



Research article

Prevalence, socio-demographic correlates and associations of adverse childhood experiences with mental illnesses: Results from the Singapore Mental Health Study

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ABSTRACT

Background: Adverse childhood experiences (ACEs) are associated with deleterious consequences throughout the lifespan of the individual, including an increased risk of mental disorders. However, an in-depth understanding of ACEs in diverse populations is still lacking especially in Asian populations, with few studies done at a population level.

Objective: The current study aimed to establish the (i) prevalence of ACEs and its socio-demographic correlates, and, (ii) association of ACEs with mental disorders and suicidality in a multi-ethnic Asian country.

Participants and Setting: Singapore residents aged 18 years and older were recruited from the community as part of a nation-wide cross-sectional epidemiological study.

Methods: Trained interviewers conducted face-to-face interviews with participants, and administered the Adverse Childhood Experiences – International Questionnaire and the Composite International Diagnostic Interview.

Results: A total of 6126 participants completed the survey. The lifetime prevalence of ACEs in the sample was 63.9 %. Multiple logistic regression analyses revealed that odds of any ACE were higher among those above 65 years (OR = 1.7) and those without university education (OR = 2.2, 1.9, and 1.5 among those with primary and below, secondary and vocational education respectively). The presence of any ACE was significantly associated with increased odds of mood (OR = 3.7, 95 % CI: 2.3–6.0), anxiety (OR = 3.9, 95 % CI: 2.3–6.8) and alcohol use (OR = 1.7, 95 % CI: 1.1–3.0) disorders.

Conclusions: ACEs are not uncommon in Asian populations. There is a need to build trauma-informed communities that can incorporate the knowledge of the impact of early trauma into policies and programs.

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1. Introduction

Adverse childhood experiences (ACEs) are stressful or traumatic events that occur during childhood (typically from birth until 18 years) and result in harm or potential for harm to a child's health, survival, development or dignity (Leeb, Paulozzi, Melanson, Simon, & Arias, 2007). ACEs include emotional, physical, and sexual abuse; physical and emotional neglect; household dysfunction such as living in a home with violence; having family member(s) with alcohol and substance misuse, mental illness, or incarceration; and parental separation or divorce (Felitti et al., 1998). Research over the past few decades attests to the deleterious consequences of ACEs on functioning throughout the lifespan of the individual (Choi, DiNitto, Marti, & Choi, 2017; Kalmakis & Chandler, 2015; Nurius, Logan-Greene, & Green, 2012).

ACEs are associated with an increased risk of mental disorders in later life including depression, anxiety, alcohol and substance use disorders, psychosis and suicide attempt (Brodsky & Stanley, 2008; McGrath et al., 2017; Pirkola et al., 2005; Sareen et al., 2013; Schilling, Aseltine, & Gore, 2007; Varese et al., 2012). Studies suggest that the impact of ACEs on health is due to 'toxic stress' resulting from exposure to the traumatic experiences and detrimental environment in childhood (Shonkoff, Boyce, & McEwen, 2009; Shonkoff, Garner, Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, & Dependent Care; Section on Developmental and Behavioral Pediatrics, 2012). Converging evidence from neurobiology and epidemiology suggests that early life exposure to toxic stress, such as abuse and related adverse experiences cause epigenetic modifications to gene expressions. These modifications in turn can lead to altered brain structure, consequently resulting in brain dysfunction that affects the lifelong health and quality of life of the individual (Cicchetti, Hetzel, Rogosch, Handley, & Toth, 2016; Yang et al., 2013). It is also possible that early life trauma leads to structural and functional changes in the brain and its stress regulatory systems, which affect emotional regulation and fear response and in turn predisposes individuals to harmful health behaviors like smoking and excessive drinking and their subsequent adverse health outcomes (Danese & McEwen, 2012). Individuals who have ACEs can be more susceptible to disease development through both differences in physiological development and persistence of health-damaging behaviours (Read, Fosse, Moskowitz, & Perry, 2014; Vaiserman, 2015). The association between ACEs and increased risk for negative effects across life course and long-term adverse outcomes ranging from poor academic performance to early death is increasingly becoming recognized as a public health concern (Biglan, Van Ryzin, & Hawkinsd, 2017; Dube, 2018; Shern, Blanch, & Steverman, 2016).

Studies have shown that exposure to one ACE increases the individual's chance of experiencing another (Chapman et al., 2004; Duke, Pettingell, McMorris, & Borowsky, 2010; Nguyen, Dunne, & Le, 2010; Turner, Finkelhor, & Ormrod, 2010). The cumulative risk hypothesis suggests that the accumulation of risk factors increases the probability of adverse cognitive and behavioral outcomes (Sameroff, 2000). Thus, a graded relationship exists between the number of ACEs and the likelihood of lifetime psychiatric disorders, with the risk of negative consequences increasing with more adverse experiences (Chapman et al., 2004; Pirkola et al., 2005; Schilling et al., 2007).

It is essential to examine the patterns of ACEs in different countries as well as cultures, as the occurrence and co-occurrence of ACEs varies widely (Bellis, Hughes, Leckenby, Perkins, & Lowey, 2014; Stoltenborgh, Bakermans-Kranenburg, van Ijzendoorn, & Alink, 2013), which in turn may influence the type of adverse outcomes (Cavanaugh, Petras, & Martins, 2015; Shin, McDonald, & Conley, 2018). Firstly, studies suggest that physical abuse may be higher in Asian populations due to strict parenting styles where disciplinary action involving the use of physical punishment remains common for educational purposes, despite some changes with time (Ji & Finkelhor, 2014; Zhai & Gao, 2009). Secondly, the collectivist culture in Asia emphasizes family values, reputation and honor above that of the individual's needs and therefore can lead to reluctance to report abusive events, especially that of sexual abuse within the family (Ji, Finkelhor, & Dunne, 2013; Stoltenborgh, Van Ijzendoorn, Euser, & Bakermans-Kranenburg, 2011). Lastly, considerable gender bias is still prevalent in many communities in Asia which may affect the behavior of the parent towards the child and constitute a risk or protective factor for ACEs, leading to gender differences in ACEs (Sekher & Hatti, 2005).

Despite the extensive evidence linking ACEs to multiple adverse outcomes, there are still gaps in the literature. For example, there is a lack of research on ACEs in diverse populations, with few studies done at a population level in Asian countries. Most of the published evidence is from studies conducted in Western societies. The current study thus aimed to establish the (i) prevalence of ACEs and its socio-demographic correlates, and, (ii) association of ACEs with mental disorders and suicidality in a multiethnic Asian community using data from the second Singapore Mental Health Study (referred to as SMHS 2016).

2. Methods

The SMHS 2016 was a population-based, cross-sectional epidemiological study conducted among Singapore residents aged 18 years and above living in Singapore (Subramaniam et al., 2019). The sampling frame was based on a national population database of all citizens and permanent residents in Singapore which is updated regularly. A probability sample was randomly selected using a disproportionate stratified sampling design with 16 strata defined according to ethnicity (Chinese, Malay, Indian, Others) and age groups (18–34, 35–49, 50–64, 65 and above). Residents aged 65 and above, Malays and Indians were over-sampled to ensure that an adequate sample size would be achieved to improve the reliability of estimates for the subgroup analysis. The study included only Singapore citizens and permanent residents who were 18 years and older, living in the country during the survey period and able to understand and speak English, Chinese or Malay. Those who were incapable of doing an interview due to severe physical or mental conditions, institutionalized or hospitalized for the entire duration of the field period, and those who were not contactable due to incomplete or incorrect address, were excluded from the survey. In all 6,126, respondents were interviewed as part of the study with a response rate of 69.5 % (Subramaniam et al., 2019).

2.1. Study procedures

An invitation letter was sent to the selected resident, followed by a personal home visit by a trained interviewer to obtain the resident's agreement to participate in the survey. Trained interviewers from a survey research company conducted face-to-face interviews with those who agreed to participate in the study. The questionnaires were available in English, Chinese and Malay, and the respondents were asked to choose the language they were most comfortable with before the interviewer initiated any study related procedures. The study was approved by the National Healthcare Group's Domain Specific Review Board. Written informed consent was obtained from all participants and parents or legally acceptable representatives of those aged below 21 years.

2.2. Questionnaires

2.2.1. World Health Organisation – composite international diagnostic interview version 3.0 (WHO-CIDI 3.0)

The fully-structured computer-assisted personal interview (CAPI) version of the WHO-CIDI 3.0 (Kessler & Ustun, 2004) was used in the study for establishing the diagnoses of lifetime and 12-month major depressive disorder (MDD), bipolar disorder, generalised anxiety disorder (GAD), obsessive-compulsive disorder (OCD) and alcohol use disorder (AUD) comprising alcohol abuse and dependence. The section on suicidality, i.e., suicidal thoughts, plan and attempt was also included. These disorders were chosen based on consultation with the policymakers as they were considered to be prevalent in the Singapore population. This decision also reflected an effort to reduce the respondent burden, which in conjunction with the stigma towards mental illness could potentially affect participation in the study.

2.2.2. Adverse childhood experiences– international questionnaire (ACE -IQ)

The ACE-IQ can be used globally, and allows the analysis of associations between adverse childhood experiences and subsequent health outcomes and health risk behaviours in those aged 18 years and above (World Health Organization, 2018). The questions from ACE-IQ cover physical, sexual and emotional abuse and neglect by parents or caregivers; peer violence; family dysfunction (violence against household members; living with household members who were substance abusers, mentally ill or suicidal, or imprisoned; having one or no parents, parental separation or divorce); witnessing community violence, and exposure to collective violence. For the current study, we did not include the questions on witnessing community violence, and exposure to collective violence as they are not that common in Singapore. Only one question was asked to assess sexual abuse – “Did someone touch or fondle you in a sexual way when you did not want them to?” More explicit questions on attempted and actual intercourse were not asked as this is the first time ACEs were elicited in a community survey across the country, and the researchers were unsure if it would lead to disengagement with the study or the nature of the questions alone would cause significant distress to the respondents as Asian societies tend to be more traditional and conservative. All questions about ACEs pertained to the respondents' first 18 years of life, and responses were binary (yes or no) or frequency-based. From these, a dichotomous variable was created to reflect exposure to each ACE type and category (abuse, neglect, household dysfunction, and bullying). In all, 11 types of ACEs were included in the final analysis. We also calculated a total ACEs score for each participant (+ 1 for each type of ACE reported). Given the sensitive nature of the questions, the questionnaire was self-administered by the respondent using a tablet. For those who were not literate, the items were read out in a neutral manner by the interviewer. Consistent with previous research (Bruffaerts et al., 2010; Hughes, Bellis, Hardcastle, Sethi, Butchart, Mikton, Jones et al., 2017; Scott et al., 2011), the number of ACEs that the respondents reported having experienced was summed into an ACE count (range 0–11) and categorised into four groups for analysis: 0 ACE, 1 ACE, 2 ACEs and 3 and more ACEs.

2.2.3. Modified fagerstrom test for nicotine dependence (FTND)

Information on smoking was collected through a question that asked respondents whether they were current smokers, ex-smokers, or non-smokers who never smoked before. Those who were current smokers were then administered the 6-item FTND to assess physical dependence on tobacco smoking (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). Scores of 4 or less were classified as low dependence while scores of 8–10, were assessed to be very high dependence. We categorised those with scores 5 and above as dependence as defined by previous studies (Manimunda et al., 2012; Picco, Subramaniam, Abidin, Vaingankar, & Chong, 2012).

2.2.4. Socio-demographic questionnaire

Data on sex, age, ethnicity (Chinese, Malay, Indian, and Others), marital status (not married, married, divorced/ separated and widowed), educational level (primary and below, secondary, vocational/ institute of technical education (ITE), pre-university/ junior college, diploma and university), employment status (employed, unemployed and economically inactive, i.e., students, homemakers and retirees) and monthly household income was collected. Monthly household income was calculated as the average pre-tax income in the past 12 months, of all family members living in the same household.

2.3. Statistical analysis

All estimates were weighted to adjust for oversampling and post-stratified for age and ethnicity distributions between the survey sample and the Singapore resident population in 2014. Frequencies and percentages were calculated for categorical variables. We examined sociodemographic correlates of adverse childhood experiences using multiple logistic regression analysis. A series of multiple logistic regression models were used to generate odds ratios (ORs) and 95 % confidence intervals using mood, anxiety, AUD, suicidality and nicotine dependence as the main outcome variables and ACEs as predictor variables adjusted for age, gender, marital

Table 1
Prevalence of Adverse Childhood Experiences in Singapore.

	N	weighted %
Emotional neglect	2013	46.5
Physical neglect	259	5.9
Living with household members who were substance abusers	248	5.3
Living with household members who were mentally ill or suicidal	225	6.0
Battered mother/ female guardian	382	8.2
Living with household members who were imprisoned	221	4.5
Parental separation, divorce or death of a parent	1090	21.8
Emotional abuse	331	8.0
Physical abuse	232	5.0
Sexual abuse	144	3.7
Bullying	90	2.0
Any ACE ^a	2842	63.9
Number of adverse childhood experiences		
– 1	1575	35.6
– 2	677	15.2
– 3 and more	590	13.1

^a Any adverse experience: Respondents have experienced at least one type of neglect, abuse, household dysfunction (household members who were substance abusers, mentally ill or suicidal or imprisoned, battered mother/ female guardian, parental separation, divorce or death), or bullying.

status, ethnicity, education, employment and income. Model fit statistics including Nagelkerke's R^2 and area under curve (AUC) statistics were also calculated for each regression model. We found that the Nagelkerke's R^2 ranged from 0.06 to 0.3 while the AUC values ranged from 0.67 to 0.85, respectively. Standard Errors (SE) and significance tests were estimated using the Taylor series linearisation method. Multivariate significance was evaluated using Wald χ^2 tests based on design corrected coefficient variance--covariance matrices. Statistical significance was evaluated at the < 0.05 level using two-sided tests. All statistical analyses were carried out using the STATA version 13 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: Stata Corp LP).

3. Results

A total of 6126 participants completed the survey, and of these 4441 respondents completed the ACE-IQ. One thousand five hundred and twenty-nine participants who completed the other modules of the survey refused to complete the ACE-IQ, thus the overall response rate for completion of ACE-IQ was 51.3 % in the current study. The SMHS 2016 found that the lifetime prevalence of ACEs in the sample was 63.9 % (Table 1). In all, 50.9 % experienced physical or emotional abuse or neglect, 33.2 % experienced some form of household dysfunction, 3.7 % experienced sexual abuse and 2.0 % experienced bullying. The most common type of ACE experienced by the overall sample was emotional neglect (46.5 %), followed by parental separation, divorce or death (21.8 %) and battered mother/ female guardian (8.2 %). 35.6 % of the respondents experienced one ACE, 15.2 % had experienced two ACEs while 13.1 % had experienced 3 or more ACEs in their lifetime.

Socio-demographic correlates of ACEs are available in Supplementary Table 1. The odds of having any ACE was significantly higher among those 65 years and above than among those aged 18–34 years (reference group). The likelihood of ACEs was also higher among those who had a primary school education and below, secondary, vocational institute/TTE education or diploma as compared to those with a university education.

The associations with individual ACEs were varied. Compared to those aged 18–34 years, the odds of experiencing emotional neglect was higher among those aged 50–64 years and odds of parental separation/divorce/death of a parent was higher among those aged 65 years and above. However, those in the age group of 50–64 years and 65 years and above had lower odds of living with household members who were mentally ill or imprisoned, as well as emotional and physical abuse.

Females were more likely to experience emotional and sexual abuse as compared to males. An association between lower educational attainment and ACEs was observed across several categories of ACEs. Those who had primary school level or below education had higher odds of emotional neglect, physical neglect, living with a household member who was a substance abuser or had been imprisoned and experiencing parental separation/divorce or death of a parent than those with a University education. Those with secondary education (compared to those with University education) had higher odds of emotional neglect, physical neglect, battered mother/ female guardian, living with a household member who had been imprisoned and experiencing parental separation/divorce or death of a parent. Those with vocational institute/TTE education had higher odds of emotional neglect, battered mother/ female guardian, living with a household member who had been imprisoned and experiencing parental separation/divorce or death of a parent and physical abuse (compared to those with a University education).

3.1. Associations of adverse childhood experiences with mood, anxiety, alcohol use disorder, suicidality and nicotine dependence

After controlling for sociodemographic factors in multiple logistic regression analyses, presence of any ACE was significantly associated with increased odds of all mental illnesses assessed by the CIDI, i.e., MDD, bipolar disorder, GAD, OCD and AUD. It was

Table 2
Associations of Adverse Childhood Experiences with mood, anxiety, alcohol use disorder, suicidality and nicotine dependence.

	Mood Disorder			Major Depressive Disorder			Bipolar Disorder			Anxiety Disorder			Generalized Anxiety Disorder			Obsessive Compulsive Disorder		
	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	
																		P Value
Emotional neglect	2.4	(1.6,3.5)	< 0.001	2.3	(1.5,3.5)	< 0.001	2.6	(1.2,5.4)	0.011	2.5	(1.6,3.9)	< 0.001	1.4	(0.6,2.9)	0.441	3.1	(1.9,5.2)	< 0.001
Physical neglect	2.2	(1.2,4)	0.015	1.7	(0.9,3.5)	0.12	3.2	(1.1,9.6)	0.035	2.2	(1.1,4.5)	0.031	1.3	(0.6,2.9)	0.482	2.5	(1.1,5.7)	0.033
Living with household members who were substance abusers	2.2	(1.2,4)	0.009	2.4	(1.3,4.5)	0.008	1.5	(0.5,5.1)	0.488	2.2	(1.1,4.6)	0.028	3.8	(1.3,10.9)	0.013	1.7	(0.7,4.1)	0.228
Living with household members who were mentally ill or suicidal	3.2	(1.9,5.3)	< 0.001	2.6	(1.5,4.7)	0.001	4.3	(1.8,10.3)	0.001	2.9	(1.5,5.4)	0.001	2.3	(0.8,6.6)	0.141	3.1	(1.6,6.2)	0.001
Battered mother/female guardian	2.9	(1.8,4.6)	< 0.001	2.8	(1.7,4.5)	< 0.001	2.5	(1.6)	0.046	2.8	(1.7,4.8)	< 0.001	2.2	(0.9,5.3)	0.094	2.7	(1.5,4.9)	0.001
Household member imprisonment	1.5	(0.8,2.9)	0.192	1.5	(0.7,3.1)	0.315	1.5	(0.5,4.5)	0.431	2.5	(1.3,4.9)	0.009	4.1	(1.4,11.9)	0.009	2.4	(1.1,5.1)	0.028
Parental separation, divorce or death	1.9	(1.3,2.9)	0.001	1.9	(1.2,3.1)	0.004	1.7	(0.8,3.5)	0.187	1.5	(0.9,2.4)	0.085	2	(1.4,2)	0.066	1.2	(0.7,2.2)	0.506
Emotional abuse	3.6	(2.2,5.6)	< 0.001	3.2	(1.9,5.4)	< 0.001	3.2	(1.4,7.2)	0.006	4	(2.4,6.6)	< 0.001	3.4	(1.5,8)	0.004	4.2	(2.4,7.4)	< 0.001
Physical abuse	4.4	(2.6,7.6)	< 0.001	3.6	(2.6,5)	< 0.001	5.2	(2.1,12.6)	< 0.001	4.7	(2.6,8.4)	< 0.001	3.9	(1.5,10.2)	0.005	4.4	(2.3,8.6)	< 0.001
Sexual abuse	2	(1.4,1)	0.056	2.3	(1.1,4.8)	0.033	0.7	(0.2,2.3)	0.604	2.8	(1.2,6.5)	0.016	3	(0.8,12.3)	0.117	2.1	(0.8,6)	0.154
Bullying	6.3	(2.8,14.1)	< 0.001	5	(2.1,2.3)	0.001	5.8	(1.5,22.5)	0.011	2.6	(1.6,5)	0.039	4.9	(1.5,16.7)	0.01	2.1	(0.7,6.2)	0.161
Any ACE	3.7	(2.3,6)	< 0.001	2.9	(1.7,4.9)	< 0.001	11	(4.9,25)	< 0.001	3.9	(2.3,6.8)	< 0.001	4	(1.5,10.8)	0.006	4.2	(2.2,8)	< 0.001

	Alcohol Use Disorder			Alcohol Abuse			Suicidality			Nicotine Dependence		
	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	P Value	OR	95 % CI	
												P Value
Emotional neglect	1.5	(0.9,2.4)	0.092	1.7	(1.2,7)	0.047	2.6	(1.8,3.7)	< 0.001	0.9	(0.5,1.5)	0.591
Physical neglect	2.0	(0.9,4.5)	0.11	2.1	(0.9,5.0)	0.097	3.1	(1.7,5.5)	< 0.001	1	(0.4,2.6)	0.98
Living with household members who were substance abusers	3.9	(2.7,6)	< 0.001	4.1	(2.1,8.3)	< 0.001	2.9	(1.7,5.1)	< 0.001	3.6	(1.6,8.0)	0.001
Living with household members who were mentally ill or suicidal	3.4	(1.7,7.1)	0.001	3.6	(1.7,7.5)	0.001	2.5	(1.4,4.4)	< 0.001	0.9	(0.3,2.6)	0.844
Battered mother/female guardian	1.7	(0.9,3.3)	0.123	1.8	(0.9,3.5)	0.118	3.7	(2.4,5.9)	< 0.001	2.1	(0.9,4.2)	0.052
Household member imprisonment	3.6	(1.7,7.4)	0.001	3.5	(1.6,7.8)	0.002	2.5	(1.4,4.4)	0.003	1.3	(0.6,3.0)	0.504
Parental separation, divorce or death	1.5	(0.9,2.6)	0.12	1.4	(0.8,2.4)	0.276	2.1	(1.4,3.0)	< 0.001	1.1	(0.7,1.9)	0.695
Emotional abuse	1.6	(0.8,3.2)	0.231	1.5	(0.7,3.3)	0.337	6.3	(4.0,9.7)	< 0.001	2.1	(0.9,5.2)	0.09
Physical abuse	2.4	(1.2,5.1)	0.019	2.5	(1.1,5.5)	0.026	4.9	(2.9,8.2)	< 0.001	2.6	(1.2,5.9)	0.019
Sexual abuse	2.2	(0.9,5.4)	0.092	2.5	(1.1,6.2)	0.049	5	(2.7,9.3)	< 0.001	0.8	(0.1,6.9)	0.836
Bullying	1.1	(0.3,4.8)	0.887	1.2	(0.3,5.6)	0.812	2.3	(1.5,5.0)	0.054	2.4	(0.5,11.9)	0.268
Any ACE	1.7	(1.1,3)	0.044	1.8	(1.0,3.2)	0.045	4.2	(2.5,7.0)	< 0.001	1	(0.5,1.8)	0.888

CI: Confidence Interval; OR: Odds ratio.
All odds ratios (OR) were estimated after controlling for age, gender, ethnicity, education, marital status, employment and income.
Mood disorder includes major depressive disorder, and bipolar disorder.
Anxiety disorder includes Generalised anxiety disorder, and Obsessive-compulsive disorder.

Table 3
Association of number of adverse childhood experiences with mood, anxiety, and alcohol use disorder, suicidality and nicotine dependence.

Number of ACEs	Mood Disorder		Major Depressive Disorder		Bipolar Disorder		Anxiety Disorder		Generalized Anxiety Disorder		Obsessive Compulsive Disorder							
	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI	P value						
0	Ref.			Ref.			Ref.		Ref.		Ref.							
1	2.3	(1.3,3.9)	0.004	1.7	(1.0,3.2)	0.071	8.2	(3.2,21)	< 0.001	2.7	(1.4,5.0)	0.002	0.099	3	(1.5,6.2)	0.002		
2	3.9	(2.1,7.2)	< 0.001	3.2	(1.6,6.4)	0.001	9.9	(3.4,28.8)	< 0.001	3.7	(1.8,7.6)	< 0.001	3	(0.8,8.2)	0.107	3.9	(1.7,9.1)	0.001
3 and more	7.9	(4.6,13.6)	< 0.001	6.1	(3.4,11)	< 0.001	19.9	(7.8,50.8)	< 0.001	7.7	(4.1,14.6)	< 0.001	8.8	(2.9,26.1)	< 0.001	7.8	(3.8,16.3)	< 0.001

Number of ACEs	Alcohol Use Disorder		Alcohol Abuse		Any CIDI		Suicidality		Nicotine Dependence						
	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI				
0	Ref.			Ref.			Ref.		Ref.						
1	1.3	(0.7,2.4)	0.465	1.3	(0.6,2.4)	0.513	2	(1.4,2.9)	< 0.001	2.5	(1.4,4.4)	0.002	0.6	(0.3,1.3)	0.193
2	1.3	(0.6,2.8)	0.47	1.5	(0.7,3.2)	0.326	3.1	(1.9,4.8)	< 0.001	4	(2.1,7.6)	< 0.001	0.8	(0.4,1.8)	0.592
3 and more	3.7	(1.9,7.2)	< 0.001	3.7	(1.8,7.5)	< 0.001	6.7	(4.4,10.1)	< 0.001	9.7	(5.5,17.1)	< 0.001	2	(1.0,4.2)	0.058

Note: All odds ratios (OR) were estimated in the multiple logistic regression analyses after controlling for age, gender, ethnicity, education, marital status, employment and income. Any CIDI includes major depressive disorder, bipolar disorder, generalized anxiety disorder, obsessive-compulsive disorder, alcohol abuse and alcohol dependence.

also significantly associated with higher odds of suicidality but not with nicotine dependence. Several individual ACEs were found to be significantly associated with increased odds of having mental illnesses. Those who experienced emotional neglect, physical neglect, living with household members who were substance abusers, mentally ill or suicidal, battered mother/ female guardian, parental separation/divorce or death of a parent, emotional abuse, physical abuse and bullying, were more likely to be associated with mood disorder (Table 2). Those who experienced - emotional neglect, physical neglect, living with household members who were substance abusers or mentally ill or suicidal, or had been imprisoned, battered mother/female guardian, emotional abuse, physical abuse, sexual abuse and bullying were more likely to be associated with anxiety disorder. Those who experienced living with household members who were substance abusers or mentally ill or suicidal, or imprisoned and those with a history of physical abuse were more likely to be associated with AUD. All ACEs assessed in this study except bullying were associated with suicidality. Living with household members who were substance abusers and experiencing physical abuse were associated with nicotine dependence.

The cumulative effects of adverse childhood experiences are shown in Table 3. A dose-response effect of ACEs on mental illnesses was observed. Those who experienced one or two ACEs (compared to no ACE exposure) were more likely to be associated with MDD, bipolar disorder, OCD and suicidality. Those who had experienced three or more ACEs were more likely to be associated with all mental disorders i.e., MDD, bipolar, GAD, OCD, alcohol abuse and suicidality. It is of note that the presence of even 1 ACE was associated with higher odds of having any one of the mental disorders assessed with the CIDI in SMHS 2016.

4. Discussion

To our knowledge, this is the first study that has examined the prevalence and correlates of ACEs in the general population of Singapore. The results indicate that the prevalence of lifetime ACEs in the Singapore adult population was 63.9 %. Comparison of prevalence across studies is fraught with difficulties due to the use of different questionnaires, methodologies, the inclusion of different ACEs, and differing sociocultural factors. However, comparing ACEs across similar categories revealed similarities and differences with other studies.

The SMHS 2016 found that 46.5 % of adults experienced emotional, and 5.9 % experienced physical neglect, in contrast, studies from other countries report lower prevalence of emotional and higher prevalence of physical neglect. The Philadelphia Urban ACE survey (USA) reported that 7.7 % and 19.1 % of adults surveyed had experienced emotional and physical neglect, respectively (Public Health Management Corporation et al., 2013) while the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) in USA reported that 9.4 % and 24.2 % of adults suffered from emotional and physical neglect, respectively (Affi et al., 2011). The rate of emotional neglect was higher in a Hong Kong study of college students which reported that 15.7 % of students had experienced emotional neglect and 4.4 % had experienced physical neglect (Ho, Chan, Chien, Bressington, & Karatzias, 2019). The SMHS 2016 found that 8.0 % of adults had suffered from emotional abuse, 5.0 % had experienced physical abuse, and 3.7 % had experienced sexual abuse. These figures are lower than that reported in other national surveys internationally; the National Epidemiologic Survey on Alcohol and Related Conditions (USA) (Affi et al., 2011) reported prevalence figures of 8.1 %, 17.6 % and 10.6 % (emotional, physical and sexual abuse, respectively), while a national household survey of adult residents in England found the prevalence of childhood verbal, physical and sexual abuse in the general population were 18.2 %, 14.8 %, and 6.3 %, respectively (Bellis et al., 2014). A study across eight medical universities in Vietnam reported emotional abuse and physical abuse were 42.3 %, 39.9 % respectively (Tran, Dunne, Van Vo, & Luu, 2015). A population-based survey of 16–25-year-old young people in Thailand found that 31.8 % had been emotionally abused, 11.7 % had been physically abused and 5.8 % had been subjected to sexual penetration (Jirapramukpitak, Prince, & Harpham, 2005).

The associations of sociodemographic factors with individual ACEs were varied. The odds of parental separation/divorce/death of a parent was higher among those aged 65 years and above in Singapore. This may reflect changes in the society over time. As Singapore has evolved into a developed country with lower mortality and with increased life expectancy (84.8 years in 2017), experiencing an earlier parental death (before the age of 18) has become less common. The prevalence of parental death before the age of 18 years was 30 % in those aged 65 years and above as compared to 6.3 % in those aged 18–34 years although parental separation and divorce were higher in those aged 18–34 years of age (12.8 % compared to 3.7 % in those aged 65 years and above).

Females were significantly associated with experiencing sexual abuse in their childhood, a finding that has been found in many previous studies (Bellis et al., 2014; Schilling et al., 2007; Wellman, 1993). This may be due to reluctance in males to report abuse, especially since males tend to be the aggressor and hence when the perpetrator is male, the same-sex element of the abuse carries significant meaning for boys. Research indicates that boys may be deeply troubled by feelings of guilt, shame, and confusion about their sexuality and thus less likely to report abuse and take a much longer time to report if they report it at all (Dorahy & Clearwater, 2012; O'Leary & Barber, 2008; Rhodes et al., 2011). It is also possible that women are sexually abused more often than males, as perpetrators are more likely to be males. Research has, in fact, demonstrated that sexual abusers are overwhelmingly male, and the majority of victims are female (Sedlak et al., 2010).

Given that ACEs occur in childhood, it follows that they would have a significant impact on their academic education in addition to their health. Experiencing ACEs was associated with poorer educational attainment in our study. Similar findings have been reported by Currie and Widom (2010) who found that adults reporting histories of child abuse and neglect had lower levels of education; adolescents exposed to violence were also at increased risk of lower educational attainment as shown in other studies (Covey, Menard, & Franzese, 2013; Macmillan & Hagan, 2004). Using data from the Behavioral Risk Factor Surveillance System (BRFSS) (USA), Metzler, Merrick, Klevens, and Ports (2017) found that those reporting four or more ACEs were more likely to report high school non-completion. A literature review by Romano, Babchishin, Marquis, and Fr chet te (2015) identified several factors that account for the relationship between childhood maltreatment and poor educational outcome: childhood maltreatment interrupts

normal brain development and can disrupt cognitive processes such as concentration, memory, language, as well as organizational abilities that are required for children to function in school (Eisen, Goodman, Qin, Davis, & Crayton, 2007; Toth & Cicchetti, 2006). In addition, caregivers who are abusive are more likely to be inattentive to their children's academic abilities, interests, and needs. Thus, academic support and encouragement is often lacking (Berridge, 2012; Hattie, 2009). Maltreated children often present with emotional and behavioural problems that may make it challenging to develop and maintain satisfying relationships with peers (Blaustein & Kinniburgh, 2010; Cicchetti & Valentino, 2006). These difficulties have an adverse impact on a variety of academic-related outcomes, including learning delays, lower grades and achievement scores, problems in school engagement, and school dropout (Crozier & Barth, 2005; Kauffman, 2001; Trout, Nordness, Pierce, & Epstein, 2003).

The current study found an association between adverse childhood experiences and mental illnesses. An increased risk of adult mental health problems was observed with each adverse childhood experience reported. Those who experienced one ACE were more likely to be associated with bipolar disorder, OCD and suicidality, while those who experienced three or more ACEs were more likely to be associated with all disorders assessed by CIDI in the current study, i.e., MDD, bipolar, GAD, OCD, alcohol abuse and suicidality. This corresponds to earlier research that has shown a graded relationship between adverse childhood experiences and mental health-related outcomes in adulthood (Anda et al., 2006; Chartier, Walker, & Naimark, 2010). The results also lend support to the cumulative risk hypothesis which posits that the accumulation of risk factors increases the probability of adverse outcomes (Sameroff, 2000).

While a number of specific types of ACEs were associated with mental disorders, we would like to highlight two of them. Emotional neglect was higher than that reported in other studies and was reported more frequently in older age groups. It is possible that parents in 1950s or 1960s in Singapore were busy trying to make ends meet, leading to benign neglect. It could also be a cultural influence of the more reserved (and less emotionally demonstrative) parenting style among the older generation; a cultural norm that has since changed in Asian societies which have become increasingly westernized. Emotional neglect was associated with mood and anxiety disorder, alcohol abuse as well as suicidality. Other studies have similarly found that emotional neglect alone was associated with mental disorders. Using data from the NESARC (2004–2005), Taillieu, Brownridge, Sareen, and Afifi (2016) reported that emotional neglect was associated with mood, anxiety and alcohol use disorders; Jardim et al. (2018) found an association between emotional neglect and suicidality among older adults, while a meta-analysis by Norman et al. (2012) observed statistically significant associations between emotional neglect and depressive disorders and suicidality. Stoltenborgh, Bakermans-Kranenburg, and van Ijzendoorn (2013) have stated that 'neglect seems to be a neglected form of maltreatment in scientific research', and given its association in the current and other studies with adverse outcomes (Jardim et al., 2018; Norman et al., 2012; Taillieu et al., 2016) it needs to be considered as seriously as other forms of ACEs and the need to provide an emotionally secure environment for a child needs to be emphasized.

It is also important to highlight that living with a battered mother/ female guardian was a significant risk factor for mood and anxiety disorders, as well as suicidality. Witnessing violence towards mother/ female guardian has been associated with an increased risk of alcoholism (Dube, Anda, Felitti, Edwards, & Williamson, 2002), illicit drug use (Dube et al., 2003) and depressive disorders (Chapman et al., 2004). Other than the trauma of witnessing interpersonal violence (IPV) itself on the child, studies have shown that the risk of experiencing other ACEs is high in these children (Radford et al., 2011). Women experiencing IPV are more likely to be associated with depression which has been linked to a poorer overall quality of parenting, which in turn is believed to increase the likelihood of distress and internalizing behaviors in children (Levendosky & Graham-Bermann, 2000). These findings underscore the importance of preventing IPV in homes. Primary prevention efforts include parent training and family conflict management training (Schwartz, Hage, Bush, & Burns, 2006), relationship skills training and education about healthy intimate relationships in schools (Coker, 2004). A systematic review by Anderson and van Ee (2018) suggests that tertiary prevention delivered through multi-leveled program of mothers and children working both separately and jointly together across sessions might generate the most successful psychosocial recovery for mothers and children who have experienced violence in the home.

4.1. Limitations

Retrospective reporting of ACEs occurring during childhood by the adult sample in this study may be affected by recall bias or current emotional state. However, retrospective reporting is an accepted method in population studies (Gilbert et al., 2009). In an Asian society, the reporting of ACEs may have been affected by cultural norms – particularly the fear of shame, the fear of “losing face” to oneself and one's family; reporting parental neglect or abuse may also be seen as a violation of filial piety. In the current study, every effort was made to minimize this by ensuring that all literate participants self-administered this questionnaire, and this particular questionnaire was administered at the tail end of the survey to avoid withdrawal from the overall survey. However, a significant number of respondents did not complete the questionnaire ($n = 1685$), which was a result of both respondent refusal and a small group of interviewers not understanding the instructions which resulted in inadvertent non-administration of the questionnaire in the initial phase of the survey ($n = 156$). Our response rate is lower than that reported by Taillieu et al. (2016) from the NESARC of 86.7 %, and similar to that reported by Hughes, Bellis, Hardcastle, Sethi, Butchart, Mikton, Dunne et al. (2017) in the English household survey (53.5 %) and Hauser, Schmutzer, Braehler, and Glaesmer (2011) for the German population survey (56 %). However, we were unable to capture the exact breakdown for the reasons of non-completion. It is possible that those who refused to complete this questionnaire could have experienced more severe abuse, which in turn could have resulted in the low prevalence of sexual abuse in the population.

The severity or duration of abuse was not measured in the current study. More severe or longer-lasting episodes of abuse may be associated with different magnitudes of later life outcomes. Reverse causation i.e., the mental disorder leading to ACEs such as abuse,

interpersonal violence, parental separation etc. caused by parental frustration or distress due to the child's condition is also possible and was not explored in the current study.

Notwithstanding these limitations, this study is one of the few in the extant literature that has examined ACEs in multiethnic Asian populations in a nation-wide survey. Other strengths of the study include the use of structured instruments to assess mental disorders and ACEs, inclusion of people speaking both English and local languages, and stringent quality control measures which ensured collection of high-quality data.

5. Conclusions

Our results suggest that ACEs are not uncommon and there is a need for further research in this area to examine the trends in ACEs in the younger adult segment as well as the impact of cultural and generational influence on ACEs in the local context given their significant association with mental conditions. Prevention and early treatment of ACEs can lead to lowering the prevalence of associated disorders in the community (Asmussen, McBride, & Waddell, 2019). A multi-agency approach should be adopted wherein those involved in children's education, welfare, mental health, substance abuse, and the correctional systems have an awareness of the impact of ACEs on the people they serve. There is also a need to build trauma-informed communities where law enforcement, mental health professionals, child welfare services and community providers need to come together to both prevent ACEs and respond to the service needs of children who have been exposed to ACEs.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.chiabu.2020.104447>.

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