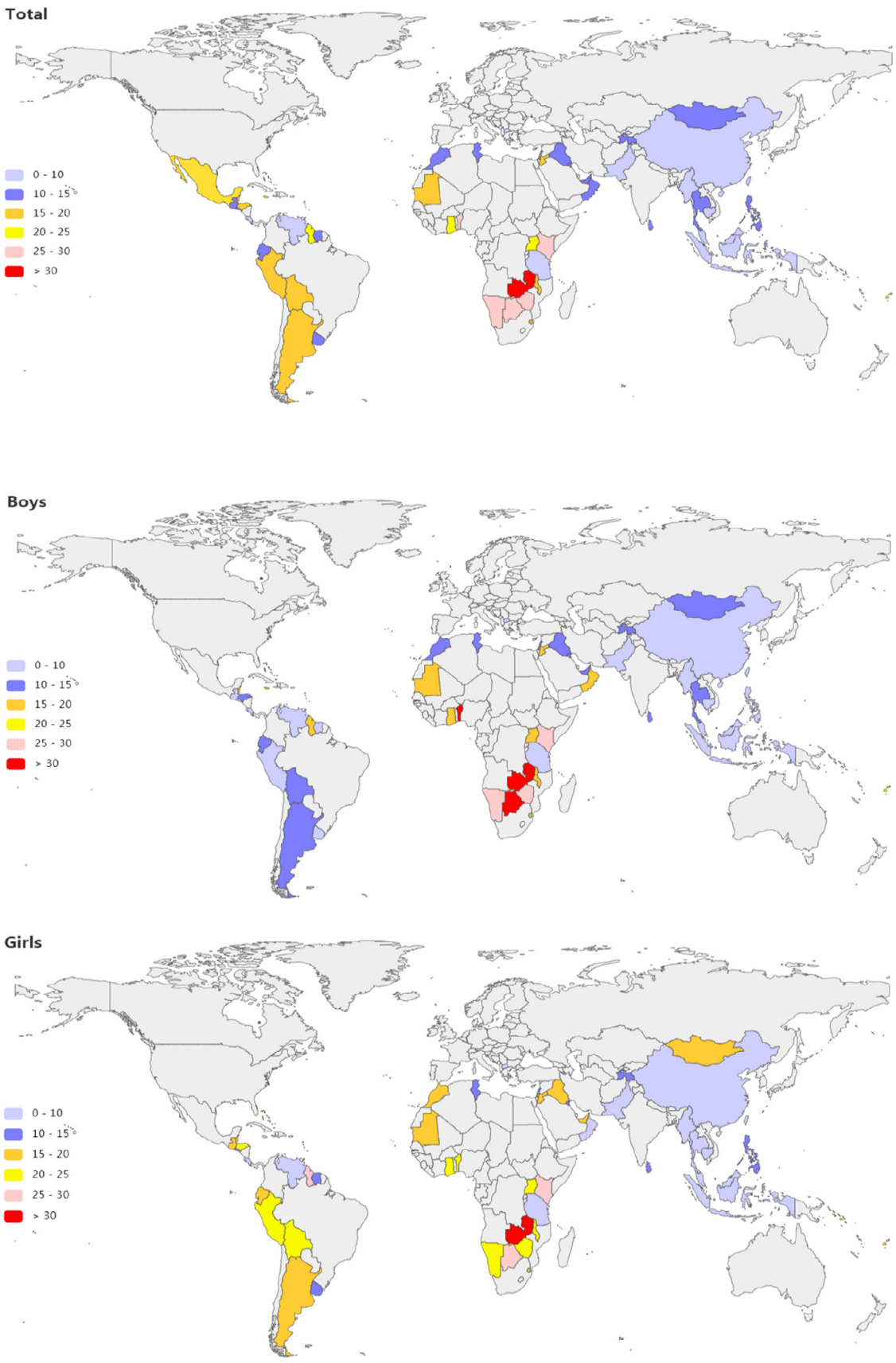

Fig. 2. Prevalence of suicide planning among adolescents aged 12–15 years in 70 countries (%). Data are from the Global school-based Students Health Survey, 2003–14.

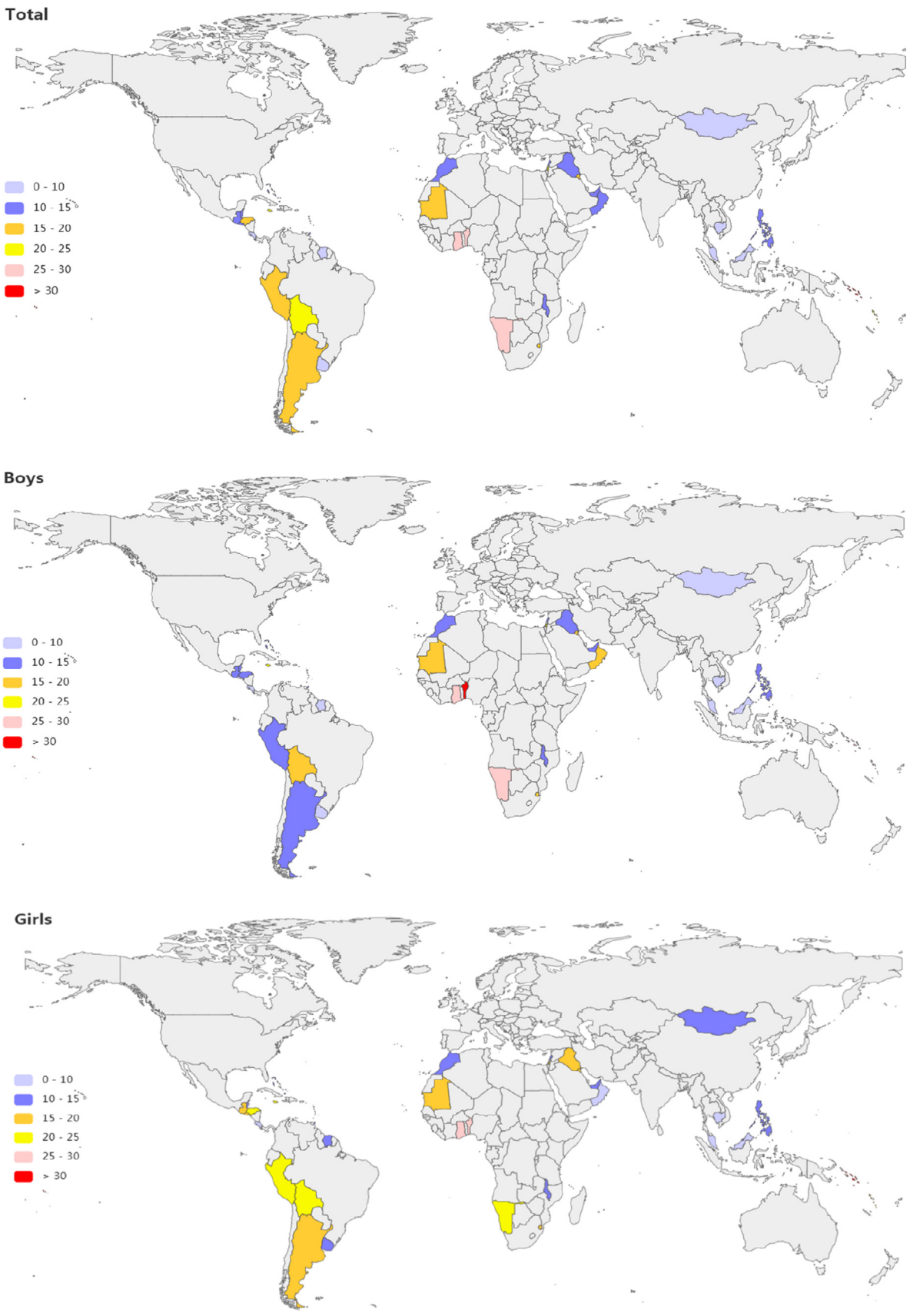

Fig. 3. Prevalence of suicide attempt among adolescents aged 12–15 years in 41 countries (%). Data are from the Global school-based Students Health Survey, 2003–14.

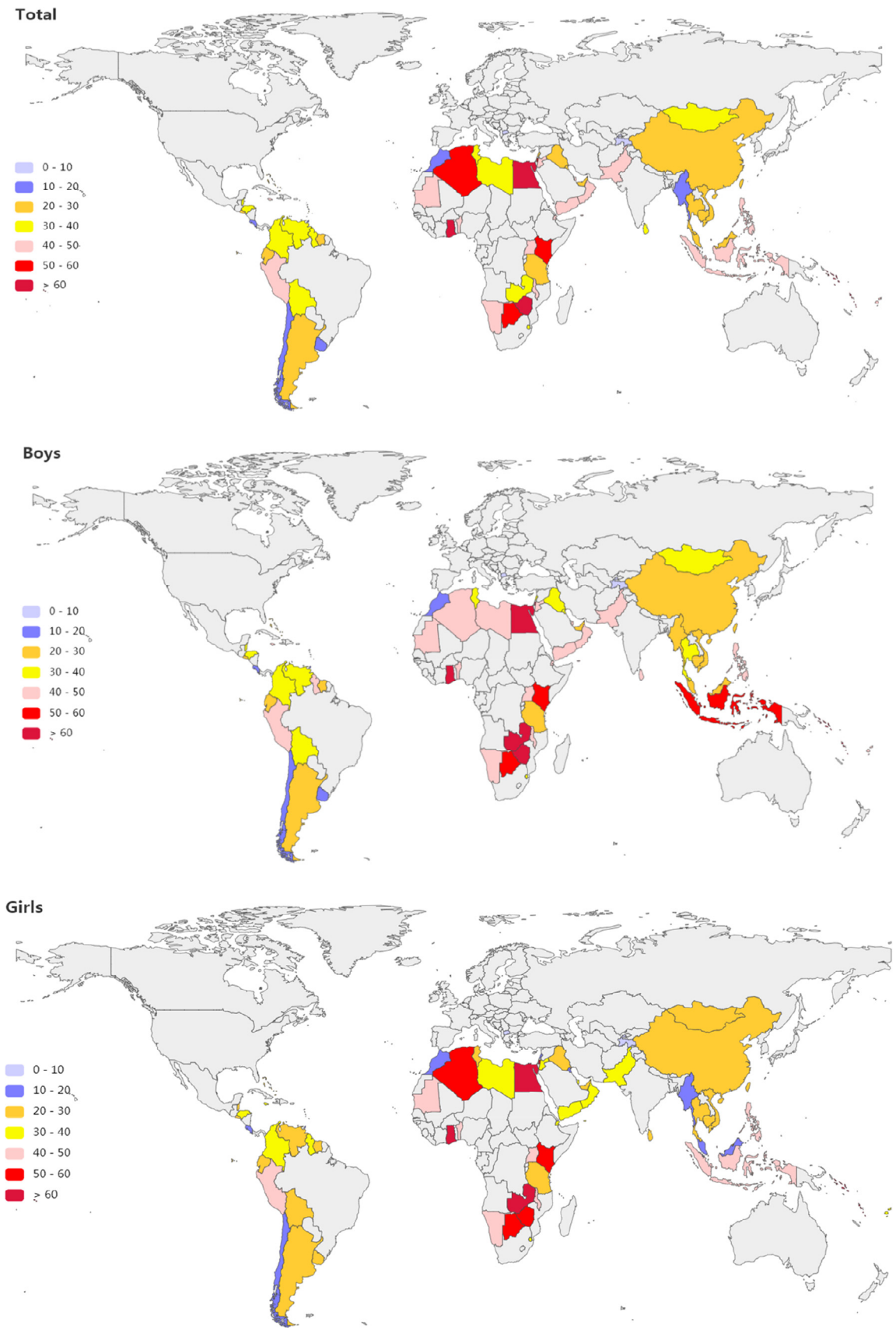

Fig. 4. Prevalence of school being bullied among adolescents aged 12–15 years in 82 countries (%). Data are from the Global school-based Students Health Survey, 2003–14.

Table 2
Association of being bullied with suicide ideation, planning and attempt among adolescents aged 12–15 years in all data and by WHO region.

	Model 1		Model 2		Model 3	
	Odds ratio (95%CI)	*P*	Odds ratio (95%CI)	*P*	Odds ratio (95%CI)	*P*
Association of being bullied with suicidal ideation [a]						
Total	***2·40 (2·33–2·47)***	***<0·001***	***2·12 (2·06–2·18)***	***<0·001***	***1·83 (1·78–1·89)***	***<0·001***
Africa	1·90 (1·76–2·04)	<0·001	1·67 (1·55–1·80)	<0·001	1·53 (1·42–1·65)	<0·001
Americas	2·55 (2·43–2·67)	<0·001	2·21 (2·11–2·32)	<0·001	1·85 (1·75–1·94)	<0·001
Eastern Mediterranean	2·43 (2·27–2·59)	<0·001	2·20 (2·05–2·35)	<0·001	1·84 (1·72–1·97)	<0·001
Europe	2·37 (1·88–2·98)	<0·001	1·93 (1·51–2·47)	<0·001	1·74 (1·35–2·24)	<0·001
Southeast Asia	2·65 (2·28–3·09)	<0·001	2·43 (2·08–2·84)	<0·001	2·04 (1·74–2·39)	<0·001
Western Pacific	2·53 (2·38–2·69)	<0·001	2·22 (2·09–2·37)	<0·001	2·00 (1·87–2·13)	<0·001
Association of being bullied with suicide planning [b]						
Total	***2·19 (2·13–2·26)***	***<0·001***	***1·94 (1·88–2·00)***	***<0·001***	***1·70 (1·65–1·76)***	***<0·001***
Africa	1·90 (1·77–2·04)	<0·001	1·71 (1·59–1·84)	<0·001	1·58 (1·47–1·71)	<0·001
Americas	2·31 (2·20–2·43)	<0·001	2·00 (1·90–2·11)	<0·001	1·72 (1·63–1·81)	<0·001
Eastern Mediterranean	2·11 (1·97–2·27)	<0·001	1·91 (1·77–2·05)	<0·001	1·63 (1·51–1·75)	<0·001
Europe	2·13 (1·65–2·74)	<0·001	1·83 (1·41–2·40)	<0·001	1·70 (1·29–2·23)	<0·001
Southeast Asia	2·12 (1·84–2·46)	<0·001	197 (1·70–2·28)	<0·001	1·68 (1·44–1·96)	<0·001
Western Pacific	2·33 (2·18–2·50)	<0·001	2·01 (1·87–2·16)	<0·001	1·81 (1·68–1·95)	<0·001
Association of being bullied with suicide attempt [c]						
Total	***2·89 (2·78–3·00)***	***<0·001***	***2·46 (2·37–2·56)***	***<0·001***	***2·14 (2·06–2·23)***	***<0·001***
Africa	2·82 (2·51–3·16)	<0·001	2·44 (2·17–2·75)	<0·001	2·24 (1·98–2·53)	<0·001
Americas	2·75 (2·60–2·91)	<0·001	2·34 (2·20–2·48)	<0·001	2·01 (1·89–2·13)	<0·001
Eastern Mediterranean	2·53 (2·34–2·73)	<0·001	2·21 (2·05–2·39)	<0·001	1·90 (1·75–2·07)	<0·001
Western Pacific	3·75 (3·46–4·07)	<0·001	3·03 (2·79–3·30)	<0·001	2·68 (2·45–2·92)	<0·001

Mode l, adjusted for age, sex, grade, socioeconomic status, income classification and survey year; Model 2, model 1 plus cigarette smoke, alcohol use, number of friends, and parental support; Model 3, model 2 plus loneliness, anxiety, and gender specified age-standardize suicide rate.
Bold digits were the overall association of being bullied with SI, SP and SA for the total sample.
[a] data from 70 countries.
[b] data from 69 countries.
[c] data from 40 countries.

Samoa and the lowest was 7·7% (7·6%–7·8%) in Tajikistan (Fig. 4 & Supplemental Table 1). Among six regions, the highest prevalence of being bullied in adolescents was 48·0% (43·4%–52·6%) in Africa, and the lowest was 8·7% (6·7%–10·8%) in Europe (Table 1).

There were no gender differences in the overall prevalence of being bullied (Table 1, top part), although data of 54 countries showed significant differences in the prevalence of being bullied between boys and girls (Supplemental Table 3). Data from six WHO regions also showed no significant gender differences in the prevalence of being bullied (Table 1).

3.3. Association of being bullied with SB, and their differences across gender and WHO regions

Table 2 shows risks of SI, SP and SA in relation to being bullied. Being bullied adolescents had significantly increased odds ratios of SI, SP and SA. Although their odds ratios were reduced with more variables adjusted, the fully adjusted models (model 3) showed that the aORs were significantly increased; for SI was 1·83 (95%CI 1·78–1·89), for SP 1·70 (1·65–1·76) and for SA 2·14 (2·06–2·33).

There were significant variations in the associations among the WHO regions. As can be seen in Table 2 and Supplemental Table 4, the association of being bullied with SI was significantly stronger in Southeast Asia (aOR 2·04, 1·74–2·39), Western Pacific (2·00, 1·87–2·13), Americas (1·85, 1·75–1·94) and Eastern Mediterranean (1·84, 1·72–1·97) than that in Africa (1·53, 1·42–1·65). The association of being bullied with SP was stronger in the Western Pacific (1·81, 1·68–1·95) than in Africa (1·58, 1·47–1·71), and with SA was the strongest in the Western Pacific (2·68, 2·45–2·92).

Table 3 shows the associations of being bullied with SI, SP and SA in boys and girls. While the association of being bullied with SI and SP was similar between boys and girls, the association with SA was stronger in boys than girls (ROR 1·12, $P = 0·008$).

4. Discussion

Our study has provided valuable and previously unavailable information about the global risks of SI, SP, SA and being bullied among adolescents. The results have shown that SI, SP, SA and being bullied are common among adolescents worldwide, with substantial variations across countries and WHO regions. Compared to boys, girls had a higher prevalence of SI and SP, but similar prevalence of SA and being bullied. Findings from this study have provided evidence that being bullied was more strongly associated with SA than SI and SP in adolescents. The association of being bullied with SB also varied across WHO regions, the strongest association with SI was in Southeast Asia, and with SP and SA were in Western Pacific. The association of being bullied with SA was stronger in boys than that in girls.

Previous studies reported inconsistent prevalence of SI, SP and SA among adolescents. In the United States, the Youth Risk Behaviour survey (YRBS) in 2017 showed that the 12 months prevalence of SI, SP and SA in adolescents of grade 9 to 12 were 17·2%, 13·6% and 7·4% [19]. An investigation conducted in a representative sample of Lithuanian adolescents aged 13 to 15 years found that the prevalence of SI, SP and SA were 23·8%, 13·7 and 13·2% [20]. A survey conducted among participants aged 12 to 17 years in Australia showed that the prevalence of SI, SP and SA was 7·5%, 5·2% and 2·4% [21]. The differences in the prevalence of adolescent SB in previous studies could be due to variations of sampling and survey methods. Compared with the findings of previous studies, our study demonstrated a higher level of SB in adolescents, particularly SA.

SA in adolescents needs to be prioritized for prevention and treatment since its ratio to completed suicides is high at about 20:1 [22]. The global prevalence of SA identified in our study was 16·4%, which was twice that of USA [19]. As a large proportion of adolescents with or without SI reported SA in this study, the suicidal patterns for the global adolescent population cannot be entirely explained by the

Table 3
Association of being bullied with suicidal ideation, suicide planning and attempt in boys and girls and their gender ratio.

	Boys		Girls		Ratio of two ORs in boys vs girls	
	OR(95%CI) [a]	*P*	OR(95%CI) [a]	*P*	ROR	*P*
Association of being bullied with suicidal ideation [a, #]						
Total	***1·81(1·72–1·89)***	***<0·001***	***1·85(1·78–1·93)***	***<0·001***	***0·98***	***0·490***
Africa	1·51(1·34–1·70)	<0·001	1·62(1·46–1·79)	<0·001	**0·93**	**0·379**
Americas	1·89(1·74–2·05)	<0·001	1·82(1·70–1·94)	<0·001	1·04	0·482
Eastern Mediterranean	1·77(1·60–1·96)	<0·001	1·88(1·71–2·08)	<0·001	0·94	0·402
Europe	1·64(1·11–2·41)	0·012	1·97(1·39–2·77)	<0·001	0·83	0·489
Southeast Asia	1·88(1·48–2·40)	<0·001	2·10(1·69–2·60)	<0·001	0·90	0·503
Western Pacific	1·95(1·77–2·16)	<0·001	2·02(1·86–2·20)	<0·001	0·97	0·596
Association of being bullied with suicide planning [b, #]						
Total	***1·72(1·63–1·80)***	***<0·001***	***1·70(1·63–1·77)***	***<0·001***	***1·01***	***0·722***
Africa	1·62(1·45–1·81)	<0·001	1·61(1·46–1·77)	<0·001	1·01	0·934
Americas	1·78(1·64–1·94)	<0·001	1·69(1·58–1·80)	<0·001	1·05	0·339
Eastern Mediterranean	1·58(1·42–1·76)	<0·001	1·66(1·50–1·83)	<0·001	0·95	0·508
Europe	1·44(0·93–2·23)	0·105	2·07(1·44–2·96)	<0·001	0·70	0·209
Southeast Asia	1·69(1·33–2·13)	<0001	1·66(1·36–3·76)	<0·001	1·02	0·950
Western Pacific	1·83(1·64–2·05)	<0·001	1·79(1·62–1·97)	<0·001	1·02	0·770
Association of being bullied with suicide attempt [c, #]						
Total	***2·28(2·14–2·42)***	***<0·001***	***2·04(1·93–2·15)***	***<0·001***	***1·12***	***0·008***
Africa	2·62(2·20–3·13)	<0·001	1·96(1·66–2·33)	<0·001	1·34	0·020
Americas	2·10(1·91–2·31)	<0·001	1·94(1·79–2·10)	<0·001	1·08	0·211
Eastern Mediterranean	2·02(1·79–2·27)	<0·001	1·79(1·60–2·00)	<0·001	1·13	0·146
Western Pacific	2·73(2·40–3·11)	<0·001	2·62(2·33–2·94)	<0·001	1·04	0·643

Bold digits were the association of being bullied with SI, SP and SA in boys and girls and their dender ratio for the total sample.
[a] data from 70 countries.
[b] data from 69 countries.
[c] data from 40 countries.
[#] Adjusted for age, sex, grade, socioeconomic status, income classification, survey year, cigarette smoke, alcohol use, number of friends, and parental support, loneliness, anxiety, and gender specified age-standardize suicide rate.

ideation-to-action framework [23]. It is possible that the risk factors for SA in GSHS population were different from studies of adolescents in Western countries or high income countries (HICs) [22,24]. Nock and colleagues have identified that the strongest diagnostic risk factor for SA was mood disorders in HICs, but impulse control disorders in LMICs [25]. This information is very important, not only for scientific understanding of SB, but also for health providers monitoring risk factors among suicidal adolescents and for public health efforts to identify those at risk for SB [7].

In this study, the prevalence of SB in adolescents varied across WHO regions and many countries significantly. The heterogeneity in the risk of SB in adolescents could in part be attributable to differences in socioeconomic factors, culture and religion [26,27]. The high risks of SI, SP and SA among adolescents in the Africa region could be partly explained by poverty [28], political unrest, high level of infectious diseases, etc [29]. There are limited data on adolescent SB in Africa, which may also hamper prevention and control of SB [30]. The regional differences in the prevalence of SB have suggested that it is important to establish national suicidal prevention strategies and surveillance systems to more accurately estimate the burden of SB [30].

Previous studies [31,32] have not well examined gender differences in the risks of adolescent SI, SP and SA. Our findings have shown that compared to boys, girls were at similar risk of SA, but higher risks of SI and SP, which were mainly from that in the Americas. In the Americas region, family relationships is a core value that serves as a protective factor against stressors [33]. Over the past few decades, Latin America and the Caribbean have made considerable progress on reducing gender disparities in education and labour force participation [34]. However, these changes may lead to more family conflicts and give the girls much more pressure that increase suicide risk in girls (including SA, Table 1) [35]. It is worth noting that the gender differences in prevalence of SI, SP and SA are opposite to the prevalence of suicide death, which is in part due to more nonlethal SB used by females in their SA [36].

The prevalence of being bullied among young adolescents was 35·3% in this study, which was particularly high in Africa (nearly half of adolescents had being bullied). The high level of being bullied among adolescents in Africa region could be partly ascribed to low socioeconomic status of adolescents, poor school, home and social environment, political violence, war, and crime [37,38]. Our data demonstrated no gender differences in the overall and regional-specific prevalence of being bullied, although more than half of countries participated GSHS showed significant gender differences. While we need to prevent and treat being bullied in boys and girls equally, countries with gender differences in being bullied should pay specific attention to this issue.

In this study we found that there were significant associations of being bullied with SI, SP and SA respectively, and the association with SA was the strongest. Previous studies [39–41] also showed being bullied was associated with an increased risk of SB in adolescents, but there were some methodological issues to be concerned. Fisher and colleagues found that being bullied in childhood increased the risk of self-harm in early adolescence, but the study sample included a small number of children who had engaged in self-harm, which may lead to unstable or biased estimates of the size of the association between self-harm and being bullied [40]. Alavi and colleagues found the association of bullying victimization with increased SI in adolescents referred for urgent psychiatric consultation (OR = 2·0), but they did not adequately adjust for confounders in the analysis [39]. In a recent study [13], Koyanagi and colleagues found that being bullied was associated with SA (aOR 3·06, 2·73–3·43), but they only adjusted for age, sex and proxy for socioeconomic status, thus the residual effects may exist. Our findings suggested that the ORs for SB in relation to being bullied were reduced gradually with adjustment for more confounding variables, which may imply there were interactions between being bullied and those variables. Future researches on exploring and identifying the interactions are needed as it may provide implications for preventing SB among bullied adolescents. Nevertheless, in our fully adjusted models the association of

being bullied with SI, SP and SA remained significant; demonstrating that being bullied would be an important factor for controlling to reduce the risk of SA in adolescents.

Findings from this study suggested that the association of being bullied with SA was stronger than on SI and SP. Given that being bullied increases the risk of mental health problem that lead to increased risk of SI, SP and SA, it might be that being bullied could contribute to poor impulse control among adolescents, which is the strongest predictors for SA [42]. However, impact of being bullied on impulse control cannot be estimated as impulsivity was not measured in GSHS, which could be an area for future investigation.

Our study showed significant regional differences in the association of being bullied with SI, SP and SA, which provides the basis for the development of regional or national suicide prevention strategies in adolescents. For example, being bullied adolescents were more likely to engage in SP and SA in the Western Pacific region, which could be related to less accessible mental health service in this region [43]. This suggests that any laws, policies and interventions used to reduce or stop bullying among adolescents could have greater effects on SP and SA reduction.

Previous studies showed inconsistent findings of gender differences in the association of being bullied with SB in adolescents [44,45]. Johannes and colleagues have reported that female victims were frequently reporting SI in a follow-up study (HR 2·68, 1·52–4·73), but not male victims [45]. Because their study only examined being bullied and SI in the past two weeks, which may introduce the bias for the association [45]. Some investigators have studied data on being bullied and SI over a longer period of time, and found SI equally prevalent in girls and boys [46]. Our study of GSHS data demonstrated that the impact of being bullied on SI and SP were equally important for girls and boys, but bullied boys had higher risk of SA than their counterpart girls, which was supported by a recent cohort study [45]. One plausible explanation for this observation was that bullied boys were more likely to have poor impulse control [47], which is a strongest predictor of SA. Gender differences in the impact of being bullied on SA in adolescents require future research on the mechanisms linking bullying with SA.

The main contribution of this study lies in what it tells us about the risks of SI, SP, SA and being bullied, and the association of being bullied with SB among adolescents globally. As far as we know, our study is the first to report the gender and WHO regional differences in the association of being bullied with SB. The GSHS used standard procedures for selecting participants and the same questions to collect data, which makes results between countries directly comparable. Our study has limitations. First, the prevalence on SI, SP, SA and being bullied were based on self-report questionnaires, which might be under-reported due to recalling issues. However, a systematic review conducted by Posner K and colleagues showed that using this method to garner information from adolescents regarding SB and being bullied should be likely to be reliable [48]. Second, the GSHS data only included two countries from Europe, which may not represent the European level of SB and being bullied in adolescents. But previous studies in Europe showed similar findings of SI, SP, and SA to our study [49]. Third, our study has a cross-sectional design, limiting inference on causal direction. However, the associations of being bullied with SI, SP and SA observed were consistent with those in longitudinal studies [40,50].

In conclusion, our study has demonstrated that SI, SP and SA in adolescents are major public health problems worldwide. The prevalence of SB varied between boys and girls and across countries and WHO region. Being bullied among adolescents was associated with increased risk of SB and the association with SA was the strongest. Most notably, the association of being bullied with SB varied by WHO regions; the strongest association for SI was found in Southeast Asia and for SP and SA was found in Western Pacific. Bullied boys were more likely to have SA than bullied girls. Our findings emphasize the need to establish or strengthen policies and programmes for reducing bullying to decrease SB in adolescents globally. Strategies to prevent SB and bullying should take regional and gender differences into account.

Declaration of competing interest

We declare no competing interests.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.eclinm.2019.100253.

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