

Prevalence of suicide attempts among Chinese adolescents: A meta-analysis of cross-sectional studies

Jiande Hu^{a,1}, Yonghai Dong^{b,1,*}, Xiaodan Chen^{c,1}, Yun Liu^{d,1}, Dongyang Ma^a, Xiaoyun Liu^d, Ruizhi Zheng^e, Xiangqun Mao^b, Ting Chen^b, Wei He^b

^aNanhui Mental Health Center, Pudong New Area, Shanghai, 201300, China

^bJiangxi Provincial Center for Disease Control and Prevention, Nanchang, 330029, China

^cJiangxi Provincial Cancer Hospital, 519 Beijing East Road, Nanchang 330029, Jiangxi, China

^dCadre Wards of Neurology Medicine, Jiangxi Provincial People's Hospital, Nanchang, 330006, China

^eSchool of Public Health, Zhejiang University, Hangzhou, 310058, China

Abstract

Objective: According to World Health Organization, for every committed suicide there were 20 suicide attempts at least. In the last decade, despite the increasing awareness on suicide attempts among adolescents in China, there has been no comprehensive system reporting vital statistics. Consequently, the prevalence of suicide attempts reported in some studies ranged variedly. Therefore, the purpose of this study was to provide the first meta-analysis of cross-sectional studies of suicide attempts to fill this gap.

Methods: Two reviewers independently screened potentially relevant cross-sectional studies of suicide attempts through PubMed-Medline, Embase, Wanfang Data, Chongqing VIP and Chinese National Knowledge Infrastructure databases using the core terms ‘suicid*’/‘suicide attempt*’/‘attempted suicide’ and ‘adolescen*’/‘youth’/‘child*’/‘student*’ and ‘China’/‘Chinese’ in the article titles, abstracts and keywords. Chi-square based Q test and I^2 statistic assessed the heterogeneity. Forest plot was used to display results graphically. Potential publication bias was assessed by the funnel plot, Begg’s and Egger’s test.

Results: In total, 43 studies with 200,124 participants met the eligibility criteria. The pooled prevalence of suicide attempts among Chinese adolescents was 2.94% (95% CI: 2.53%–3.41%). Substantial heterogeneity in prevalence estimates was revealed. Subgroup analyses showed that the prevalence for males was 2.50% (95% CI: 2.08%–3.01%), and for females was 3.17% (95% CI: 2.56%–3.91%).

Conclusions: In sum, abstracting across the literatures, the prevalence of suicide attempts among Chinese adolescents was moderate compared with other countries around the world. Necessary measures should be set out prevent them in the future.

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1. Introduction

More than 800,000 people die due to suicide every year in the world, and suicide has become a major public health and social problem. According to the World Health Organization (WHO), suicide is one of the three major causes of death among people aged 15–44 years and the second cause of death among people aged 15–29 years globally in 2012 [1]. By 2020, suicide will constitute 2.4% of the total disease burden, while the proportion was only 1.8% in 1998 [2]. So,

suicide has led to serious economic burden all over the world [3,4]. WHO’s first suicide report has pointed out that preventing suicide is a global imperative [5].

It is well known that suicide behaviors can be recognized as a complex set of processes which range from suicidal ideation to suicide planning, attempted suicide, and completed suicide in the end [6]. So, suicide attempts play a vital role among the suicide behaviors. According to SUPRE, for every committed suicide there were 20 suicide attempts at least [7]. What’s more, some researches reported

* Corresponding author. Tel.: +86 079 188 334 129.

E-mail address: dyhai123@126.com (Y. Dong).

¹ These authors contributed equally to this manuscript.

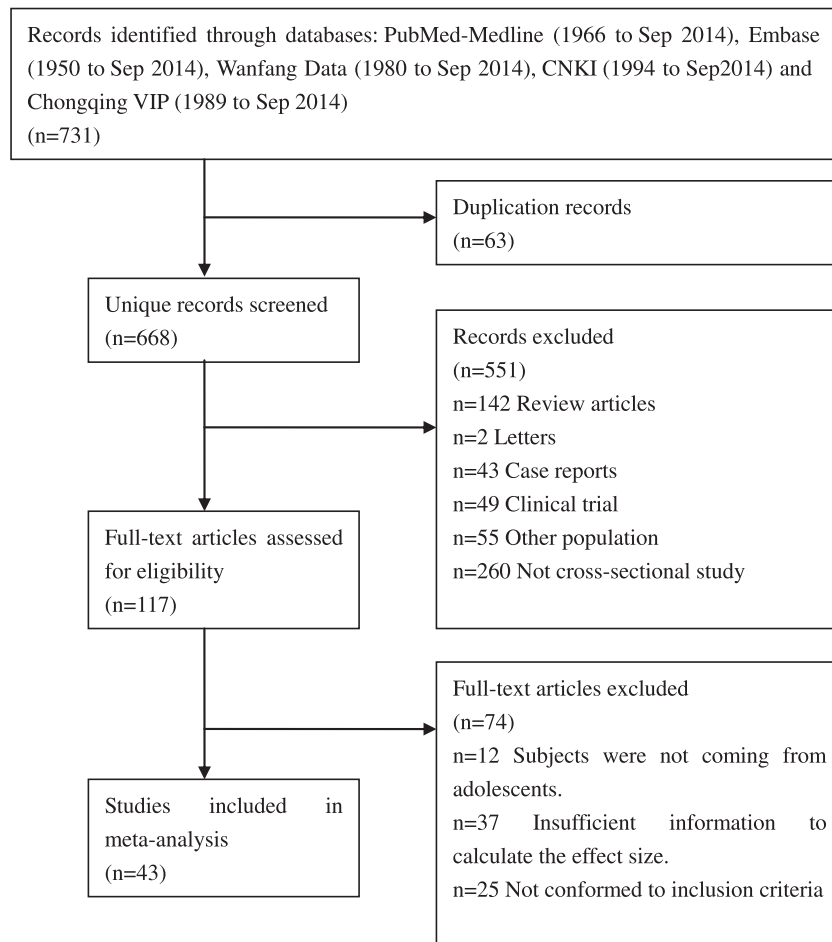


Fig. 1. Flowchart of study selection procedure.

that there were as many as 40 attempts for one completed suicide [8]. Suicide attempters were at an increased risk for recurrence [9,10]. Treméau et al. [11] reviewed several psychological autopsy studies and found about 40% of suicides had been preceded by at least one previous, nonfatal attempt. Suicide attempts could lead to huge economic losses. In the USA, 17% of the nonfatal suicide attempters were permanently disabled, restricted in their ability to work, at a cost of \$127,000 per person each year [12]. In Switzerland, treatment of suicide attempters in Basel's main hospitals amounted to 3,373,025 Swiss Francs (CHF), mainly attributable to psychiatric care in 2003 [13].

So, the seriousness of suicide attempts should arouse global attention. Before we took measures to prevent them, a crucial step was to know the prevalence of suicide attempts on the whole. For instance, in the US, approximately 538,000 suicide attempts were reported every year between 2005 and 2008 [14]. In South Korea, a web-based anonymous self-reported survey with 72,623 adolescents aged 12–18 years revealed that the prevalence of suicide attempts was 4.9% in the past 12 months [15]. China has the largest population in the world, as well as containing the largest adolescent population. In China, the prevalence of

suicide attempts ranged from 0.94% to 9.01% which resulted from published literatures [16,17]. Though, there were a few studies with more than ten thousand adolescents in China, the results were inconsistent [18–22]. Despite the increasing awareness on suicide attempts among adolescents in the last decade, there has been no systematic review associated with Chinese adolescents. In addition, China does not have a comprehensive system to report vital statistics, and the prevalence of suicide attempts reported in some studies ranged variedly. Therefore, this meta-analysis aims to address this range and fill this gap. Specifically, this paper aims to (1) present a pooled prevalence of suicide attempts among Chinese adolescents and (2) explore the prevalence of suicide attempts with different characters such as gender in the subgroup analysis.

2. Methods

2.1. Search strategy and selection criteria

We systematically searched PubMed (1966 to Sep 2014), Embase (1950 to Sep 2014), Wanfang Data (1980 to Sep 2014), Chongqing VIP (1989 to Sep 2014) and Chinese

Table 1
Results from key studies on suicide attempts in Chinese adolescents.

ID	Study	Year	Age	Study area	Location		Sample Size			Prevalence of SA (%)	Measurement of SA	Survey Point	Quality Score
					E/C/W	S/N	Male	Female	Overall				
1	Tang et al.	2011	10–24	Wuhan	C	S	1101	912	2013	3.48	SDQ	past 1-year	8
2	Liang et al.	2014	13.92 ± 1.63	Sichuan	W	S	1085	1046	2131	0.94	AHRBI	lifetime	7
3	Xing et al.	2010	–	Beijing, Shaoxing, Ezhou, Harbin, Taiyuan, Guiyang, Chongqing	E + C + W	S + N	6216	6254	12470	2.71	SDQ	past 1-year	8
4	Li et al.	2012	15 ± 1.2	Guangzhou	E	S	565	687	1252	7.99	Youth Self-Report	past 6-months	6
5	Zhang et al.	2012	15.1 ± 1.87	Guangdong, Anhui, Hubei, Heilongjiang, Yunnan	E + C + W	S + N	–	–	14537	4.10	Youth Self-Report	past 1-year	7
6	Liu et al.	2005	14.6 ± 3.4	Shandong	E	N	822	540	1362	7.05	–	past 6 months	7
7	Cui et al.	2010	11–17	Beijing, Hangzhou, Wuhan, Urumqi	E + C + W	S + N	4297	4481	8778	7.99	GSHS	past 1-year	7
8	Law et al.	2013	–	Hong Kong	E	S	1282	1297	2579	3.92	–	past 1-year	7
9	Pan et al.	2011	15.7	Jiangsu	E	S	12087	11889	23976	2.65	–	past 1-year	7
10	Hesketh et al.	2002	13–17	Hangzhou, Chunan	E	S	770	806	1576	9.01	–	–	8
11	Wang et al.	2010	12–19	Guangzhou	E	S	2111	2533	4644	3.04	–	past 1-year	7
12	Li et al.	2004	–	–	–	–	430	1602	2032	7.48	YRBSS	past 1-year	8
13	Wang et al.	2009	–	Beijing	E	N	–	–	1915	2.09	HBRQ-CA	past 1-year	7
14	Mai et al.	2008	–	Guangzhou	E	S	1386	1535	2921	2.98	HRBQ-CA	past 1-year	6
15	Tian et al.	2012	12–20	Hangzhou	E	S	ns	–	6632	1.91	HRBQ-CA	past 1-year	7
16	Gao et al.	2000	12–20	Hefei	C	S	1224	820	2044	2.50	YRBSS	past 1-year	6
17	Yang et al.	2007	11–16	Henan	C	N	2554	2604	5158	2.48	HRBQ-CA	past 1-year	6
18	Yang et al.	2008	11–20	Henan	C	N	4281	4034	8315	1.95	HRBQ-CA YRBSS	past 1-year	6
19	Li et al.	2006	–	Liuzhou	W	S	1566	1841	3407	2.70	HRBQ-CA	past 1-year	6
20	Man et al.	2011	–	Beijing	E	N	540	605	1145	1.75	HRBQ-CA	past 1-year	5

21	Xiong et al.	2012	–	Nanchang	C	S	–	–	3153	4.06	HRBQ-CA	past 1-year	6
22	Zhuang et al.	2007	17.5	Nantong	W	S	1876	1922	3798	3.00	SDQ	past 1-year	6
23	Zhang et al.	2007	–	Nanyang	C	N	1908	1674	3582	2.23	HRBQ-CA	past 1-year	6
24	Huang et al.	2009	12–19	Shanghai	E	S	469	578	1047	3.06	HRBQ-CA	past 1-year	7
25	Feng et al.	2006	16–19	Shanghai	E	S	1139	1445	2584	1.12	SDQ	past 1-year	7
26	Gao et al.	2007	10–17	Shanghai	E	S	–	–	2079	1.88	YRBSS	past 1-year	7
27	Yang et al.	2012	14.85 ± 1.76	Shenzhen	E	S	1563	1448	3034	1.22	SDQ	past 1-year	6
28	Liu et al.	2009	–	Shenzhen	E	S	–	–	4177	1.46	SBQ-R	past 1-year	7
29	Zhang et al.	2010	12–18	Sichuan	W	S	3600	3311	6911	4.34	HRBQ-CA	past 1-year	7
30	Liu et al.	2009	–	Tianjin	E	N	1372	1682	3054	2.78	AHRBI	past 1-year	6
31	Deng et al.	2007	11–24	Yichang	C	S	–	–	2860	2.87	HRBQ-CA	past 1-year	5
32	Ma et al.	2012	–	Yinchuan	W	N	577	672	1249	4.24	HRBQ-CA	past 1-year	6
33	Wu et al.	2009	junior:14.79 ± 1.19; senior:17.80 ± 1.18	Zaozhuang	E	N	1686	1647	3333	1.89	HRBQ-CA	past 1-year	6
34	Yuan et al.	2007	11–20	Zhangjiagang	E	S	2535	2362	4897	2.12	SDQ	past 1-year	6
35	Xia et al.	2012	12–20	Zhongshan	E	S	465	480	945	1.69	–	–	6
36	Li et al.	2005	16.98 ± 1.14	Zhuhai	E	S	276	1460	1736	4.49	YRBSS	past 1-year	6
37	Yan et al.	2014	–	Dujiangyan	W	S	1090	1053	2143	3.27	SDQ	–	9
38	Ma et al.	2014	–	Wuyi,Zhangye	W	N	–	–	3897	2.67	HRBQ-CA	past 1-year	7
39	Zhang et al.	2013	–	Shanghai	E	S	629	458	1087	2.12	HRBQ-CA	–	7
40	Hang et al.	2013	16.09 ± 1.92	Tongxiang	E	S	467	491	958	2.30	HRBQ-CA	–	6
41	Liu et al.	2014	–	Xinjiang	W	N	8445	9096	17541	2.55	HRBQ-CA	past 1-year	5
42	Zhu et al.	2013	–	Zhangye	W	N	–	–	3355	3.52	HRBQ-CA	past 1-year	5
43	Chen et al.	2014	14.8 ± 1.8	Shenyang, Xinxiang, Chongqing, Guangzhou	E + W	S + N	6644	7173	13817	4.67	SDQ	past 1-year	7

E = East; C = Center; W = West; SDQ = Self-designed Questionnaire; GSHS = Global School-based Student Health Survey; YRBSS = Youth Risk Behavior Surveillance System; AHRBI = Adolescent Health related Risk Behaviors Inventory; HRBQ-CA = Health-related Behavior Questionnaire for Chinese Adolescents; SBQ-R = Suicide Behavior Questionnaire-Revised; NA = Not Applicable.

National Knowledge Infrastructure (CNKI, 1994 to Sep 2014) databases using the core terms ‘suicid*’/‘suicide attempt*’/‘attempted suicide’ and ‘adolescen*’/‘youth’/‘child*’/‘student*’ and ‘China’/‘Chinese’ in the article titles, abstracts and keywords. We also scrutinized the reference lists of the identified reviews, reports and other relevant articles to find additional pertinent studies. However, no studies were identified. Three reviewers independently screened the potential publication titles and abstracts, and reviewed the full-text of the eligible articles.

The studies included in this meta-analysis should meet the following criteria: (1) a cross-sectional study aimed at Chinese adolescents; (2) the study adopted a random sampling method; (3) having clear definition of suicide attempts; (4) containing data on suicide attempts incidence or providing sufficient information to calculate effect sizes; (5) a sample size >500; and (6) language was limited in Chinese or English. In addition, if two or more studies were published based on the same sample, the article with the greatest epidemiological quality was included. Any studies which did not meet the above-mentioned criteria were excluded.

2.2. Data extraction

Two authors (Wei He and Ting Chen) independently extracted the information using a standardized form for each study, including author’s name, year of publication, study site, study design, mean age of participants, urban or rural, point estimates, and sample size and so on. Any conflicts were resolved through consensus. If needed, we also attempted to gain the additional omitted information through communicating with study authors.

2.3. Quality assessment

The methodological quality of the studies included was assessed using an 11-item checklist which was recommended by Agency for Healthcare Research and Quality (AHRQ). An item would be scored ‘0’ if it was answered ‘NO’ or ‘UNCLEAR’; if it was answered ‘YES’, then the item scored ‘1’. Article quality was assessed as follows: low quality = 0–3; moderate quality = 4–7; high quality = 8–11.

2.4. Statistical analysis

Data management, transformation of effect size, and calculation of pooled prevalence were performed using Comprehensive Meta-Analysis (CMA) version 2.0 (Biostat, Englewood, NJ, United States). Since considerable heterogeneity was expected, we performed all analyses with a random effects model. Q -statistics were calculated to assess heterogeneity between studies, where $P < 0.10$ was regarded to be statistically significant. The I^2 was calculated to describe the percent of observed variation across studies caused by heterogeneity, and it ranged from 0% to 100% (values of 25%, 50%, and 75% were considered representing

low, moderate, and high heterogeneity respectively). Forest plots were used to display results graphically. To examine the potential publication bias, we used the funnel plot firstly. When larger and smaller studies were non-symmetrically distributed, visual inspection of the funnel plot offered an indication of publication bias. The presence of publication bias was further tested using Begg’s test and Egger’s test. A $P \leq 0.05$ was considered to be statistically significant.

3. Results

3.1. Search results

The literature search yielded a total of 731 potentially relevant citations. Of these studies, 11 studies [16–20,23–28] were from PubMed and Embase, while the other 32 studies [21,22,29–57,58] published in Chinese were from Wanfang Data, Chongqing VIP and Chinese National Knowledge Infrastructure (CNKI). Among these studies, we removed 63 duplicate studies. Of the remains, 551 studies were excluded by reviewing titles and abstracts. Therefore, 117 were identified and retrieved for full-text screening. Finally, 74 additional papers didn’t meet inclusion criteria. That is, this process resulted in 43 studies which met the rigid inclusion criteria. The flowchart of reviews showed the detailed process of selection (Fig. 1).

3.2. Methodological quality assessment

All of the selected articles were assessed for methodological quality. The quality score of each study was presented in Table 1. Five studies were of high quality and thirty-eight studies were of moderate quality. There were no articles with low quality rating (Table 1).

3.3. Study characteristics

In this review, 43 studies were identified through the search as eligible for inclusion. Table 1 displayed basic characteristics of literatures in the meta-analysis. The 43 studies comprised 200,124 adolescents. As shown, all the included cross-sectional studies were published after 2000. Of the 43 articles, 11 were published in English, and 32 were published in Chinese. 29 studies provided the detailed information of suicide attempts with different sex characteristics. 8 studies reported the prevalence of suicide attempts in rural area, and 8 studies reported in urban area. 4 studies which were conducted in several regions were multi-center trials. 1 study reported the lifetime prevalence of suicide attempts, 2 studies reported the 6-months prevalence, and others reported the 1-year prevalence (Table 1).

3.4. Overall prevalence of suicide attempts

The prevalence of suicide attempts among Chinese adolescents for each study was calculated and ranged from 0.94% to 9.01% (Fig. 2; Table 2). The pooled prevalence of 43 studies was 2.94% (95% CI: 2.53%–3.41%). There was

Meta Analysis

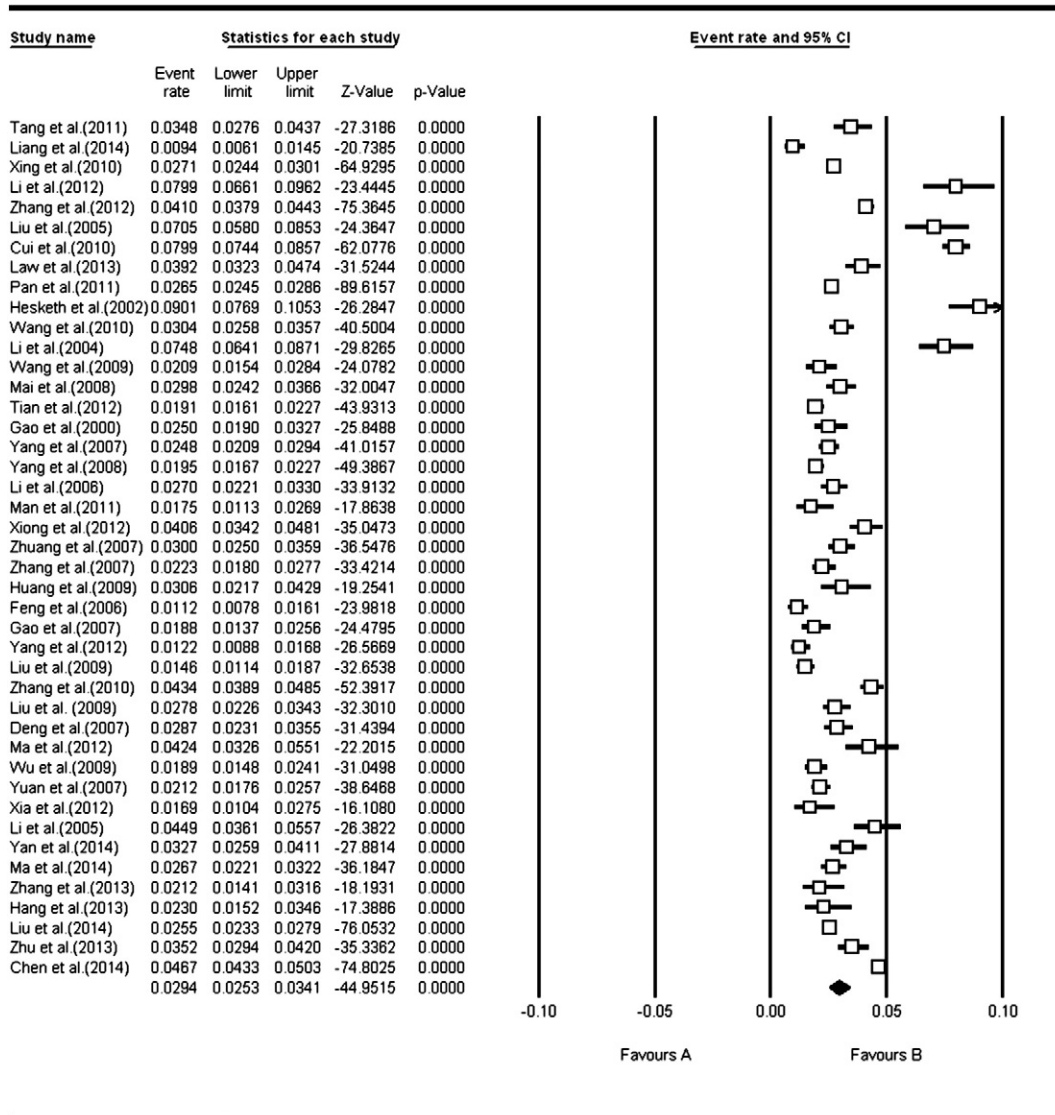


Fig. 2. Forest plot of the 43 studies included in the meta-analysis.

evidence of substantial heterogeneity for combined effect size ($Q = 1488.98$, $P < 0.0001$; $I^2 = 97.18\%$).

3.5. Publication bias

For the publication bias, funnel plot graphic indicated slight asymmetry through visual inspection (Fig. 3). However, Begg's test didn't reveal risk of publication bias ($Z = 1.61$, $P = 0.107 > 0.05$).

3.6. Subgroup analysis

3.6.1. Gender

When we studied prevalence of suicide attempts with different gender, 29 studies separately reported sufficient data on females and males. The pooled prevalence for males

was 2.50% (95% CI: 2.08%–3.01%), and for females was 3.17% (95% CI: 2.56%–3.91%).

3.6.2. Grade

In this study, we found that the prevalence of suicide attempts among junior school students in China was 2.83% (95% CI: 2.44%–3.27%); the prevalence among senior school students was 2.56% (CI: 2.14%–3.05%).

3.6.3. Rural/urban

8 studies referring to Chinese adolescents in rural area revealed that the prevalence of suicide attempts was 3.10% (95% CI: 2.17%–4.41%). However, it was lower than the estimation in urban area 3.56% (95% CI: 2.67%–4.45%).

Table 2

The prevalence of suicide attempts in different subgroup of Chinese adolescents.

Character		No. studies	r(%)	95% CI		Heterogeneity			Begg's test		Egger's test	
				Lower	Upper	Q-value	P	I-squared	z	P	t	P
Overall		43	2.94	2.53	3.41	1488.981	<0.001	97.179	1.612	0.107	2.749	0.009
Gender	Male	29	2.50	2.08	3.01	410.373	<0.001	93.177	1.069	0.285	3.094	0.005
	Female	29	3.17	2.56	3.91	720.613	<0.001	96.114	1.107	0.268	2.310	0.029
Grade	Junior high school	25	2.83	2.44	3.27	210.998	<0.001	88.625	1.658	0.097	2.457	0.022
	Senior high school	26	2.56	2.14	3.05	370.651	<0.001	93.255	1.190	0.234	1.910	0.068
Rural/Urban	Rural	8	3.10	2.17	4.41	202.020	<0.001	96.535	0.124	0.902	0.083	0.936
	Urban	8	3.56	2.67	4.73	180.885	<0.001	96.130	0.371	0.711	0.363	0.729
Location	East	22	2.67	2.11	3.36	551.276	<0.001	96.191	1.184	0.236	0.751	0.461
	Center	7	2.72	2.20	3.35	48.598	<0.001	87.654	0.601	0.548	0.524	0.623
	West	9	2.92	2.39	3.55	93.928	<0.001	91.483	0.313	0.754	0.496	0.635
	South	26	2.74	2.28	3.28	536.776	<0.001	95.343	2.072	0.038	1.259	0.220
	North	12	2.73	2.23	3.33	147.850	<0.001	92.560	0.069	0.945	0.272	0.792
Year of publication	2000–2005	5	5.65	3.83	8.26	81.045	<0.001	95.064	1.715	0.086	4.448	0.021
	2006–2010	19	2.56	1.96	3.32	806.287	<0.001	97.768	1.049	0.294	4.900	<0.001
	2011–2014	19	2.87	2.41	3.41	401.509	<0.001	95.517	0.910	0.363	1.293	0.213
Language	English	11	4.13	2.99	5.67	726.379	<0.001	98.623	0.000	1.000	0.089	0.931
	Chinese	32	2.61	2.26	3.02	569.255	<0.001	94.554	1.508	0.132	3.175	0.003
Sample size	<3000	21	3.10	2.39	4.02	451.881	<0.001	95.574	3.593	<0.001	5.777	<0.001
	3000–5000	12	2.47	2.07	2.93	98.443	<0.001	88.825	3.223	0.001	5.169	<0.001
	>5000	10	3.22	2.41	4.30	797.613	<0.001	98.872	0.716	0.474	1.832	0.104

3.6.4. Location

Considering the influence of regional variations, we also analyzed different ratio of suicide attempts in different location. Most of survey locations mainly were in the east and south of China. In this study, we found that the pooled prevalence of suicide attempts was 2.67% (95% CI: 2.11%–3.36%) in the east, 2.72% (2.20%–3.35%) in the center, 2.92% (95% CI: 2.39%–3.55%) in the west, 2.74% (95% CI:

2.28%–3.28%) in the south, and 2.73% (95% CI: 2.23%–3.33%) in the north of China.

3.6.5. Sample size

Regarding sample size, the pooled prevalence of suicide attempts was 3.10% (95% CI: 2.39%–4.02%) for sample size <3000, 2.47% (95% CI: 2.07%–2.93%) for sample size 3000–5000 and 3.22% (95% CI: 2.41%–4.30%) for sample size >5000, respectively.

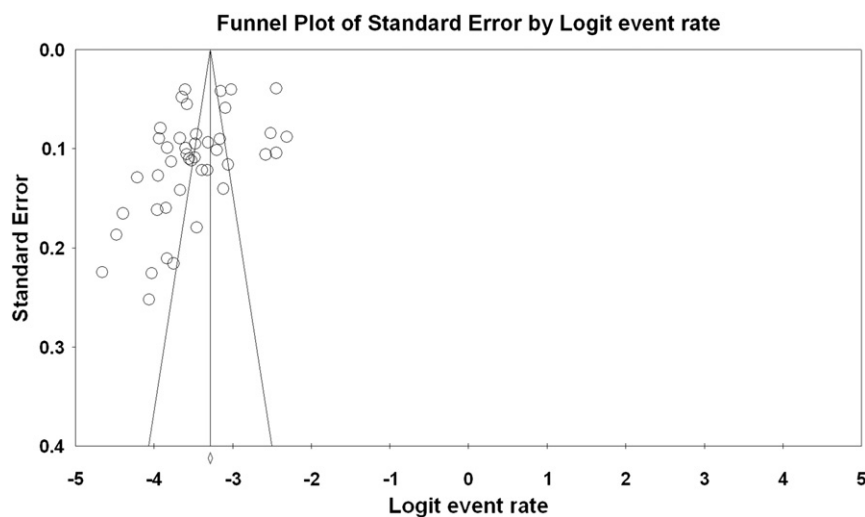


Fig. 3. Funnel plot of the 43 studies included in the meta-analysis.

Table 3
The prevalence of suicide attempts in other countries.

ID	Study	Year	Country	Main Findings
1	Rey Gex C et al.	1998	Switzerland	9268 15- to 20-year-old adolescents attending school or college were surveyed using self-administered anonymous questionnaire. In total, 3% reported suicide attempts.
2	Wichstrøm L et al.	2002	Norwegian	A representative sample of Norwegian students (9,679) in grades 7–12 were followed from 1992 to 1994. This study found that more girls (10.4%) than boys (6.0%) reported a previous attempt and more girls (3.3%) than boys (1.9%) reported an attempt during the study period.
3	Fleming et al.	2007	New Zealand	9570 randomly selected 9- to 13-year-old students from 114 schools were surveyed. In total, 739 students (4.7% of males and 10.5% of females) reported suicide attempts within the last 12 months.
4	Aseltine Jr et al.	2009	USA	Screening data from 32,217 students, between the ages of 11 and 19 years, in 225 schools were analyzed. This study found that the 1-year prevalence of suicide attempts in females was 6.8%, and in males was 2.8%, respectively.
5	West et al.	2010	Atlanta, USA	The data were from the 2007 Youth Risk Behavior Survey, which included a nationally representative sample (n = 14,041) of high school students in grades 9–12. Overall, 6.9% of adolescents attempted suicide (9.3% of girls vs. 4.6% of boys).
6	Swahn et al.	2012	France and USA	The data were based on the 2003 European School Survey Project on Alcohol and Other Drugs (ESPAD) survey (France; n = 13,187) and the 2003 Youth Risk Behavior Survey (YRBS) (United States; n = 15,136). This study revealed that 7.6% of students reported suicide attempts in the USA and 8.9% in France.
7	Lee et al.	2013	Korea	This study used the 2007 Korea Youth Risk Behavior Web-based Survey (KYRBWS). 400 middle schools and 400 high schools in Korea were monitored, and 74,698 students completed the questionnaires. 4.46% boys and 7.66% girls reported suicide attempts during the previous 12 months.
8	Tørmoen et al.	2013	Oslo, Norway	Cross-sectional survey of 11,440 adolescents aged 14–17 years in Oslo, Norway. 4.5% of all respondents reported suicide attempts.
9	Pisani et al.	2013	USA	7978 high-school students (48.6% male, 49.9% female) in 30 high schools from predominantly rural, low-income communities were surveyed. 683 students (8.6%) reported a past-year suicide attempt.
10	Taliaferro et al.	2014	USA	The data were from the 2010 Minnesota Student Survey. The population-based sample included 70,022 students in grades 9 and 12. In this study, 2.9% attempted suicide in the past year.

3.6.6. Periods

Most of the included studies in this review were published after 2006. The pooled prevalence estimate of suicide attempts was 2.56% (95% CI: 1.96%–3.32%) between 2006 and 2010, and 2.87% (95% CI: 2.41%–3.41%) between 2011 and 2014. However, the prevalence was higher in 2000 to 2005 (5.65%, 95% CI: 3.83%–8.26%).

3.6.7. Language

The pooled prevalence of suicide attempts in studies published in Chinese was 2.61% (95% CI: 2.26%–3.02%). However, the prevalence was abnormally high in those articles published in English, and it reached 4.13% (95% CI: 2.99%–5.67%).

3.7. Prevalence of suicide attempts around the world

In order to compare the prevalence of suicide attempts among adolescents in China with those in other countries, we searched PubMed database using the core terms ‘suicid*’/‘suicide attempt*’/‘attempted suicide’ and ‘adolescen*’/

‘youth’/‘child*’/‘student*’ in the article titles, abstracts and keywords. All cross-sectional studies with sample size >5000 were included. Finally, 10 studies were screened [59–68]. Based on the information about suicide attempts listed in Table 3, we knew that the prevalence of suicide attempts among Chinese adolescents was moderate compared with other countries around the world.

4. Discussion

To the best of our knowledge, the current paper is the first comprehensive meta-analysis aiming to pool the prevalence of suicide attempts among Chinese adolescents. Through rigorous screenings, 43 eligible literatures were included with a total of 200,124 participants in this study. Among Chinese adolescents, we found that the prevalence of suicide attempts ranged from 0.94% to 9.01%, and the overall prevalence was 2.94% (95% CI: 2.53%–3.41%). Our results

suggested that three in one hundred adolescents had attempted suicide in China.

Around the world, the prevalence of suicide attempts among adolescents varied in different countries. For example, in Vietnam, Nguyen et al. [69] conducted a cross-sectional study with 1161 secondary students in Can Tho city, and they found that the prevalence of suicide attempts was 3.8%. Nath et al. [70] surveyed 1817 undergraduate college youth aged 18–24 years in India, and found that the prevalence of lifetime suicide attempts among those was 4.0%. These studies were basically matched with our result in this meta-analysis. However, not all conclusions conformed to our result. Sampasa-Kanyinga et al. [71] who conducted a cross-sectional regional school-based survey among students in selected grade 7 to 12 classes in Canada, found that the prevalence of suicide attempts was 10.9%. In America, West et al. [68] assessed the prevalence of suicide behaviors using data from the 2007 Youth Risk Behavior Survey for students in grades 9–12, and found that the prevalence of suicide attempts was 6.9%. Another cross-sectional study among Korean adolescents revealed that the prevalence of suicide attempts was up to 11.6% [72]. These results were higher than that of our study. However, Arun et al. [73], who surveyed 2402 students from classes 7 to 12, found that the prevalence of suicide attempts was only 0.39% in India. The National College Health Assessment Survey (NCHA) found that 1.5% of 15,977 college students in the academic year 1999–2000 had attempted suicide within the last school year [74]. Those results reflected the difference in prevalence of suicide attempts among countries in the world. What contributed to the difference? Some previous studies had revealed that region [75], cultural diversity [76], racial difference [77], economic strain [77], gender discrimination [78], and so on, could influence the suicide behaviors to a large extent, which leads to the different distribution of suicide behaviors around the globe.

In addition, some regional differences of suicide attempts among adolescents were reflected in China. Our findings in this study reported that the prevalence of suicide attempts in East, Center and West had a tiny difference; it was 2.67%, 2.72% and 2.92%, respectively. The difference was intimately associated with the levels of different regions and social stability. In economically developed areas, especially in the east of China, adolescents could enjoy stable life and receive better education than those in underdeveloped areas.

Gender might significantly affect the prevalence of suicide attempts. In this study, we found that the pooled prevalence of suicide attempts for males was 2.50%, and for females was 3.17%. A significant difference was existed in different gender. In America, West et al. [68] also found that females were more likely to suicide attempts than males in the past year (9.3% of females versus 4.6% of males). Other studies, for example, those of Bhola et al. [79], Dieserud et al. [80], and Kokkevi et al. [81], also reported similar results with our study. The reason attributed to the difference

in psychological development between males and females, and females were more vulnerable when they met with setbacks.

Interestingly, our findings revealed that adolescents in rural areas had a slightly lower prevalence of suicide attempts than those in urban areas. However, most literatures [82–84] reported that rural population had a higher rate than urban. Several possible explanations for this uncommon phenomenon in our study might be as follows. Firstly, because only 8 studies described the characters of suicide attempts about rural and urban, sample size was not enough. Secondly, under the social background of stepping up urbanization construction, although a large number of teenagers moved into town, their ideas or education level had not significantly improved with the development of society. In a word, it is a puzzle which we have to be cautious to handle. Only by multicenter, large sample studies can we draw an accurate conclusion in the future.

Yet the puzzle of this study was that the articles published in English had a much higher rate of suicide attempts than those in Chinese. We checked the information of each article as closely as possible. However, what was regrettable was that there was no sufficient information that could explain this trouble. Language bias might be one of the factors.

On an individual basis, one or several factors could work, and even accidental factors might also contribute to suicide attempts. Other factors, such as grade, publication period, history of family suicide, religious belief, and cultural orientation, could affect the prevalence of suicide attempts among Chinese adolescents. For a population, those factors affecting suicide attempts were not single, but multifaceted. Thus, comprehensive measures should be taken to prevent suicide attempts in Chinese adolescents.

5. Limitations

Although this meta-analysis included 43 studies encompassing a larger sample size than individual studies, there were still several limitations that we should consider. First and foremost, the heterogeneity of both total population and subgroup was high. Secondly, the literatures searched were limited to articles published in English or Chinese. Thus, it was likely that the meta-analysis did not reflect all outcomes. Thirdly, there was no unique definition for suicide attempts. Several common instructions for suicide behavior were HRBQ-CA, YRBSS, and AHRBI in China. What's more, the measured time-point was not in accordance with each other, such as past 6 months, past 12 months, past 2 years, lifetime, and so on. Finally, the studies surveyed in center or west China were fewer, which indicated that the representation of sample was not enough. Thus, a few more extensive multi-center studies using a large sample to investigate the epidemiology of suicide attempts among adolescents are required in the future. Therefore, the results of this study should be contemplated with caution considering the above mentioned limitations.

6. Conclusions

The results indicated that the prevalence of suicide attempts among Chinese adolescents was moderate compared with other countries around the world. However, suicide attempts should be given attention by our country, and necessary measures should be set out to prevent them in the future.

Conflict of interest

We declare that there is no conflict of interest.

Ethical standard

This review did not involve animal or human experimentation.

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