The Association Between Child Abuse and Attempted Suicide

A Retrospective Cohort Study

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Abstract. *Background:* Child abuse and suicide among the young population is a serious and prevalent problem. Many studies have demonstrated that people with adverse childhood experiences, such as child abuse, are likely to develop suicidal behavior. This study evaluates the connection between child abuse and suicidal behavior in the Hong Kong community where incidents of child abuse have been on the rise over the past decade. *Aims:* To determine the association between child abuse and attempted suicide in the child population of Hong Kong using hospital electronic medical records system. *Method:* From January 1, 1995 to July 31, 2016, patients with admission age < 18 years with the diagnosis of child abuse or influenza infection (comparison group) were included in this study ($n = 54,256$). In secondary data analysis, an association was found between children who had experienced child abuse and the outcome measure of hospital admission for attempted suicide compared with influenza infection. *Results:* The adjusted hazard ratio of attempting suicide in children who experienced sexual abuse and physical abuse compared with the influenza-infected group was 6.48 (95% CI [4.56, 9.19]) and 4.83 (95% CI [3.67, 6.34]). The age at onset of adverse incidents was negatively associated with the attempted suicide timing. Female patients had a 1.64 higher risk of repeating attempted suicide. In addition, nearly 5% of children who had experienced child abuse attempted suicide in the 10 years after their admission, and more than 36% of patients had a record of repeated suicide attempt in the 20 years after the initial admission. *Limitations:* The accuracy of the diagnosis, selection bias, insufficiency of study period, Berkson's bias, incomplete socioeconomic status, as well as the absence of psychiatric diagnosis are the limitations. *Conclusion:* Our results indicate that there is a significant association between child abuse and suicide attempts in Hong Kong. If confirmed, the study (a) demonstrates that hospital admission records are a critical source for identifying children with a high risk for suicidal behavior; (b) may inform policy makers that additional and long-term intervention programs should be provided to children so as to reduce subsequent suicide attempts.

Keywords: child abuse, attempted suicide, influenza infection, electronic patient record

It is difficult to identify children with suicidal behaviors, although many risk factors have been reported in previous studies (Afifi et al., 2016; Brausch & Holaday, 2015; Devries et al., 2014; Fang et al., 2015; Martin, Dykxhoorn, Afifi, & Colman, 2016; Qin, Webb, Kapur, & Sorensen, 2013; Rodway et al., 2016). *Child abuse* or *maltreatment* are umbrella terms that can include sexual, physical, and emotional abuse as well as neglect. The World Health Organization (WHO, 2016) listed child abuse as one of the risk factors for suicide attempts. However, scholars find it difficult to predict when children will attempt suicide after being exposed to abuse (Kuramoto, Runeson, Stuart, Lichtenstein, & Wilcox, 2013). The underlying issues that affect the development of child suicidal behaviors are still unclear.

In Canada, the United States, and Australia, researchers demonstrated that child abuse, especially sexual abuse, is related to suicidal behavior (Afifi et al., 2016; Cero & Sifers, 2013; Davies & Jones, 2013; Devries et al., 2014; Martin et al., 2016). Child abuse and suicide among the young population is a prevalent problem. Miller, Esposito-Smythers et al. (2013) also found that child maltreatment is a significant risk factor for suicide attempts in a systematic review.

Child Abuse and Suicide in Hong Kong

In Hong Kong, the Census and Statistics Department (2015b) records show that the incidence of child abuse has been increasing in the past two decades, especially child neglect and sexual abuse. Studies have reported an increase in annual child maltreatment hospitalization rates from 31.0

per 10,000 children in 2001 to 73.4 per 10,000 in 2010 (Ip et al., 2016). There were 589 registered child abuse cases in 2005, which increased to 874 in 2015 (Social Welfare Department, 2015) In Hong Kong, Lo et al. (2018) observed a significant upward trend of child abuse from 2003 to 2010 using health-care and social service databases. The authors also detected a higher prevalence of injury, mental health problems, and suicide attempts among children who had experienced abuse. (Lo et al., 2018).

The present study aimed to investigate the relationship between child abuse and suicide attempts in Hong Kong, and to determine the timing of hospital admissions for attempted suicide after exposure to abuse. Therefore, an appropriate study design was to select patients during the same time period without a history of child abuse, mental disease, and chronic illness (Andrade, Sesso, & Diniz, 2015; Chung, Han, Park, & Kim, 2014; Liu, Yeh, Weng, Bai, & Chang, 2016; Martin et al., 2016) as a comparison group. If we used the aforementioned criteria, then over 80% of the child population in Hong Kong would be included in this study (Census and Statistics Department, 2015b). The sample size would be much larger than the power needed to address the research question. Mental and behavioral problems, as well as injuries and accidents, are associated with child abuse (Lo et al., 2018). Therefore, the study selected a common disease as a comparable group. Influenza infection is a common disease in Hong Kong. Hospital admissions for children with influenza infection without exposure to child abuse and any history of mental illness were selected for the comparison group.

Electronic patient records (EPR) are a reliable data source that allows researchers to utilize the database to conduct surveillance and research (Coleman et al., 2015). Clinicians determine and enter diagnosis codes into the EPR system when a patient is admitted to the hospital. Therefore, the EPR system can reveal an individual's detailed health history and the long-term health consequences.

Research Gaps

The relationship between child abuse and the adverse psychological consequences is well established and accepted by scientists (Norman et al., 2012). Many studies report the association between child maltreatment and adolescent suicidal behavior (Afifi et al., 2016; Devries et al., 2014; Martin et al., 2016). However, almost all of these studies used cross-sectional data with a retrospective report or focus groups to examine the association between child abuse and suicidal behavior. There were limitations in detecting the incidence of child abuse associated with suicidal attempt and the timing for attempted suicide after the adverse incident.

Method

Data Source and Study Design

This study is a retrospective cohort study with data retrieved from the EPR system of Hong Kong's Hospital Authority (HA), which is a territory-wide system that records all public hospital admissions (Man et al., 2017). The target participants were any patients younger than 18 years who were admitted to any public hospital from January 1, 1995, to July 31, 2016 with a diagnosis of child abuse or influenza infection. The data collected were from accident and emergency units, outpatient units, and inpatient records, because all child abuse cases will first appear in these units in the HA system. Data extraction was conducted in two phases. First, the ICD-9 coding was used to select children admitted with child abuse and influenza infection to build the main dataset. The ICD-9 codes for child abuse are 995.5 (child maltreatment syndrome), 995.8 (other specified adverse effects such as injury, untreated illnesses, poor hygiene, etc.), and E967 (perpetrator of child and adult abuse), which refers to being a victim of child abuse by a specific perpetrator (e.g., father, mother, grandparents). Code 487 was used to extract child influenza cases. Information including an individual's gender, race (Chinese or non-Chinese), age at admission, district of residence, perpetrator, along with the database reference identity number, was extracted. Only the first episode of child abuse and influenza infection was kept in the primary record. Any cases that were not captured in the system may be due to misdiagnosis. The clinical data system has been reported as a reliable data source for previous epidemiological studies (Mok, 2011; Yim, Graham, & Rainer, 2009).

In the second step, the individual's record reference number was used to find any reported suicide attempts in the hospital records after the onset of child abuse exposure or influenza admission. The suicide attempts code included ICD-9 code of E950–E959 (suicide/self-inflicted injury), 300.9 suicide attempt and A&E injury traumatic type with self-harm. As part of the study design, those who had a history of suicide attempt before the onset of child abuse or influenza infection were excluded.

Data Analysis

SPSS version 21 software was used to perform the data analysis. Two imputation methods were used for handling missing responses depending on the level of measurement. Hot-deck imputation was used to replace the missing responses for gender and race (Andridge & Little,

Table 1. Demographic characteristics of the study sample

Characteristics	N	%
Groups		
Influenza	42,207	77.8
Child abuse	12,049	22.2
Gender		
Male	28,980	53.4
Female	25,276	46.6
Race		
Chinese	48,525	89.4
Non-Chinese	5,731	10.6
Suicide attempts		
No	53,595	98.8
Yes	661	1.2
Suicide attempts age (years)		
0–10	123	18.6
11–15	202	30.6
16–20	247	37.4
> 20	89	13.5
Abuse type[a]		
Unknown	6,826	57.0
Physical	3,888	32.3
Sexual	1270	10.5
Physical and sexual	65	0.5
Age group (year)[a]		
0 – 5	3348	27.8
6 – 10	4541	37.7
11 – 15	3642	30.2
16 – 18	518	4.3
Perpetrator[a]		
Other relatives/other person	8,526	70.8
Father	2,018	15.7
Mother	1,403	11.6
Father and mother	102	0.9

Note. N = 54,256. [a]Only for the child abuse data (n = 12,049).

2010), and a mean value for the whole group was used to replace continuous missing responses for household income and size. The chi-square test and unpaired *t* test were used to detect significant differences in univariate variables between groups. Cox regression was used for multivariable-adjusted analysis to determine the independent effect of child abuse on suicide attempts. Kaplan–Meier survival analysis and 1-minus survival with log-rank analysis were used to measure the fraction of patients who made suicide attempts after the first hospital admission. Linear regression was used to detect the risk factor for timing of attempted suicide. Logistic regression was used to detect the risk factors for repeated attempted suicide. Subgroup analysis comparing suicide attempts between patients who experienced physical abuse or sexual abuse with influenza groups was conducted to detect the different risk behaviors between these two types of child abuse. Covariates included admission age, average household size, average household income, race, and follow-up time. The household income and household size were based on the population census data (Census and Statistics Department, 2015a).

Results

From January 1, 1995, to July 31, 2016, a total of 54,256 patients were included in this study. Of these, 42,207 (77.8%) were first admitted to the hospital for influenza while 12,049 were first admitted with a diagnosis of child abuse. Among 12,049 cases of child abuse, 6,826 (57.0%) cases did not specify the abuse type, while 3,888 (32.3%) cases were of physical abuse, 1,270 (10.5%) were sexual abuse, and 65 (0.5%) cases were children suffering from both physical and sexual abuse. There were 428 cases of both child abuse and influenza, and these were classified as child abuse (Figure 1). The male-to-female ratio was 1:0.87. The study patients were mainly Chinese (89.4%). The hospital admission records showed that 661 patients had a first suicide attempt after child abuse or influenza hospital admission (Table 1). The mean and standard deviation of the age of the patients at the time of attempted suicide were 14.2 and 6.3 years. After taking into consideration the timeframe of suicide attempts, 83 cases with a controversial sequence of events were removed from the analysis. The resulting dataset contained a total of 54,173 patients, of whom 12,014 had been diagnosed with child abuse and 42,159 with influenza infection (Figure 1).

Data showed an annual increase in first hospital admissions for child abuse and influenza infections in Hong Kong (Figure 2). Hospital admissions showed child abuse cases were at 15.6 per 100,000 in 1995. After reaching a peak at 72.6 cases per 100,000 in 2009, such admissions gradually decreased to 61.9 cases per 100,000 in 2015. Hong Kong suffered from the H1N1 pandemic during 2009, and the severity of the pandemic led to a huge increase of hospitalizations among children (Yang et al., 2012), thus explaining the peak admission rate for influenza in 2009.
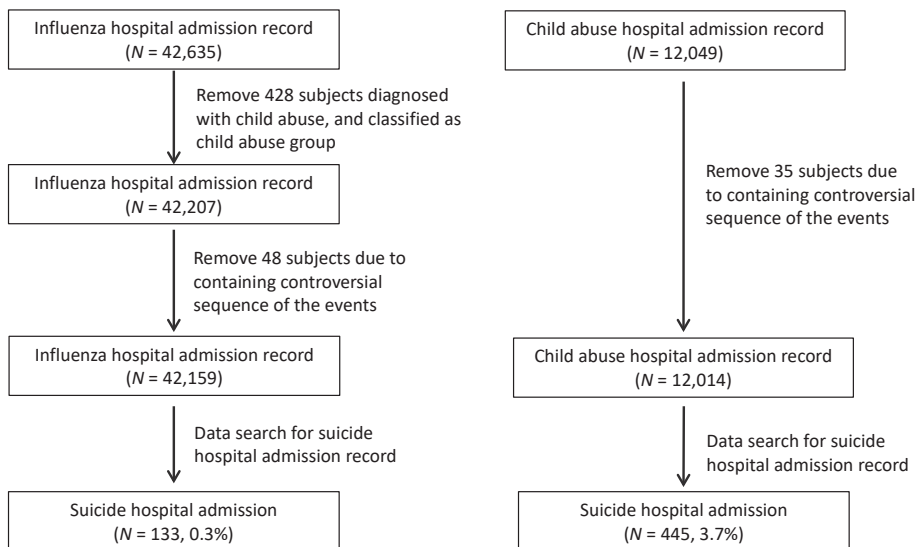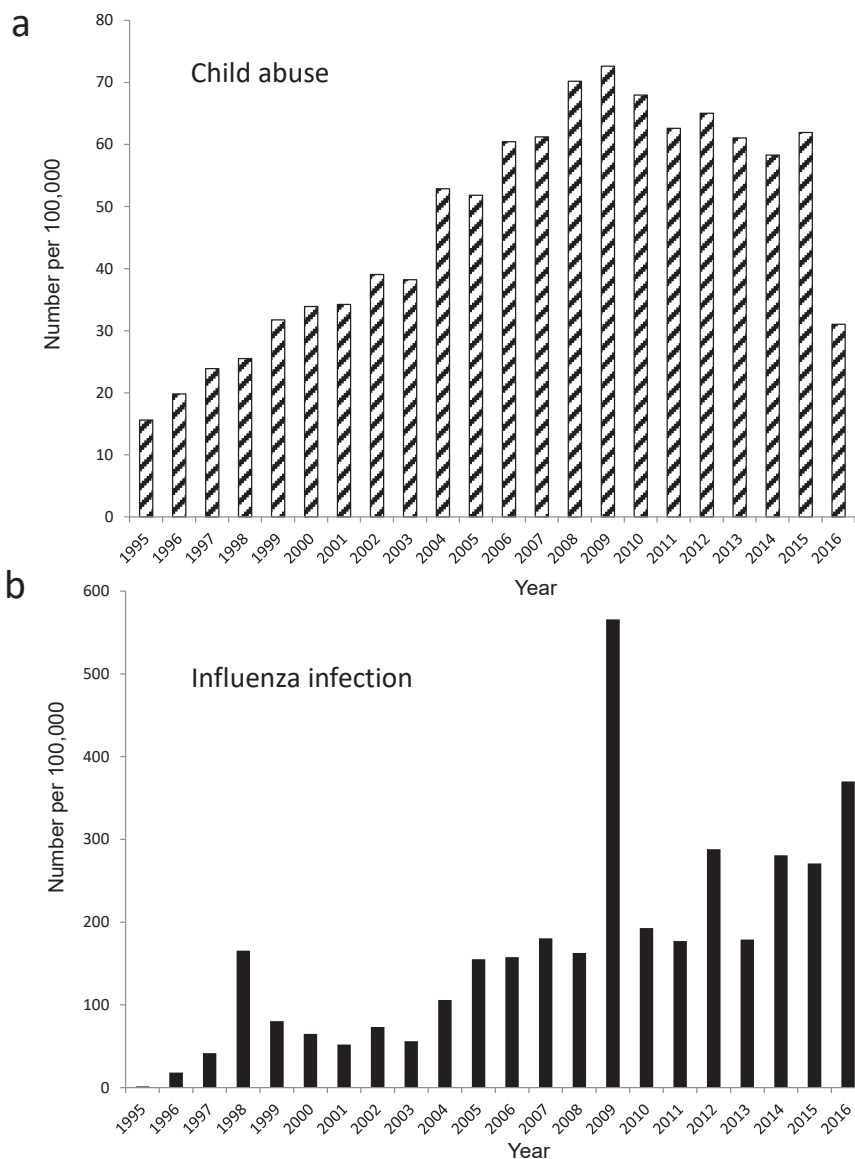
Figure 1. Data retrieval flow diagram.

Figure 2. First hospital admission for (a) child abuse and (b) influenza infection between 1995 and July 2016.

Univariate Analysis of Associations Between Child Abuse and Influenza-Infected Groups With Suicide Attempts

Chi-square tests showed a significant unadjusted association between suicide attempts and child abuse compared with the control group ($p < .001$). More than 3% of the children attempted suicide after being exposed to abuse, while only 0.3% of influenza patients attempted suicide. The odds ratio was 12.2 with a 95% confidence interval (CI) of 10–14.8 (Table 2).

Cox Regression Results Between Child Abuse and Influenza-Infected Groups

Cox regression results indicated that, after controlling for gender, race, admission age, average household size, and average household income, exposure to child abuse was a significant factor affecting the risk of attempted suicide compared with the influenza group. The adjusted hazard ratio (HR) indicated that at any given point in time, children who had experienced child abuse had a 4.79-fold higher risk (95% CI [3.88, 5.92]) of attempting suicide, compared with influenza-infected children ($p < .001$; Table 3). Cox regression results also revealed that, in addition to child abuse, other significant independent risk factors affecting the risk of attempting suicide were gender, race, and admission age (Table 3). There were 428 children diagnosed with both child abuse and influenza and they were grouped as child abuse cases. Sensitivity analysis was performed by excluding children with either diagnosis to confirm the association of child abuse with suicide attempts. The sensitivity analysis results showed a higher adjusted HR for risk suicide attempt of 9.36 (95% CI [7.67, 11.42]) among children who had experienced abuse.

Table 2. Univariate analysis for gender, race, suicide attempts, age of admission, household income, and household size comparing the child abuse and the influenza infected groups

	Child abuse	Influenza infection		
	N (%)/M(SD)	N (%)/M (SD)	p	OR/difference (95% CI)
Gender			< .001	1.36
Female	6,304 (52.5%)	18,923 (44.9%)		(1.30, 1.41)
Male	5,710 (47.5%)	23,236 (55.1%)		
Race			< .001	1.59
Chinese	11,036 (91.9%)	37,411 (88.7%)		(1.48, 1.72)
Non-Chinese	879 (8.1%)	4,748 (11.3%)		
Suicide attempts			< .001	12.2
Yes	445 (3.7%)	133 (0.3%)		(10.0, 14.8)
No	11,569 (96.3%)	42,026 (99.7%)		
Timing of attempted suicide (years)			.001	1.6
Mean (SD)	4.8 (4.7)	6.4 (5.1)		(0.7, 2.6)
Age of admission (years)			< .001	4.2
Mean (SD)	8.3 (4.5)	4.1 (3.9)		(4.1, 4.3)
Household income (HK$)			< .001	1046.8
Mean (SD)	24,427.8 (4190.8)	25,474.6 (23.3)		(955.6, 1138.0)
Household size (no. of persons)			< .001	0.012
Mean (SD)	2.89 (0.132)	2.90 (0.138)		(0.009, 0.015)

Table 3. Cox regression analysis for developing suicidal behavior comparing the child abuse and influenza-infected groups after controlling for others risk factors

Factors	B	SE B	p	Adjusted hazard ratio (AHR)	95% CI for AHR
Whole dataset					
Group (abuse vs. influenza)	1.57	0.11	< .001	4.79	(3.88, 5.92)
Gender: male vs. female	−0.64	0.09	< .001	0.53	(0.44, 0.63)
Race: Non-Chinese vs. Chinese	−0.60	0.22	.006	0.55	(0.36, 0.84)
Age of admission, per year increase	0.15	0.01	< .001	1.16	(1.14, 1.18)
Average household size, per number of person increase	−0.01	0.34	.97	0.99	(0.51, 1.92)
Average household income, per one-dollar increase	0.00	0.00	.31	0.9993	(0.999, 1.0003)
Subgroup analysis					
Group (physical abuse vs. influenza)	1.57	0.14	< .001	4.83	(3.67, 6.34)
Group (sexual abuse vs. influenza)	1.87	0.18	< .001	6.48	(4.56, 9.19)

Table 4. Difference in suicide attempts between child abuse and influenza-infected group

	Abuse group		Influenza inflected group		
Follow-up years	Survival (%)	Reverse survival (%)	Survival (%)	Reverse survival (%)	Log-rank p
5	99.76	0.24	99.81	0.19	< .001
10	95.87	4.13	99.65	0.35	
15	94.33	5.67	99.26	0.74	
20	92.95	7.05	98.97	1.03	

The adjusted HR of physical abuse in comparison with influenza-infected children was 4.83 (95% CI [3.67, 6.34]). The results indicated that the risk of suicide attempts for children who had experienced physical abuse was 4.83 times higher compared with those had influenza. The adjusted HR for suicide attempts in children who had experienced sexual abuse was 6.48 times higher (95% CI [4.56, 9.19]) compared with influenza-infected children (Table 3).

Time Between Adverse Incident to Suicide Attempt in Child Abuse and Influenza–Infected Groups

The result of the Kaplan–Meier analysis showed that more children in the group who had experienced child abuse attempt suicide in the future (Table 4). Nearly 5% of patients attempted suicide within 10 years of admission, and more than 7% of patients attempted suicide within 20 years of admission. The test statistic for the log-rank analysis was 824.5 with a p value of less than .001, indicating that the percentage of suicide attempts among children who had experienced child abuse was significantly higher than the influenza-infected group (p < .001). The Kaplan–Meier results also showed a difference in suicide attempts between the abuse group (0.24%) and influenza-infected group (0.19%; Table 4). The analysis demonstrated that the overall mean and standard deviation of the timing of attempted suicide was 5.2 and 4.9 years, respectively. Further subgroup analysis showed that the mean and standard deviation for child abuse patients was 4.8 and 4.7 years, respectively, which was significantly shorter than influenza-infected patients with 6.4 and 5.1 years, respectively (Table 2). Of the child abuse patients, 38.6% who attempted suicide had a record of repeated suicide attempts, which was also higher than 27.1% in the influenza-infected group. However, after performing linear regression and logistic regression analysis, only the age at onset during the adverse incident was negatively associated with the attempted suicide timing, with an adjusted coefficient of −0.312. The logistic regression also showed that only gender was significantly associated with repeated suicide attempts, with female patients having a 1.64-fold higher risk than their male counterparts.

Discussion

The results of this study indicate that child abuse in Hong Kong is a significant risk factor associated with suicide attempts. Our results are comparable to those reported in studies from other countries. Early life stressors including child abuse is a risk factor associated with adult psychopathological consequences (Koola, Ahmed, Sebastian, & Duncan, 2018; Koola et al., 2013). In addition, our study also found that the highest adjusted HR of suicide attempt was in sexual abuse cases among other types of abuse. A study in Atlanta also showed that the combination of childhood physical and sexual abuse is a significant risk factor for suicidal behavior (Miller, Adams, Esposito-Smythers, Thompson, & Proctor, 2014). An important message from our study is that 4.13% of children who suffered from child abuse had hospital admissions due to suicide attempts within the next 5 years and this reached 7.1% in 20 years. The prevalence rate of suicide attempts among children who had been abused in the current study was 370 per 10,000, which was much higher than the prevalence rate 0.27 per 10,000 seen in 2014 in the healthy population, as estimated by the Hong Kong Council of Social Service in 2014 (Hong Kong Council of Social Service, 2014).

In our study, we demonstrated a higher risk of suicide attempt for children who had experienced child abuse, especially sexual abuse, and also a higher rate of repeated suicide attempts. Therefore, policies should focus on reducing the child abuse rate in Hong Kong and also aim to provide long-term support services for reducing suicide attempts.

Limitations

This study has several limitations. First, the main limitation is the accuracy of the diagnosis, which may result in significant underreporting of child maltreatment cases. The reasons may include heavy workload of clinicians and children not willing to disclose the details during consultation (McElvaney, Greene, & Hogan, 2014). Second, the study may also have selection bias since many minor self-harm cases might not present to public hospitals. Third, the study period was not sufficient to trace back all records and ensure the temporal sequences of the event and outcome. Fourth, there is the possibility of Berkson's bias that more severe cases have a higher chance of being selected for the study. The possible misclassification of child abuse diagnoses should also be mentioned here. Another limitation concerns the use of average household income of the residential area and household size to represent a child's economic status, as the figure may not truly reflect their socioeconomic status (SES) or parental education levels. That is, aggregate-level SES data may not accurately reflect individual-level SES. Also, depression is a psychiatric diagnosis commonly associated with suicide (Zalsman et al., 2016). However, this information was not included in the analysis of this study because it was not available from the hospital admission records. Lastly, the dataset did not contain any information regarding suicide deaths; therefore, the results did not cover the whole spectrum of suicidal behavior and its association with child abuse.

Conclusion

When compared with influenza infection, exposure to child abuse was an independent factor associated with suicide attempts. The risk of suicide attempts was higher in a child who was exposed to abuse than in a child infected by influenza. The results also showed that among children who experienced abuse, those exposed to sexual abuse had a higher hazard ratio of suicide attempts compared with those exposed to physical abuse and infected with influenza. Thus, this group may be the most vulnerable among all children who have experienced child abuse. Another important message of this study concerns the timing of suicide attempts. In a long-term follow-up, a significant difference in suicide attempts between children who had been abused and those who were infected with influenza was found. The percentage of repeated attempted suicide was very high also.

Previous studies that demonstrated an association between child abuse and suicide attempts were mainly cross-sectional surveys (Hu et al., 2015; Kann et al., 2016; Norman et al., 2012; Singh, Manjula, & Philip, 2012; Smith et al., 2016; Yang et al., 2012). Few studies have addressed the timing of attempted suicide after exposure to child abuse (Dunn, McLaughlin, Slopen, Rosand, & Smoller, 2013), or demonstrated that patients' hospital records could be used to address the aforementioned research questions. The ultimate aim of this study is to raise public awareness of issues regarding child abuse. Child abuse can have serious consequences, and may cause children who have experienced abuse to contemplate or attempt suicide. The study results revealed that an association between child abuse and suicide attempts existed among the child population in Hong Kong. Therefore, suicide prevention programs could target patients presenting to hospitals who have been diagnosed as child abuse cases (Farré et al., 2016). Further studies are needed to understand the link between child abuse and suicide attempts and to help develop suitable intervention programs in the

community and to investigate whether they can help reduce child abuse and suicide attempt rates.

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