

# Prevalence of suicidal behaviour among students living in Muslim-majority countries: systematic review and meta-analysis

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## Background

Assessing suicidal behaviours among students would help to understand the burden and enhance suicide prevention.

## Aims

We aimed to determine the prevalence of suicidal behaviour among students living in Muslim-majority countries.

## Method

We followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A systematic search was conducted in Medline, EMBASE and PsycINFO. Meta-analyses were performed to pool the lifetime, 1-year and point prevalence rates for suicidal ideation, plans and attempts.

## Results

From 80 studies, 98 separate samples were included in this analysis. The majority ( $n = 49$ ) were from the Eastern Mediterranean, and 61 samples were of university students. The pooled prevalence of suicidal ideation was 21.9% (95% CI 17.4%–27.1%) for lifetime, 13.4% (95% CI 11.1%–16.1%) for the past year and 6.4% (95% CI 4.5%–9%) for current. The pooled prevalence of suicide plans was 6.4% (95% CI 3.7%–11%) for lifetime, 10.7% (95% CI 9.1%–12.4%) for the past year and 4.1% (95% CI 2.7%–

6.2%) for current. The pooled prevalence of suicide attempts was 6.6% (95% CI 5.4%–8%) for lifetime and 4.9% (95% CI 3.6%–6.5%) for the past year. The lifetime prevalence of suicidal ideation was highest (46.2%) in South-East Asia, but the 12-month prevalence was highest (16.8%) in the Eastern Mediterranean.

## Conclusions

The study revealed notably high rates of suicidal behaviours among students living in Muslim-majority countries. However, the quality of studies, differences in regional and cultural factors, stages of studentship and methods of measurement should be considered when generalising the study results.

## Keywords

Suicide; Muslim countries; systematic review; meta-analysis; prevalence.

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## Background

Suicide is the fourth leading cause of death among persons aged 15–29 years.<sup>1</sup> About 77% of total suicides and 88% of suicides among adolescents occur in low- and middle-income countries (LMICs).<sup>1</sup> The burden is higher when considering suicidal behaviour. Suicidal behaviour includes suicidal thoughts, plans, attempts and death by suicide.<sup>2</sup> These are influenced by multifaceted interactions between biological, genetic, psychological, social and cultural factors.<sup>3</sup> Research has found that the factors associated with suicidal behaviour in young people include mental health problems;<sup>4</sup> alcohol and substance misuse;<sup>5</sup> sexual minority status;<sup>6,7</sup> familial factors such as parental loss, discord and separation;<sup>8</sup> academic stress;<sup>8,9</sup> economic difficulties<sup>10</sup> and low social support.<sup>11</sup>

## Suicidal behaviour among students

Suicidal ideation not only raises the risk of suicide attempt and death from suicide,<sup>12</sup> but also has associations with mental health problems, high-risk sexual practices and criminal activity.<sup>13</sup> It appears to be more common among university students. According to a multi-country study, approximately 29% of university students had experienced suicidal thoughts at some point in their lives.<sup>14</sup> Another multi-country survey found that 11.7% of university students had experienced suicidal thoughts at some point in their lives.<sup>15</sup>

There are about 50 Muslim-majority countries/territories in the world, most with LMIC backgrounds.<sup>16–18</sup> There are religious prohibitions against suicide, and suicide is considered a criminal

offence in several Islamic countries,<sup>19</sup> and as a result, suicide has historically been understudied in these countries.<sup>20,21</sup> Furthermore, many Islamic nations do not collect or submit national suicide statistics to the World Health Organization (WHO).<sup>22</sup> To our knowledge, ours is the first systematic review and meta-analysis assessing the prevalence of suicidal behaviour among students in Muslim-majority countries.

## Method

### Search strategy

A systematic search was conducted in the databases Medline, EMBASE and PsycINFO, using predesigned search terms to locate articles mentioning the prevalence of suicidal behaviour among students living in Muslim-majority countries. Search details are in Supplementary File 1 available at <https://doi.org/10.1192/bjo.2023.48>, and we registered the protocol in advance (PROSPERO identifier CRD42022319612). The review included all of the published articles from inception to search date (10 March 2022), irrespective of the period of data collection.

### Inclusion criteria

Articles reporting results from original research studies that had cross-sectional designs, included quantitative estimates of rates of suicidal behaviour, focused on students in Muslim-majority

countries, were published in the English language and for which the full text was available were included. No age or gender restrictions were applied.

### Exclusion criteria

We excluded articles with qualitative outcomes. For multiple papers from the same project, we included the most recent and/or comprehensive paper and excluded the rest. All types of review, editorial, erratum and letters without primary data were excluded.

### Study selection

Two authors (S.M.Y.A., V.M.) screened the studies independently and a third author (A.B.) commented if any ambiguous situations arose. We followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and the stepwise details of the search are described in Supplementary File 2.

### Data extraction

We extracted the name of the lead authors, year of publication, country where the study was conducted, WHO region of the country, name of the journal, place of study, instruments measuring suicidal behaviour, study duration, data collection year, study design, data collection methods, study setting (rural/urban), level of studentship (elementary school/high school (college)/university), sources of the case, sample size, male/female ratio and rates of suicidal ideation, suicide plan, suicide attempts and non-suicidal self-injury (NSSI) in the lifetime, past year and during the current time (study period). We extracted data from Muslim countries in the studies conducted in multiple countries and considered a different set of data. The data yielded 80 studies from which 98 separate samples were included in this review. Among the 50 Muslim territories, studies were identified from 19 countries (Azerbaijan, Bangladesh, Brunei Darussalam, Egypt, Indonesia, Iran, Jordan, Kuwait, Libya, Lebanon, Malaysia, Morocco, Palestine, Pakistan, Sierra Leone, Saudi Arabia, Turkey, Tunisia and United Arab Emirates). Two authors (S.T. and R.A.M.) separately extracted the data in Microsoft Excel version 10 for Windows, and a third opinion from another author (S.M.Y.A.) was taken when necessary.

### Quality assessment

The methodological quality of the studies was assessed using the Newcastle–Ottawa Scale, adapted for cross-sectional studies.<sup>23</sup> The tool includes three parameters: selection (representativeness of the sample, sample size, non-respondents, ascertainment of exposure), comparability (comparability of individuals in different outcome groups on the basis of design or analysis) and outcome (assessment of outcome, statistical test). Two of the authors (S.M.Y.A. and N.V.) examined the full texts of the included articles to categorise every study on these parameters. A score of ‘1’ or ‘0’ was given under each parameter depending on whether the criteria were satisfied or not, respectively, as per the manual of the Newcastle–Ottawa Scale. In some studies, when the criteria were satisfied with a validated method, a score of ‘2’ was given. The sum of scores for all subscale items was used to categorise overall study quality as either high (>7), moderate (5–7) or low (<5). Any disagreement was resolved by mutual discussion among senior authors.

### Data analysis

The prevalence estimates in the selected studies for different suicidal behaviours (ideation, plan and attempt) and NSSI were meta-analysed to create pooled prevalence estimates with the ‘Meta’ and

‘Metafor’ packages in RStudio version 1.4.1717 for Windows (Posit Software PBC, Boston, USA; <http://www.rstudio.com/>). The random intercept logistic regression method was used to pool the data. Heterogeneity was examined with the  $I^2$ -statistic. Because of the high heterogeneity, random-effects models were used for the syntheses. Pooled results were displayed with forest plots. Subgroup analyses were performed to see whether the prevalence estimates varied across three settings: university, high school and elementary school. Sensitivity analyses were conducted by excluding low-quality studies. Moderator analyses were performed to test the moderating effect of gender composition (i.e. percentage of males) and the year of publication on effect sizes. Publication bias was analysed by inspecting the funnel plots, and the Egger’s test was used for funnel plot asymmetry; a significant  $P$ -value (<0.05) for Egger’s test indicated the presence of publication bias. Subgroup analyses, moderation analyses and tests of funnel plot asymmetry were not performed in meta-analyses with fewer than ten studies. Only those subgroups having at least two studies were included in the subgroup analysis.

### Ethical aspects

We reviewed secondary data from publicly available articles. Therefore, no institutional review board approval was sought to conduct the study.

## Results

### Characteristics of included studies

A total of 80 studies were included in this review. In cross-country studies, the population in each country was considered as a separate population when conducting meta-analyses; thus, a total of 98 separate samples were included in the analyses. The characteristics of these studies are summarised in Table 1. The majority of these populations were from the Eastern Mediterranean ( $n = 49$ ), followed by Europe ( $n = 23$ ), South-East Asia ( $n = 18$ ), the Western Pacific ( $n = 7$ ) and Africa ( $n = 1$ ). With regard to individual countries, the highest number of studies was obtained from Turkey ( $n = 22$ ), followed by Iran ( $n = 15$ ) and Bangladesh ( $n = 11$ ).

A wide range of instruments had been used in the included studies for the assessment of suicidal behaviours and/or NSSI. The most frequently used instrument was the Global School-Based Student Health Survey (GSHS), which was used in 14 studies. The next most commonly used scale was the Suicidal Behaviors Questionnaire-Revised (SBQ-R), used in seven studies.

The majority of samples were composed of university students ( $n = 61$ ); 15 were composed of high school students and 22 were composed of elementary school students. The size of individual study samples ranged from 75 to 28 303. The percentage of males in the samples ranged from 15.3% to 100%, with a median of 46.3%.

### Pooled prevalence rates of suicidal behaviours

#### Prevalence of suicidal ideation

The pooled lifetime prevalence of suicidal ideation among students overall was 21.9% (95% CI 17.4%–27.1%). The majority of studies (31) reporting a lifetime prevalence of suicidal ideation was conducted among university students, but a few (3) were conducted among high school students (Fig. 1). The prevalence in these two subgroups was similar. No corresponding studies among elementary school students were available. The 12-month prevalence of suicidal ideation among students overall was 13.4% (95% CI 11.1%–16.1%). High school students exhibited the highest prevalence (16.6%) out of the three subgroups, whereas elementary

**Table 1** Characteristics of studies

| Serial number | Study                                   | Region | Country              | Study setting | Instruments  | Study duration   | Data collection year | Data collection methods                  | Level of study | Sources of cases   | Suicidal behaviour         | Number of cases | Male: female ratio | Quality appraisal |
|---------------|---|--------|----------------------|---------------|--|------------------|----------------------|--|----------------|--|----------------------------|-----------------|--------------------|-------------------|
| 1             | Abdeen et al, 2018 <sup>24</sup>        | EMR    | Palestine            | Urban         | Health Behavior in School Aged Children in the Middle East Study Scale | 5 months         |                      | Survey                                   | School         | 93 single-gender and seven coeducation schools                     | Ideation and attempt       | 5713            | 0.44:1             | Moderate          |
| 2             | Afifi, 2004 <sup>25</sup>               | EMR    | Egypt                | Urban         | Attitude Towards Suicide Scale   | 1 year           | 1996                 | Survey                                   | High school    | 12 schools in six districts of Alexandria                          | Ideation and attempt       | 1621            | 1.03:1             | Moderate          |
| 3             | Ahmad et al, 2014 <sup>26</sup>         | WPR    | Malaysia             | Nationwide    |  | 2 months, 3 days | 2012                 | Secondary analysis of national GSHS data | School         | 234 government schools   | Ideation                   | 25174           | 0.96:1             | Moderate          |
| 4             | Ahmadpoor et al, 2021 <sup>27</sup>     | EMR    | Iran                 | Urban         |  | 1 year, 3 months | 2017                 | Survey                                   | University     | 13 medical universities  | Ideation and attempt       | 4261            | 1.26:1             | Moderate          |
| 5             | Ahmed et al, 2016 <sup>28</sup>         | EMR    | Egypt                | Urban         | BSSI   | 1 month          | 2016                 | Survey (online)                          | University     | Undergraduate medical students                                     | Ideation and plan          | 612             | 0.45:1             | Moderate          |
| 6             | Asante et al, 2021 <sup>29</sup>        | AFR    | Sierra Leone         |               | Single item question from GSHS questionnaire                           |                  | 2017                 | Secondary analysis of national GSHS data | School         | Secondary school   | Ideation and attempt       | 2798            | 0.87:1             | Moderate          |
| 7             | Aldalaykeh et al, 2020 <sup>30</sup>    | EMR    | Jordan               | Urban         |  |                  |                      | Survey                                   | University     | Public university  | Attempt                    | 160             | 0.66:1             | Low               |
| 8             | Almoammar et al, 2021 <sup>31</sup>     | EMR    | Saudi Arabia         | Urban         |  | 3 months         | 2020                 | Survey (online)                          | University     | Dental students and interns  | Ideation and attempt       | 218             | 0.73:1             | Moderate          |
| 9             | Amiri et al, 2013 <sup>32</sup>         | EMR    | United Arab Emirates | Urban         |  |                  |                      | Survey                                   | University     | University students at the Faculty of Medicine and Health Sciences | Ideation and attempt       | 115             | 0.69:1             | Moderate          |
| 10            | Arafat et al, 2022 <sup>33</sup>        | SEAR   | Bangladesh           | Urban         |  | 3 months         | 2021                 | Survey (online)                          | University     | Medical college and university students                            | Attempt                    | 529             | 1.07:1             | Low               |
| 11            | Akpınar Aslan et al, 2020 <sup>34</sup> | EUR    | Turkey               | Urban         | MINI   |                  |                      | Survey                                   | University     | Turkish university freshmen students                               | Attempt                    | 355             | 0.37:1             | Moderate          |
| 12            | Atlam et al, 2017 <sup>35</sup>         | EUR    | Turkey               | Urban         | Addiction Profile Index-short form                                     | 1 year           |                      | Survey (online)                          | University     | Undergraduate and postgraduate university students                 | Attempt and plan           | 2973            | 0.82:1             | Moderate          |
| 13            | Azami and Taremiyan, 2020 <sup>36</sup> | EMR    | Iran                 | Urban         |  |                  | 2019                 | Survey                                   | High school    | High school students   | Attempt                    | 400             | 0.84:1             | Moderate          |
| 14            | Badr, 2017 <sup>37</sup>                | EMR    | Kuwait               |               | Three items from GSHS questionnaire                                    | 12 months        | 2010–2011            | Secondary analysis of national GSHS data | School         | Adolescents aged 13–15 years                                       | Ideation, plan and attempt | 2672            | 1.01:1             | Moderate          |
| 15            | Badr and Francis, 2018 <sup>38</sup>    | EMR    | Kuwait               |               | Kuwait GSHS questionnaire  | 12 months        |                      | Secondary analysis of national GSHS data | School         | Adolescents aged 13–15 years                                       | Ideation, plan and attempt | 1310            |                    | High              |
| 16            | Bibi et al, 2021 <sup>39</sup>          | EMR    | Pakistan             |               | SBQ-R  |                  |                      | Survey (online)                          | University     | University students  | Ideation and attempt       | 355             | 0.45:1             | Low               |
| 17            | Canbaz and Terzi, 2018 <sup>40</sup>    | EUR    | Turkey               | Urban         | YRBSS  | 2 months         | 2015                 | Survey                                   | High school    | High school  | Ideation                   | 2438            | 0.97:1             | Moderate          |
| 18            | Chen et al, 2005 <sup>41</sup>          | WPR    | Malaysia             | Both          | Malaysian Modified YRBSS   | 3 months         | 2001                 | Survey                                   | School         | Schools  | Ideation, plan and attempt | 4500            | 0.86:1             | Low               |
| 19            | Çimen et al, 2017 <sup>42</sup>         | EUR    | Turkey               | Urban         | Inventory of Statements About Self-injury                              |                  |                      | Survey                                   | School         | School students of 7th–10th grades                                 | NSSI                       | 555             | 0.76:1             | Low               |
| 20            | Dalkilic et al, 2013 <sup>43</sup>      | EUR    | Turkey               | Urban         | CES-D  | 2 months         | 2010                 | Survey                                   | High school    | High school students   | Ideation                   | 28303           | 0.84:1             | Moderate          |
| 21            | Elhadi et al, 2020 <sup>44</sup>        | EMR    | Libya                | Urban         |  | 10 days          | 2020                 | Survey                                   | University     | Medical students   | Ideation                   | 2430            | 0.26:1             | Low               |
| 22            | El-Maturity, 2021 <sup>45</sup>         | SEAR   | Indonesia            | Urban         | C-SSRS   |                  |                      |  | University     | Undergraduate students at 14 colleges                              | Ideation and attempt       | 504             | 0.86:1             | Moderate          |

(Continued)

Table 1 (Continued)

| Serial number | Study  | Region | Country              | Study setting | Instruments   | Study duration | Data collection year | Data collection methods                  | Level of study | Sources of cases                        | Suicidal behaviour            | Number of cases | Male: female ratio | Quality appraisal |
|---------------|--|--------|----------------------|---------------|---|----------------|----------------------|--|----------------|---|-------------------------------|-----------------|--------------------|-------------------|
| 23            | Eskin et al, 2005 <sup>46</sup>              | EUR    | Turkey               | Urban         |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 1262            | 0.84:1             | Low               |
| 24a           | Eskin et al, 2019 <sup>47</sup>              | EUR    | Azerbaijan           |               |   |                |                      | Survey                                   | University     | University students                     | Suicidal ideation and attempt | 711             | 0.96:1             | Moderate          |
| 24b           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Egypt                |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 653             | 0.98:1             | Moderate          |
| 24c           | Eskin et al, 2019 <sup>47</sup>              | SEAR   | Indonesia            |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 300             | 0.44:1             | Moderate          |
| 24d           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Iran                 |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 700             | 1.0:1.0            | Moderate          |
| 24e           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Jordan               |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 700             | 1.0:1.0            | Moderate          |
| 24f           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Lebanon              |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 706             | 0.95:1             | Moderate          |
| 24g           | Eskin et al, 2019 <sup>47</sup>              | WPR    | Malaysia             |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 560             | 1.09:1             | Moderate          |
| 24h           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Pakistan             |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 700             | 0.86:1             | Moderate          |
| 24i           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Palestine            |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 793             | 0.66:1             | Moderate          |
| 24j           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Saudi Arabia         |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 1137            | 0.6:1              | Moderate          |
| 24k           | Eskin et al, 2019 <sup>47</sup>              | EMR    | Tunisia              |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 707             | 0.99:1             | Moderate          |
| 24l           | Eskin et al, 2019 <sup>47</sup>              | EUR    | Turkey               |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 750             | 0.73:1             | Moderate          |
| 25            | Eskin et al, 2011 <sup>48</sup>              | EUR    | Turkey               | Urban         |   |                |                      | Survey                                   | University     | Medical students                        | Ideation and attempt          | 326             | 1.4:1              | Low               |
| 26            | Eskin et al, 2014 <sup>49</sup>              | EUR    | Turkey               | Urban         |   |                |                      | Survey                                   | High school    | High school students                    | Ideation and attempt          | 541             | 0.55:1             | Low               |
| 27a           | Eskin et al, 2016 <sup>14</sup>              | EMR    | Iran                 |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 1000            | 0.65:1             | Moderate          |
| 27b           | Eskin et al, 2016 <sup>14</sup>              | EMR    | Jordan               |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 436             | 0.68:1             | Moderate          |
| 27c           | Eskin et al, 2016 <sup>14</sup>              | EMR    | Palestine            |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 358             | 0.67:1             | Moderate          |
| 27d           | Eskin et al, 2016 <sup>14</sup>              | EMR    | Saudi Arabia         |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 413             | 2.33:1             | Moderate          |
| 27e           | Eskin et al, 2016 <sup>14</sup>              | EMR    | Tunisia              |               |   |                |                      | Survey                                   | University     | University students                     | Ideation and attempt          | 484             | 0.29:1             | Moderate          |
| 27f           | Eskin et al, 2016 <sup>14</sup>              | EUR    | Turkey               |               |   |                |                      | Survey                                   | University     | University students                     | Suicidal ideation and attempt | 497             | 0.59:1             | Moderate          |
| 28            | Eskin et al, 2007 <sup>50</sup>              | EUR    | Turkey               | Urban         |   |                |                      | Survey                                   | High school    | High schools                            | Ideation and attempt          | 805             | 1.19:1             | Moderate          |
| 29            | Evren et al, 2014 <sup>51</sup>              | EUR    | Turkey               | Urban         | Adapted from ESPAD survey questionnaire               | 3 months       | 2012                 | Survey (online)                          | School         | Schools                                 | Ideation and attempt          | 4957            | 0.82:1             | High              |
| 30            | Fekih-Romdhane et al, 2020 <sup>52</sup>     | EMR    | Tunisia              | Urban         | Suicidal Ideation Questionnaire                       |                |                      | Survey                                   | University     | Medical students                        | Ideation and attempt          | 390             | 0.34:1             | Moderate          |
| 31            | Ghahremani et al, 2019 <sup>53</sup>         | EMR    | Iran                 | Urban         | Modified adolescents high-risk behavior questionnaire |                |                      |  | High school    | High school students                    | Ideation, plan and attempt    | 483             | 1.65:1             | Moderate          |
| 32            | Ghazanfar et al, 2015 <sup>54</sup>          | EMR    | Pakistan             | Urban         |   | 31 months      | 2012–2014            | Survey                                   | University     | Medical students                        | Ideation                      | 1132            | 0.92:1             | Low               |
| 33            | Gholamrezaei et al, 2016 <sup>55</sup>       | EMR    | Iran                 | Urban         | SBQ-R and NSSI Scale                                  |                |                      | Survey                                   | University     | University students                     | NSSI and attempt              | 554             | 0.75:1             | Moderate          |
| 34            | Ghrayeb et al, 2014 <sup>56</sup>            | EMR    | Palestine            | Urban         | Arabic version of GSHS                                |                |                      | Secondary analysis of national GSHS data | High school    | High school students                    | Ideation and attempt          | 720             | 1.01:1             | Low               |
| 35            | Guedria-Tekari et al, 2019 <sup>57</sup>     | EMR    | Tunisia              | Urban         | SBQ-R   | 2 months       | 2012                 | Survey                                   | High school    | High school students                    | Ideation and attempt          | 821             | 0.47:1             | Moderate          |
| 36            | Hamdan and Hallaq, 2021 <sup>58</sup>        | EMR    | Palestine            | Urban         | C-SSRS, and SBQ-R                                     |                |                      | Survey                                   | University     | University and college students         | Ideation and attempt          | 303             | 0.94:1             | Moderate          |
| 37            | Hasan et al, 2022 <sup>59</sup>              | SEAR   | Bangladesh           | Urban         |   | 6 months       | 2013                 |  | University     | Undergraduate medical students          | Ideation and attempt          | 221             | 0.63:1             | Moderate          |
| 38            | Ibrahim and Mahfoud, 2021 <sup>60</sup>      | EMR    | United Arab Emirates | Urban         |   |                |                      | Secondary analysis of national GSHS data | School         | School students between grades 7 and 12 | Ideation, plan and attempt    | 5826            | 0.91:1             | High              |
| 39            | Idig-Camuroglu and Gölge, 2018 <sup>61</sup> | EUR    | Turkey               | Urban         | Inventory of Statements about Self-Injury             |                |                      | Survey                                   | University     | University students                     | NSSI                          | 1000            | 0.45:1             | Moderate          |

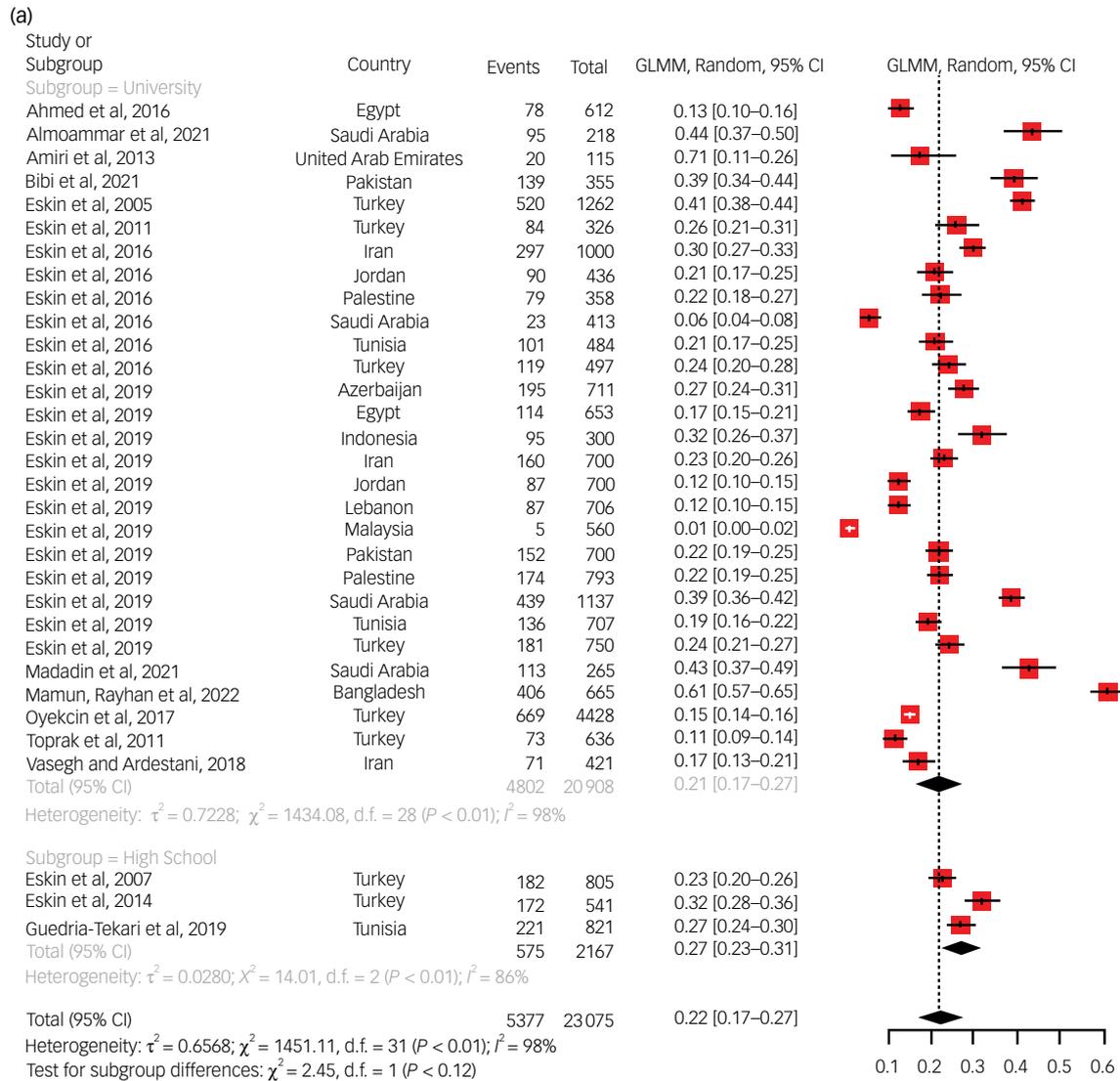
|     |  |      |                      |       |   |                |           |                          |   |  |                            |        |        |          |
|-----|--|------|----------------------|-------|---|----------------|-----------|--------------------------|---|--|----------------------------|--------|--------|----------|
| 40  | Irish and Murshid, 2020 <sup>62</sup>      | SEAR | Bangladesh           |       | GSHS survey questionnaire                                   |                |           |                          | Secondary analysis of School national GSHS data | School students of classes 7 to 10                           | Attempt                    | 2883   | 0.67:1 | Moderate |
| 41  | Itani et al, 2017 <sup>63</sup>            | EMR  | Palestine            |       | GSHS survey questionnaire                                   | Not applicable | 2010      |                          | Secondary analysis of School national GSHS data | Students aged 13–15 years, studying in grades 7–9 in schools | Ideation                   | 14,303 | 0.89:1 | Moderate |
| 42  | Itani et al, 2018 <sup>64</sup>            | EMR  | United Arab Emirates |       | GSHS survey questionnaire                                   |                |           |                          | Secondary analysis of School national GSHS data | Adolescent school students aged 13–17 years                  | Ideation                   | 2520   | 0.71:1 | Moderate |
| 43  | Izadi-Mazidi et al, 2019 <sup>65</sup>     | EMR  | Iran                 | Urban | Persian version of Functional Assessment of Self-Mutilation | 5 months       | 2018      | Survey                   | School  | School students aged 15–18 years                             | NSSI                       | 646    | 1.19:1 | Moderate |
| 44  | Karbeyaz et al, 2016 <sup>66</sup>         | EUR  | Turkey               | Urban |   | 12 years       |           | Nationalised record data | University                                      | Deceased students  | Suicide                    | 75     | 1.2:1  | Low      |
| 45  | Khan et al, 2020 <sup>67</sup>             | SEAR | Bangladesh           |       | GSHS survey questionnaire                                   |                |           |                          | Secondary analysis of School national GSHS data | School students aged 11–17 years                             | Ideation, plan and attempt | 2989   | 1.88:1 | High     |
| 46  | Khokher and Khan, 2005 <sup>68</sup>       | EMR  | Pakistan             |       | GHQ-28  |                |           | Survey                   | University                                      | Medical students   | Ideation                   | 217    | 0.79:1 | Low      |
| 47  | Khosravi and Kasaeiyan, 2020 <sup>69</sup> | EMR  | Iran                 | Urban | BSSI  | 3 months       |           | Survey                   | University                                      | Medical students   | Ideation                   | 376    | 1      | High     |
| 48  | Klibert et al, 2021 <sup>70</sup>          | EMR  | Pakistan             | Urban | SBQ-R   |                |           | Survey                   | University                                      | University students  | Ideation, plan and attempt | 449    | 0.18:1 | Moderate |
| 49  | Madadin et al, 2021 <sup>71</sup>          | EMR  | Saudi Arabia         | Urban | GHQ-28  |                |           | Survey (online)          | University                                      | Medical students   | Ideation                   | 265    | 0.67:1 | Low      |
| 50  | Mamun et al, 2022 <sup>72</sup>            | SEAR | Bangladesh           | Urban |   | 2 months       | 2019      | Survey                   | University                                      | University students  | Ideation                   | 665    | 2.1:1  | Moderate |
| 51  | Mamun et al, 2022 <sup>73</sup>            | SEAR | Bangladesh           | Urban |   | 10 days        | 2019      | Survey                   | University                                      | University students  | Ideation, plan and attempt | 911    | 1.16:1 | Moderate |
| 52  | Marin et al, 2020 <sup>74</sup>            | EMR  | Iran                 | Urban |   |                | 2017–2018 | Survey                   | High school                                     | High school students (aged 14–18 years)                      | NSSI                       | 6229   | 0.88:1 | Moderate |
| 53  | Mousavi et al, 2012 <sup>75</sup>          | EMR  | Iran                 | Urban | BSSI  | 8 months       |           | Survey                   | University                                      | University students  | Ideation                   | 435    | 0.71:1 | Moderate |
| 54  | Nemati et al, 2020 <sup>76</sup>           | EMR  | Iran                 | Urban |   |                | 2017      | Survey                   | High school                                     | High school students   | NSSI                       | 3966   | 0.89:1 | Low      |
| 55  | Osama et al, 2014 <sup>77</sup>            | EMR  | Pakistan             | Urban |   | 1 month        | 2013      | Survey                   | University                                      | Medical students   | Ideation, plan and attempt | 331    | 0.7:1  | Moderate |
| 56  | Oksuz and Malhan, 2005 <sup>78</sup>       | EUR  | Turkey               | Urban | YRBSS   | 8 months       | 2003      | Survey                   | University                                      | University students  | NSSI and attempt           | 640    | 0.96:1 | Moderate |
| 57  | Oyekcin et al, 2017 <sup>79</sup>          | EUR  | Turkey               | Urban |   | 9 months       | 2011–12   | Survey (online)          | University                                      | University students  | Ideation                   | 4428   | 0.87:1 | Low      |
| 58  | Payci et al, 2005 <sup>80</sup>            | EUR  | Turkey               | Urban | Turkish version of YRBSSQ                                   |                | 1999–2000 | Survey                   | High school                                     | High school students   | Ideation, plan and attempt | 2352   | 1      | Moderate |
| 59a | Peltzer and Pengpid, 2017 <sup>81</sup>    | SEAR | Indonesia            |       | GSHS survey questionnaire                                   |                | 2007      |                          | Secondary analysis of School national GSHS data | School   | Ideation                   | 2867   | 0.98:1 | Moderate |
| 59b | Peltzer and Pengpid, 2017 <sup>81</sup>    | WPR  | Malaysia             |       | GSHS survey questionnaire                                   |                | 2012      |                          | Secondary analysis of School national GSHS data | School   | Ideation                   | 16095  | 0.98:1 | Moderate |
| 60a | Peltzer and Pengpid, 2017 <sup>15</sup>    | SEAR | Indonesia            | Urban |   |                | 2015      | Survey                   | University                                      | University students  | Ideation and attempt       | 231    | 0.31:1 | Moderate |
| 60b | Peltzer and Pengpid, 2017 <sup>15</sup>    | WPR  | Malaysia             | Urban |   |                | 2015      | Survey                   | University                                      | University students  | Ideation and attempt       | 1023   | 0.97:1 | Moderate |
| 61  | Pengpid and Peltzer, 2020 <sup>82</sup>    | SEAR | Indonesia            |       | GSHS  |                | 2015      |                          | Secondary analysis of School national GSHS data | School   | Ideation, plan and attempt | 11105  |        | Moderate |
| 62  | Poorolajal et al, 2019 <sup>83</sup>       | EMR  | Iran                 | Urban |   | 15 months      | 2016–2017 | Survey                   | University                                      | Medical students   | Ideation and attempt       | 4261   | 0.79:1 | Moderate |

(Continued)

Table 1 (Continued)

| Serial number | Study                                    | Region | Country           | Study setting | Instruments  | Study duration | Data collection year | Data collection methods                  | Level of study | Sources of cases     | Suicidal behaviour         | Number of cases | Male: female ratio | Quality appraisal |
|---------------|--|--------|-------------------|---------------|--|----------------|----------------------|--|----------------|----------------------|----------------------------|-----------------|--------------------|-------------------|
| 63            | Putra et al, 2019 <sup>84</sup>          | SEAR   | Indonesia         |               | GSHS questionnaire   |                | 2015                 | Secondary analysis of national GSHS data | School         | School students      | Ideation and attempt       | 8634            | 0.73:1             | Moderate          |
| 64            | Rahman et al, 2022 <sup>85</sup>         | SEAR   | Bangladesh        | Urban         |  | 5 months       | 2019                 | Survey                                   | University     | University students  | Ideation                   | 407             | 1.18:1             | Moderate          |
| 65            | Rahman et al, 2022 <sup>86</sup>         | SEAR   | Bangladesh        | Urban         | SBQ-R  | 16 days        | 2021                 | Survey (online)                          | University     | University students  | Suicidal behaviour         | 2100            | 1.27:1             | Moderate          |
| 66            | Rasheduzzaman et al, 2022 <sup>87</sup>  | SEAR   | Bangladesh        | Urban         |  | 2 months       | 2019                 | Survey                                   | University     | University students  | Ideation, plan and attempt | 1844            | 2.25:1             | Moderate          |
| 67            | Sadeghian et al, 2021 <sup>88</sup>      | EMR    | Iran              | Urban         |  | 12 months      | 2018                 | Survey                                   | University     | Medical students     | Ideation and attempt       | 224             | 0.6:1              | Moderate          |
| 68            | Sakib et al, 2021 <sup>89</sup>          | SEAR   | Bangladesh        | Urban         | Patient Health Questionnaire (PHQ-9)                                 | 3 months       | 2019                 | Survey                                   | University     | University Students  | Suicidal behaviour         | 955             | 1.04:1             | Low               |
| 69            | Shahedifar et al, 2020 <sup>90</sup>     | WPR    | Brunei Darussalam |               | GSHS   |                | 2014                 | Secondary analysis of national GSHS data | School         | School students      | Ideation, plan and attempt | 2599            | 1                  | Moderate          |
| 70            | Somer et al, 2015 <sup>91</sup>          | EUR    | Turkey            | Urban         | Inventory of Statements About Self-Injury, Suicide Probability Scale |                | 2010–2011            | Survey                                   | High school    | High school students | NSSI                       | 1656            | 0.82:1             | Moderate          |
| 71            | Tan et al, 2015 <sup>92</sup>            | WPR    | Malaysia          | Urban         | SBQ-R  | 2 months       | 2013                 | Survey                                   | University     | Medical students     | Suicidal behaviour         | 537             | 0.54:1             | Moderate          |
| 72            | Tasnim et al, 2020 <sup>93</sup>         | SEAR   | Bangladesh        |               |  | 2 months       | 2020                 | Survey (online)                          | University     | University students  | Ideation and attempt       | 3331            | 1.5:1              | Moderate          |
| 73            | Toprak et al, 2011 <sup>94</sup>         | EUR    | Turkey            | Urban         |  | 13 months      | 2007–08              | Survey                                   | University     | University students  | NSSI, ideation and attempt | 636             | 0.85:1             | High              |
| 74            | Toros et al, 2004 <sup>95</sup>          | EUR    | Turkey            | Both          |  |                |                      | Survey                                   | School         | School students      | Attempt                    | 4143            |                    | High              |
| 75            | Tresno et al, 2012 <sup>96</sup>         | SEAR   | Indonesia         | Urban         | The Deliberative Self-Harm Inventory                                 |                |                      | Survey                                   | University     | University students  | NSSI and attempt           | 307             | 0.31:1             | Low               |
| 76            | Vasegh and Ardestani, 2018 <sup>97</sup> | EMR    | Iran              |               |  |                |                      | Survey                                   | University     | University students  | Ideation, plan and attempt | 421             | 0.48:1             | Moderate          |
| 77            | Vehid et al, 2006 <sup>98</sup>          | EUR    | Turkey            | Urban         | BDI  |                |                      | Survey                                   | School         | School students      | Ideation                   | 3609            | 1.11:1             | Moderate          |
| 78            | Zarrouq et al, 2015 <sup>99</sup>        | EMR    | Morocco           | Urban         | MINI (Moroccan Arabic version)                                       | 8 months       | 2012–13              | Survey                                   | High school    | High school Students | Ideation, plan and attempt | 3020            | 1.13:1             | Low               |
| 79            | Ziaei et al, 2017 <sup>100</sup>         | EMR    | Iran              |               | GSHS questionnaires  |                | 2013–2014            | Secondary analysis of national GSHS data | High school    | High school students | Ideation                   | 1517            | .92:1              | High              |
| 80            | Zoroglu et al, 2003 <sup>101</sup>       | EUR    | Turkey            | Urban         |  |                |                      | Survey                                   | High school    | High school students | NSSI and attempt           | 839             | 0.63:1             | Moderate          |

EMR, Eastern Mediterranean region; WPR, Western Pacific region; GSHA, Global School-Based Student Health Survey; BSSI, Beck Scale for Suicide Ideation; AFR, African region; SEAR, South-East Asian region; MINI, Mini International Neuropsychiatric Interview; EUR, European region; SBQ-R, Suicidal Behaviors Questionnaire-Revised; YRBSS, Youth Risk Behavior Surveillance System; NSSI, non-suicidal self-injury; CES-D, XXX, C-SSRS, Columbia Suicide Severity Rating Scale; ESPAD, European School Survey Project on Alcohol and Other Drugs; GHQ-28, General Health Questionnaire 28; YRBSQ, Youth Risk Behavior Survey Questionnaire; BDI, Beck Depression Inventory.



**Fig. 1** Pooled estimate for the prevalence of suicidal ideation in the lifetime, past year and current time. (a) Pooled estimate for the prevalence of suicidal ideation in the lifetime. (b) Pooled estimate for the prevalence of suicidal ideation in the past year. (c) Pooled estimate for the prevalence of suicidal ideation in the current time. GLMM, generalised linear mixed model.

school students had the lowest (9.3%). This subgroup difference was statistically significant ( $P = 0.0068$ ) (Table 2). The point prevalence of suicidal ideation overall was 6.4% (95% CI 4.5%–9%), and it was higher among high school students (14.7%) compared with university students (5.2%). This subgroup difference was statistically significant ( $P = 0.0024$ ). No studies among elementary school students were available in this regard.

#### Prevalence of suicide plans

The lifetime prevalence of suicide plans was reported in three studies, and the pooled prevalence rate was 6.4% (95% CI 3.7%–11%). All of these three studies were conducted among university students. Nine studies reported the 12-month prevalence of suicide plans, and their pooled prevalence rate was 10.7% (95% CI 9.1%–12.4%). Out of the three subgroups, the highest prevalence was observed among high school students (Fig. 2). A point prevalence of suicide plans was reported by three studies, generating a pooled prevalence of 4.1% (95% CI 2.7%–6.2%). No studies reporting a point prevalence of suicide plans among elementary school students were found.

#### Prevalence of suicide attempts

The lifetime prevalence of suicide attempts was reported in 34 studies, and their pooled prevalence rate was 6.6% (95% CI 5.4%–8%). The majority of these studies (31) were conducted among university students, with three studies being conducted on high school students. There was no statistically significant difference between these two subgroups. No studies in this regard were available among elementary school students. Thirty-two studies reported the 12-month prevalence of suicidal attempts, and the pooled prevalence rate was 4.9% (95% CI 3.6%–6.5%) (Fig. 3). Statistically significant subgroup differences were observed ( $P = 0.0017$ ); the highest prevalence was seen among elementary school students (7.5%) and the lowest rate (3%) was seen among university students.

#### Prevalence of NSSI

Six studies reported the lifetime prevalence of NSSI, and the pooled prevalence rate was 16.5% (95% CI 9.5%–27.2%). Notable subgroup differences were observed: 28.5% of university students reported a history of NSSI, and the corresponding rates among high school students and elementary school students were 12.4% and 11.4%,

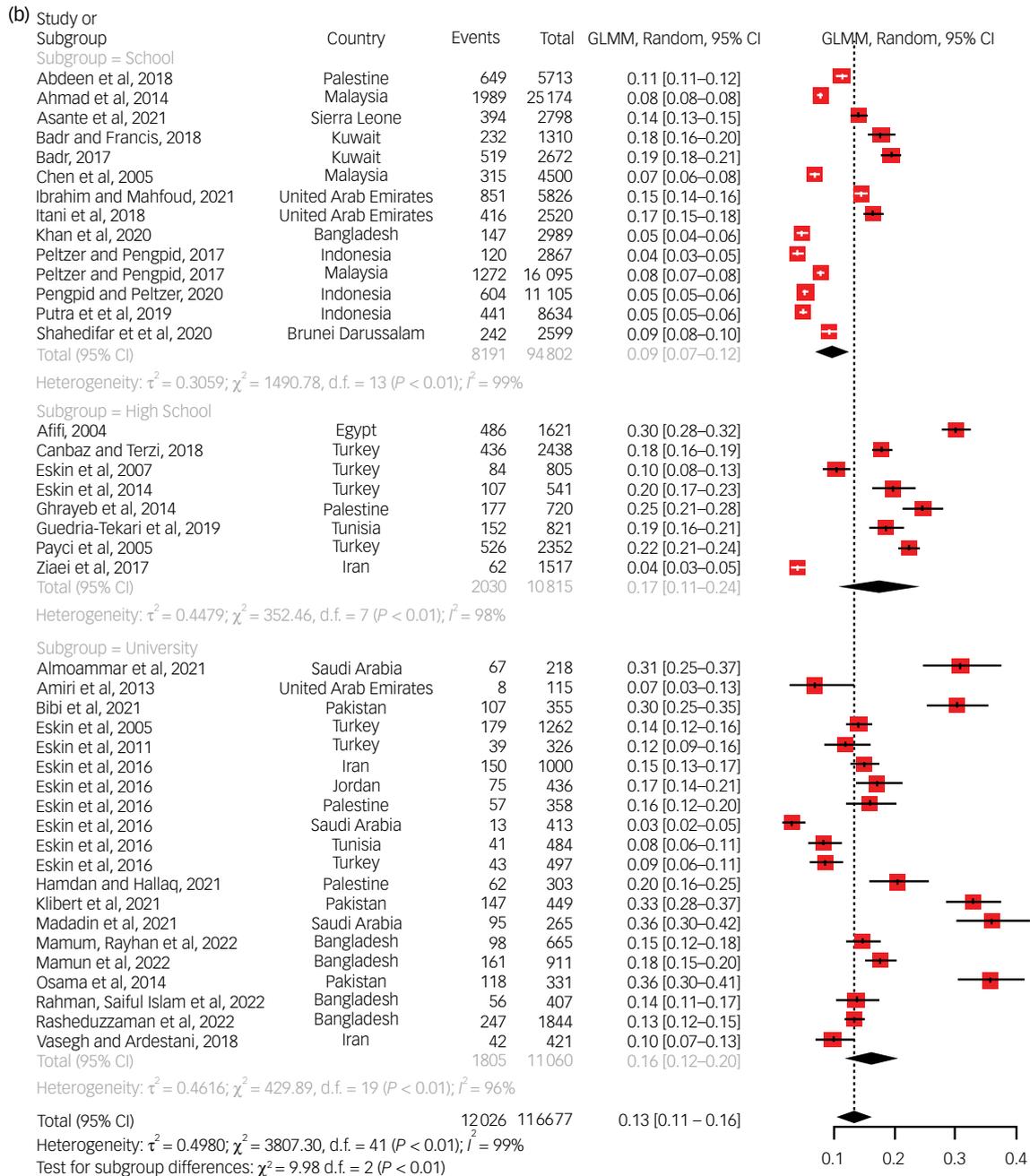


Fig. 1 Continued.

respectively. The 12-month prevalence of NSSI was reported by only two studies, and their pooled prevalence was 10.2% (95% CI 2.1%–37.7%) (Supplementary File 3). The prevalence rates reported by these two studies were remarkably different (27.5% v. 3.3%).

### Gender differences in prevalence of suicide attempts

A meta-analysis of odds ratios was conducted to calculate the pooled male/female ratio of suicide attempts among students. When suicide attempts were considered irrespective of the time-frame, the male/female ratio was 0.77 (95% CI 0.59–1.01), based on data from 19 studies. When suicide attempts during the lifetime were considered, the male/female ratio was 0.77 (95% CI 0.53–1.11), based on data from eight studies. With regard to suicide attempts during the previous 12 months, the male/female ratio was 0.83 (95% CI 0.46–1.50), based on five studies. None of these gender differences reached statistical significance.

### Regional differences

#### Suicidal ideation

Both the lifetime ( $P = 0.0432$ ) and 12-month ( $P < 0.0001$ ) prevalence of suicidal ideation showed significant regional differences, but the point prevalence of suicidal ideation did not ( $P = 0.8304$ ). The lifetime prevalence was highest (46.2%) in South-East Asia, but the 12-month prevalence was highest (16.8%) in the Eastern Mediterranean (Table 3).

#### Suicide plans

The number of studies reporting the prevalence of suicide plans was too few to conduct and meaningfully interpret subgroup analyses. The 12-month prevalence showed some regional variation, with the highest rate (14.1%) observed in Europe (Table 3).

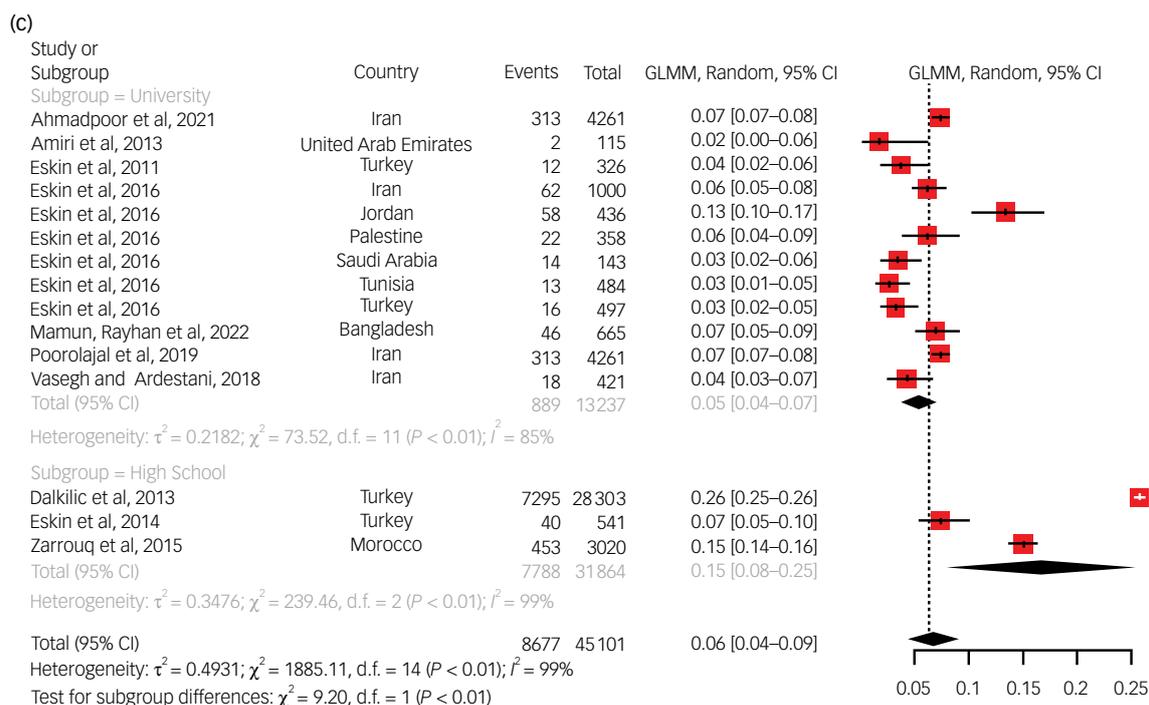


Fig. 1 Continued.

### Suicide attempts

The regional variations in the lifetime and 12-month prevalence rates of suicide attempts were not statistically significant. The highest lifetime prevalence was observed in Europe (7.7%), and the highest 12-month prevalence was seen in Africa (19.3%; finding based on a single study).

### NSSI

The number of studies reporting the prevalence of NSSI was too few to conduct subgroup analyses and meaningfully interpret their findings. The highest lifetime prevalence of NSSI (30%) was seen in South-East Asia. Data on 12-month prevalence were available only from the Eastern Mediterranean.

### Moderator analyses

Moderator analyses were performed to test whether the gender composition (percentage of males) of study samples and the year of publication had moderating effects on prevalence estimates in the meta-analyses. The findings of these moderator analyses are included in Table 2. Moderator analysis was not done if the total number of studies in a particular meta-analysis was fewer than ten, as was seen in the meta-analyses on suicide plans and NSSI. Neither of the selected moderator variables (i.e. gender composition nor publication year) showed significant moderation effects.

### Publication bias

Publication bias was assessed with funnel plots for meta-analyses with at least ten studies. The findings of the Egger's test of funnel plot asymmetry are included in Table 2.

### Quality assessment

Among the 80 studies, two-thirds of the studies ( $n = 53$ ) were of moderate quality, a fourth ( $n = 19$ ) were of low quality and the remaining 10% ( $n = 8$ ) were of high quality (Table 1). On the comparability parameter, 47 out of 72 studies (moderate and low

quality) scored at least  $>1$ , whereas 25 studies scored 0. Risk of bias was noted in selected domains in all of the included studies. With respect to outcome, all of the studies had a validated outcome assessment or self-report measure and described the statistical test employed.

### Sensitivity analyses

Sensitivity analyses showed that the exclusion of low-quality studies (based on the quality assessment) from each meta-analysis did not lead to substantial changes in the pooled prevalence estimates.

## Discussion

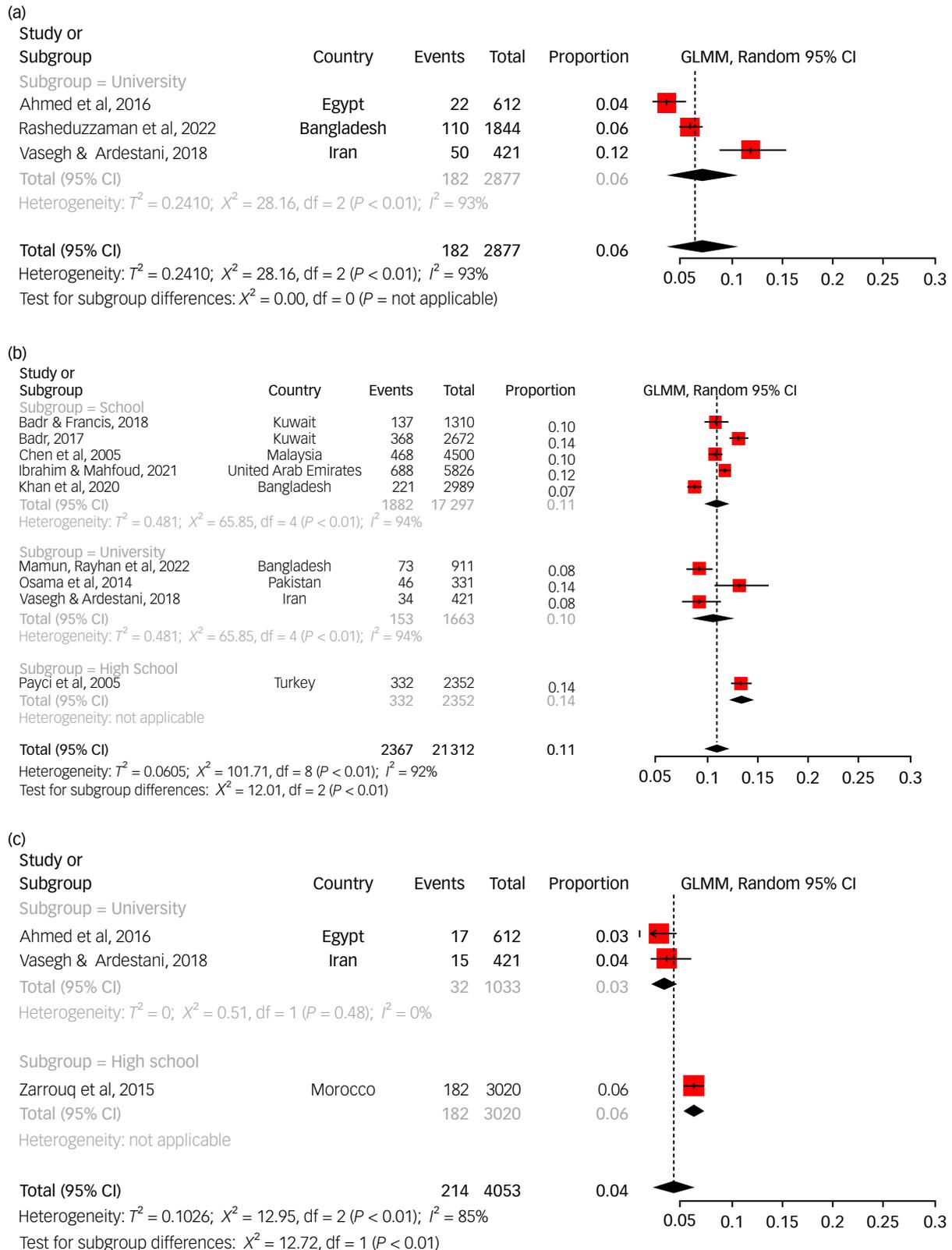
### Main findings of the review

We aimed to provide pooled prevalence estimates of different types of suicidal behaviour among students living in Muslim-majority countries. We found that about one in five students (high school and university) had experienced suicidal ideation at some point in their lifetime. One in eight students reported experiencing suicidal ideation in the year before assessment, whereas one in 16 reported experiencing it at the time of assessment; these prevalence rates were significantly higher among high school students compared with university students. Pooled prevalence rates of lifetime suicide plans and suicide attempts were similar; about one in 16 had experienced these phenomena. One in 20 students reported making an attempt to end their life in the year before assessment; once again, the prevalence was significantly higher among elementary school students compared with university students.

One in six students reported NSSI behaviours during their lifetime, with about one in ten reporting such phenomena in the year before the assessment. Interestingly, the prevalence of NSSI behaviours was significantly higher among university students compared with school (high and elementary) students. Overall, few studies provided data for comparison of the regional prevalence of suicidal behaviours. Prevalence of lifetime suicidal ideation was highest in

**Table 2** Meta-analysis summary

| Suicidal behaviour       | Time period         | Pooled prevalence [95% CI], number of studies (k), total population (n) and heterogeneity (I <sup>2</sup> ) |   |   |  | Test of subgroup differences | Tests of moderation        |                            |                                       |
|--------------------------|---------------------|---|---|---|--|------------------------------|----------------------------|----------------------------|---------------------------------------|
|                          |                     | Overall   | University  | High school   | School   |                              | Male percentage            | Year of publication        | Egger's test of funnel plot asymmetry |
| Suicidal ideation        | Lifetime prevalence | 21.9% [17.4%–27.1%],<br>k = 32, n = 23075,<br>I <sup>2</sup> = 97.9%  | 21.3% [16.6%–27.1%],<br>k = 29, n = 20908,<br>I <sup>2</sup> = 98%    | 26.9% [22.9%–31.2%],<br>k = 3, n = 2167,<br>I <sup>2</sup> = 85.7%          | Not applicable   | Q = 2.45, P = 0.1178         | QM = 1.85,<br>P = 0.1731   | QM = 1.1,<br>P = 0.2940    | t = -1.89, P = 0.0681                 |
|                          | 12-month prevalence | 13.4% [11.1%–16.1%],<br>k = 42, n = 11 6677,<br>I <sup>2</sup> = 98.9%                                      | 15.9% [12.2%–20.4%],<br>k = 20, n = 94 802,<br>I <sup>2</sup> = 95.6% | 16.6% [11.1%–24.2%],<br>k = 8, n = 10 815,<br>I <sup>2</sup> = 98%          | 9.3% [7.1%–12.1%], k = 14,<br>n = 11 060, I <sup>2</sup> = 99.1%           | Q = 9.98, P = 0.0068         | QM = 1.89,<br>P = 0.1687   | QM = 0.077,<br>P = 0.781   | t = 2.19, P = 0.0348                  |
|                          | Point prevalence    | 6.4% [4.5%–9%], k = 15,<br>n = 45 101, I <sup>2</sup> = 99.3%   | 5.2% [3.9%–6.9%], k = 12,<br>n = 13 237, I <sup>2</sup> = 85%         | 14.7% [8.1%–25.3%], k = 3,<br>n = 31 864, I <sup>2</sup> = 99.2%            | Not applicable   | Q = 9.20, P = 0.0024         | QM = 0.22,<br>P = 0.6391   | QM = 0.0029,<br>P = 0.9573 | t = -5.10, P = 0.0002                 |
| Suicide plans            | Lifetime prevalence | 6.4% [3.7%–11%], k = 3,<br>n = 2877, I <sup>2</sup> = 92.9%   | 6.4% [3.7%–11%], k = 3,<br>n = 2877, I <sup>2</sup> = 92.9%           | Not applicable  | Not applicable   | Not applicable               | Not applicable             | Not applicable             | Not applicable                        |
|                          | 12-month prevalence | 10.7% [9.1%–12.4%], k = 9,<br>n = 21 312, I <sup>2</sup> = 92.1%  | 9.6% [7.1%–12.7%], k = 3,<br>n = 1663, I <sup>2</sup> = 81.2%         | 14.1% [12.8%–15.6%],<br>k = 1, n = 2352, I <sup>2</sup> = Not<br>applicable | 10.6% [8.9%–12.7%], k = 5,<br>n = 17 297, I <sup>2</sup> = 93.9%           | Not applicable               | Not applicable             | Not applicable             | Not applicable                        |
|                          | Point prevalence    | 4.1% [2.7%–6.2%], k = 3,<br>n = 4053, I <sup>2</sup> = 84.6%  | 3.1% [2.2%–4.4%], k = 2,<br>n = 1033, I <sup>2</sup> = 0%             | 6% [5.2%–6.9%], k = 1,<br>n = 3020, I <sup>2</sup> = Not<br>applicable      | Not applicable   | Not applicable               | Not applicable             | Not applicable             | Not applicable                        |
| Suicidal attempts        | Lifetime prevalence | 6.6% [5.4%–8%], k = 34,<br>n = 26 307, I <sup>2</sup> = 93.2%   | 6.6% [5.4%–8.1%], k = 31,<br>n = 21 941, I <sup>2</sup> = 93%         | 6.8% [3%–14.6%], k = 3,<br>n = 4366, I <sup>2</sup> = 95.5%                 | Not applicable   | Q = 0, P = 0.9606            | QM = 1.8563,<br>P = 0.1731 | QM = 1.101,<br>P = 0.294   | t = -1.89, P = 0.0681                 |
|                          | 12-month prevalence | 4.9% [3.6%–6.5%], k = 32,<br>n = 77 404, I <sup>2</sup> = 98.9%   | 3% [2.1%–4.3%], k = 15,<br>n = 15 379, I <sup>2</sup> = 94.5%         | 6.4% [2.7%–14.5%], k = 5,<br>n = 6039, I <sup>2</sup> = 98.6%               | 7.5% [5.2%–10.8%], k = 12,<br>n = 55 986, I <sup>2</sup> = 99.4%           | Q = 12.8, P = 0.0017         | QM = 0.8621,<br>P = 0.3532 | QM = 0.6957,<br>P = 0.4042 | t = -2.66, P = 0.0124                 |
| Non-suicidal self-injury | Lifetime prevalence | 16.5% [9.5%–27.2%], k = 6,<br>n = 13 713, I <sup>2</sup> = 99.5%  | 28.8% [26.5%–31.4%],<br>k = 2, n = 1307,<br>I <sup>2</sup> = 0%       | 12.4% [5.2%–26.8%], k = 3,<br>n = 11 851, I <sup>2</sup> = 99.7%            | 11.4% [9%–14.3%], k = 1,<br>n = 555, I <sup>2</sup> = Not<br>applicable    | Not applicable               | Not applicable             | Not applicable             | Not applicable                        |
|                          | 12-month prevalence | 10.2% [2.1%–37.7%], k = 2,<br>n = 6875, I <sup>2</sup> = 99.8%  | Not applicable  | 3.3% [2.9%–3.8%], k = 1,<br>n = 6229, I <sup>2</sup> = Not<br>applicable    | 27.5% [24.3%–31.1%],<br>k = 1, n = 646, I <sup>2</sup> = Not<br>applicable | Not applicable               | Not applicable             | Not applicable             | Not applicable                        |

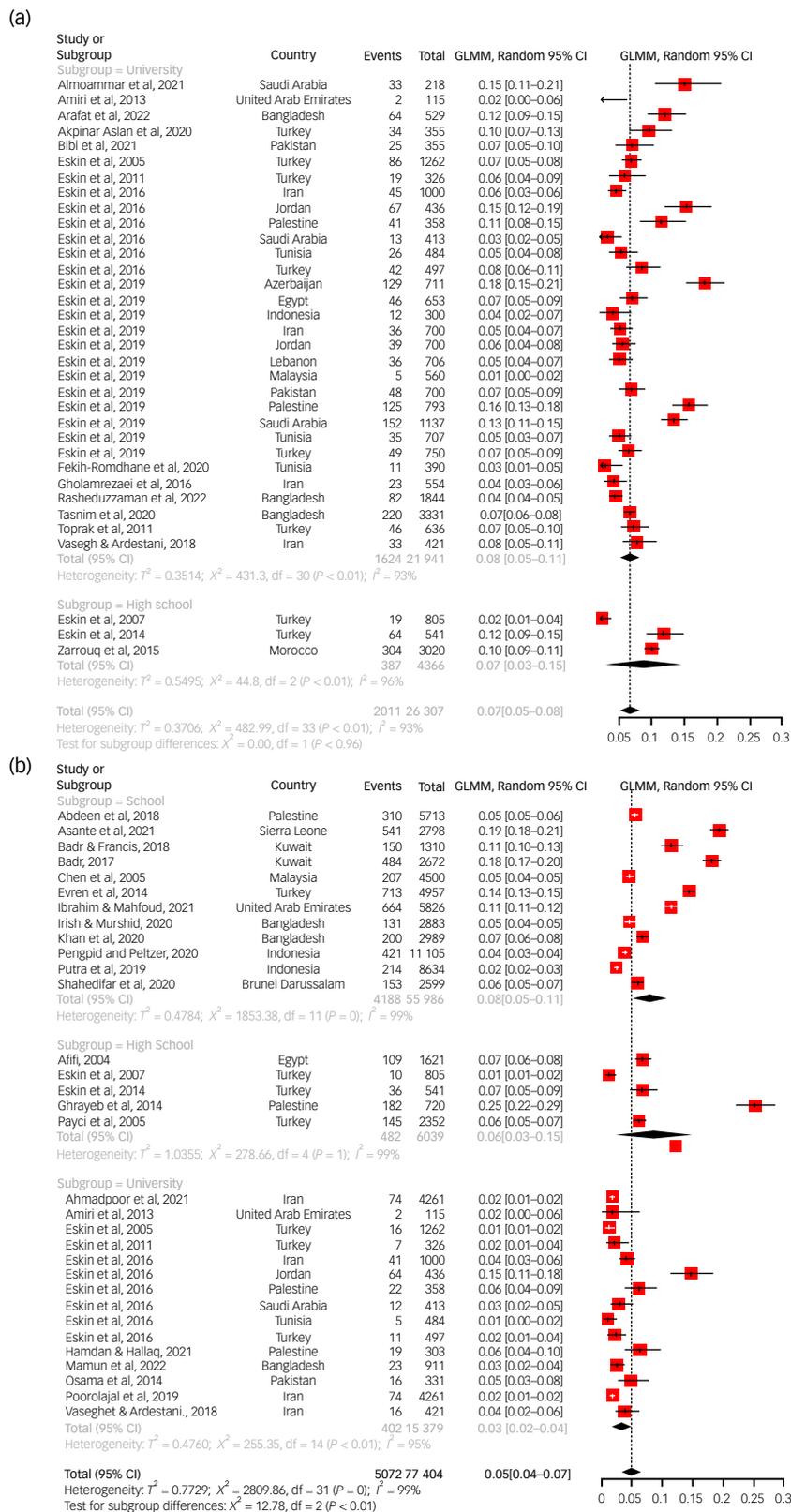


**Fig. 2** Pooled estimate for the prevalence of suicide planning in lifetime, past year and current time. (a) Pooled estimate for the prevalence of suicide planning in the lifetime. (b) Pooled estimate for the prevalence of suicide planning in the past year. (c) Pooled estimate for the prevalence of suicide planning in the current time. GLMM, generalised linear mixed model.

South-East Asia, but the corresponding 12-month prevalence rates were highest among students in Eastern Mediterranean countries; for other suicidal behaviours, the number of studies was too few to make meaningful interpretations. These findings were, largely, robust across sensitivity analyses excluding low-quality studies.

### Implications of findings

Traditionally, as suicide is proscribed in Islam, suicide rates in Muslim countries have been thought to be low. However, the data have been inconsistent,<sup>16</sup> and there has been no systematic



**Fig. 3** Pooled estimate for the prevalence of suicidal attempt in the lifetime and past year. (a) Pooled estimate for the prevalence of suicidal attempt in the lifetime. (b) Pooled estimate for the prevalence of suicidal attempt in the past year. GLMM, generalised linear mixed model.

collection of national suicide data and reporting in many Muslim nations.<sup>102</sup> As pointed out by Pritchard et al in their population-based study comparing differences in patterns of suicide, undetermined and accidental deaths between Islamic and Western nations, underreporting of suicides was common, with greater

underreporting noted in more orthodox Islamic nations such as Middle Eastern and North African nations compared with less orthodox countries.<sup>103</sup> Interestingly, underreporting of suicide was also noted in Western nations and, given the stronger cultural taboos against suicide in Muslim nations, the authors argued that

**Table 3** Regional variations of prevalence of suicidal behaviour among students living in Muslim countries

| Suicidal behaviour       | Time period         | Eastern Mediterranean       | Europe                     | South-East Asia            | Western Pacific           | Africa                     | Test of subgroup differences <sup>a</sup> |
|--------------------------|---------------------|-----------------------------|----------------------------|----------------------------|---------------------------|----------------------------|---|
| Suicidal ideation        | Lifetime prevalence | 21.6% [17.4%–26.5%], k = 20 | 23.9% [18.8%–29.8%], k = 9 | 46.2% [26.9%–66.7%], k = 2 | Not applicable            | Not applicable             | Q = 6.3; P = 0.0432                       |
|                          | 12-month prevalence | 16.8% [12.9%–21.6%], k = 22 | 14.6% [11.4%–18.5%], k = 7 | 8.6% [5.8%–12.6%], k = 8   | 7.9% [7.7%–8.1%], k = 4   | 14.1 [12.8%–15.4%], k = 1  | Q = 50.5; P < 0.0001                      |
| Suicide plans            | Point prevalence    | 6% [4.1%–8.7%], k = 10      | 7.2% [3%–16.7%], k = 4     | 6.9% [5.2%–9.1%], k = 1    | Not applicable            | Not applicable             | Q = 0.37 P = 0.8304                       |
|                          | Lifetime prevalence | 6.6% [2.8%–14.9%], k = 2    | Not applicable             | 6% [5%–7.1%], k = 1        | Not applicable            | Not applicable             | Not applicable                            |
| Suicidal attempts        | 12-month prevalence | 11.7% [10.1%–13.4%], k = 5  | 14.1% [12.8%–15.6%], k = 1 | 7.5% [6.8%–8.4%], k = 2    | 10.4% [9.5%–11.3%], k = 1 | Not applicable             | Not applicable                            |
|                          | Point prevalence    | 4.1% [2.7%–6.2%], k = 3     | Not applicable             | Not applicable             | Not applicable            | Not applicable             | Not applicable                            |
| Non-suicidal self-injury | Lifetime prevalence | 6.8% [5.4%–8.5%], k = 20    | 7.7% [5.4%–10.7%], k = 9   | 6.3% [4.1%–9.6%], k = 4    | 0.9% [0.4%–2.1%], k = 1   | Not applicable             | Q = 0.55; P = 0.7578                      |
|                          | 12-month prevalence | 5.5% [3.5%–8.6%], k = 16    | 3.4% [1.7%–6.7%], k = 7    | 3.9% [2.9%–5.2%], k = 6    | 5.2% [4.3%–6.1%], k = 2   | 19.3% [17.9%–20.8%], k = 1 | Q = 3.97; P = 0.2644                      |
| Non-suicidal self-injury | Lifetime prevalence | 7.3% [5.9%–9%], k = 2       | 22.4% [13.2%–35.3%], k = 3 | 30% [25.1%–35.3%], k = 1   | Not applicable            | Not applicable             | Not applicable                            |
|                          | 12-month prevalence | 10.2% [2.1%–37.7%], k = 2   | Not applicable             | Not applicable             | Not applicable            | Not applicable             | Not applicable                            |

<sup>a</sup> Regions with only one study (k = 1) were omitted from the subgroup analysis.

this may explain the relationship between level of religiosity and underreporting of suicide.

Given this background, our findings provide the first meta-analytic evidence for suicidal behaviour among students in Muslim countries. In fact, our pooled prevalence estimates for all subtypes of suicidal phenomena were higher than what had been reported in the general population in prior national and cross-national meta-analytic reviews.<sup>104,105</sup> They were also higher than figures noted in prior national and cross-national reviews on college students, particularly for suicide attempts.<sup>106,107</sup> These findings suggest the need for instituting robust suicide surveillance and data-gathering mechanisms to design effective suicide prevention programmes aimed at high school and university students in Muslim-majority countries. They also suggest the need for these issues to be high on the research and policy agenda. As our results show, authorities in Muslim nations should regard suicide as a public health issue, and not minimise its extent or severity. In many Islamic nations, suicide attempt is a punishable offence; in this context, decriminalisation of attempted suicide would be a welcome step to encourage suicide reporting, and more importantly, reduce stigma and improve help-seeking behaviour.<sup>19</sup> Finally, considering suicide as an outcome of social and mental health issues in Muslim nations, best practices for assessing suicide and suicide risk in a sensitive, non-judgemental manner that neither decreases the patient's self-esteem nor challenges their religious beliefs, would enhance suicide reporting and improve help-seeking behaviour. This may enhance data-gathering efforts.

The prevalence of suicidal ideation noted was higher than what was reported in three other multi-country studies, all of whom reported prevalence rates of 12%–17%.<sup>108–110</sup> The prevalence figures for suicide plan were higher than those reported by McKinnon et al (5.8%–8.3%),<sup>110</sup> but lower than those reported by Uddin et al (17%).<sup>108</sup> With regard to lifetime suicide attempts, our pooled estimates were lower than a large, cross-national analysis from 53 LMICs (11%).<sup>111</sup> Likewise, the past year attempt rates were also lower than two prior reports, also from LMICs.<sup>106,108</sup> However, as mentioned before, the figures were higher than those reported in multinational analysis not restricted to low-resource settings.<sup>106</sup> These variations may reflect, in part, differences in the meaning, context and attitudes toward suicide in various cultural, religious and economic settings. The increased figures of suicidal ideation and suicide attempt noted may reflect pressures of rapid socio-economic transition in Muslim nations with attendant intergenerational conflicts, which when coupled with academic stress, can contribute to suicidal behaviours.<sup>112</sup>

Interestingly, although our pooled prevalence estimates for lifetime and past year suicidal ideation and lifetime suicide plans were comparable with prior cross-national reviews on college and university students, differences in prevalence rates were more pronounced for past year suicide plans and both lifetime and past year suicide attempt.<sup>106,113</sup> This raises the intriguing possibility that students in Muslim countries may have higher rates of transition from suicidal ideas or plans to a suicide attempt, compared with their counterparts in other countries. This must be systematically examined in future research, along with risk factors for such transitions, as it has obvious implications for suicide prevention. Prior research has shown that the majority of transitions from ideation to attempt occur in the first year following onset of suicidal ideation. Additional risk factors identified were younger age, female gender and presence of psychiatric morbidity.<sup>104</sup> These relevant cultural factors need to be investigated in this context, to identify subgroups of students at a higher risk of suicidal behaviour transition.

Prevalence of suicidal behaviours was higher among high school students compared with university students. Indeed, the figures were higher than that found in prior analyses on high school

students and adolescents.<sup>114,115</sup> Prior observations from Turkey, showing a high proportion of university students contemplating suicide compared with their counterparts from Western countries, are consistent with what we have found.<sup>116</sup> There is a need to explore the role of commonly implicated risk factors for suicide and suicidal behaviour in this group, such as mental health issues, academic stress and exposure to violence in the school and community.<sup>117–119</sup> At the same time, there is a need to assess and strengthen protective factors that may reduce the risk of suicide. Some of the evidence-based protective factors in this group are increasing levels of parental supervision, and better parent–child and school–child connectedness.<sup>120</sup> Whether enrolment in a university confers additional risk over and above that experienced by peers in Muslim countries who do not attend university may be investigated, to know whether a causal relationship exists between university attendance and suicidal behaviours.

Rates of suicidal ideation were higher in the South-East Asian and Eastern Mediterranean regions. For other suicide constructs, few studies provided data for a meaningful interpretation of regional variations. Prior analysis of age-standardised suicide rates in Muslim-majority nations has also shown considerable regional variations.<sup>16,121</sup> Suicide is a complex, multidimensional behaviour anchored in unique sociocultural contexts. Existing studies identified that the suicide rate is higher in African Muslim countries than in Asia and Europe.<sup>16,121</sup> Further studies are warranted to explore this variation.

From a preventive standpoint, our findings highlight the importance of understanding drivers of suicidal behaviour among students living in Muslim countries. Specifically, there is a need to understand factors that may drive progression from suicidal ideation to behaviours in this group, to inform actionable strategies for the prediction and prevention of suicidal behaviour. Existing adolescent suicide prevention programmes can be divided into two types: strategies for early recognition and referral of at-risk individuals through comprehensive, periodic, school-based screening programmes; and strategies aimed at addressing risk or protective factors in this group.<sup>122</sup> Given the high burden of suicide among high school students, we also recommend incorporation of life skills training, also recommended by the WHO, and stress management materials into the school curriculum.<sup>123</sup> A recent review of suicide prevention strategies among university students found that gatekeeper training of peer counsellors, combining education with skills training, is effective in improving knowledge about suicide and boosting self-efficacy in suicide prevention.<sup>124</sup>

### Methodological considerations

Paradoxically, the 12-month prevalence of suicide plans was higher than the lifetime prevalence. A possible reason for this may be recall bias, noted in other contexts.<sup>125</sup> Specifically, participants may underreport past suicide plans or behaviours, and thus, studies assessing lifetime suicide phenomena may report lower prevalence than those assessing recent phenomena. This may be particularly relevant for suicide plans, which are not as well-defined as suicidal ideation/attempt. It might be complicated by how the terminologies for suicidal thoughts and behaviours used by the researchers were understood by the students living in countries where suicide is socially proscribed and a criminal offence.

A striking finding was that most included studies were of low to moderate quality, with most studies falling short on the domains of sample representativeness. This would influence the grade of evidence and the strength of recommendations. Different studies used different instruments to assess suicidal behaviour. Further, more than half of the included studies came from the Eastern Mediterranean region. There was also a disproportionate

contribution from a few countries; only one study was available from Africa. This imbalance in the geographical distribution of studies suggests the need for expanded and high-quality research on student suicide across Muslim-majority nations.

Most of the studies used self-report questionnaires, which might be prone to recall bias and social desirability bias, both of which may lead to systematic underreporting. This issue may have particular significance when assessing issues such as suicidal behaviour and mental health, both of which are issues surrounded by stigma. As such, it is possible that participants may have modified their responses to report desirable attributes that better suit their situation. Further, the use of single-item measures or selected items from a larger measure to assess suicidal behaviours, used in some studies in the present review, is prone to misclassification error and may have influenced the reported rates of suicidal behavior.<sup>126</sup>

### Strengths and limitations

Suicide is under-researched in Muslim-majority countries. It is the first systematic review and meta-analysis revealing higher rates of suicidal behaviour among the students of Muslim-majority countries. These findings would encourage practicing psychiatrists to assess suicidal behaviour when treating mental health issues among students. There were many limitations to the present meta-analysis. First, the quality of the majority of studies used in this meta-analysis was low or moderate, and only 10% of the studies were of high quality. This may have biased the cross-national comparisons. Second, there was a disproportionate research output from several nations, and therefore, the results may not be generalisable to other Muslim-majority nations from which there was little to no data. Third, an overwhelming majority of included studies were conducted in specific urban settings, and thus, the results may not be generalisable to other settings and regions in the countries. Fourth, the instruments measuring the suicidal behaviour varied widely. Data from included studies were mostly based on retrospective self-report of suicidal thoughts and behaviours, which may be subject to recall bias or deliberate underreporting. The latter may be particularly relevant in a study of this nature because of the religious sanctions against suicide in Islam and its criminal status in some Muslim nations.<sup>19</sup> Fifth, the age of the participants varied widely in this meta-analysis, which limits the power of subgroup analyses for specific developmental time periods. We have not assessed sociodemographic or clinical risk factors for suicide, and this affects our ability to understand the broad basis of suicidal behaviour in the studied settings. Sixth, we have not studied the rates of transition from ideation to planning to attempt, as this information was not available in studies. This is an important focus for future research because of its obvious implications for suicide prevention. Finally, many subgroup analyses lacked statistical power because there were a limited number of studies that provided the necessary data, which led to a greater probability of false negative results.<sup>127</sup>

The study revealed notably high rates of suicidal behaviours among students living in Muslim-majority countries. The pooled lifetime prevalence of suicidal ideation, plan and attempt among students was 21.9%, 6.4% and 6.6%, respectively. However, the quality of studies, differences in regional and cultural factors, stages of studentship and methods of measurement should be considered when generalising the study results.

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## Supplementary material

Supplementary material is available online at <https://doi.org/10.1192/bjo.2023.48>

## Data availability

The data that support the findings of this study are available from the corresponding author, S.M.Y.A., upon reasonable request.

## Author contributions

S.M.Y.A. and M.R. provided the study concept and supervision. S.M.Y.A. conducted the investigation and data validation, and provided the study methodology and project administration. S.M.Y.A., S.G. and R.A.M. conducted data curation. A.B. and V.M. conducted the formal analysis. All authors (S.M.Y.A., A.B., V.M., R.S., N.V., S.G., R.A.M. and M.R.) contributed to writing, reviewing and editing the manuscript. All authors have read and approved the final version of the manuscript.

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None.

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