Linking health care and social service databases to study the epidemiology of child maltreatment and associated health problems: Hong Kong's experience

Camilla Kin-ming LO[a], MSW, Frederick Ka-wing HO[b], PhD, Ko Ling CHAN[c], PhD, Wilfred Hing-sang WONG[b], PhD, Rosa Sze-man WONG[b], MPhil, Chun-bong CHOW[b], MD, Anita Man-ching TSANG[b], MBBS, Winnie Wan-yee TSO[b], MBBS, Patrick IP[b], MPH

Affiliations: [a]Department of Social Work & Social Administration, The University of Hong Kong, Hong Kong; [b]Department of Paediatrics and Adolescent Medicine, LKS Faculty of Medicine, The University of Hong Kong, Hong Kong; [c]Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hong Kong

Address correspondence to: Dr. Patrick Ip, Department of Paediatrics and Adolescent Medicine, The University of Hong Kong, Queen Mary Hospital, Pokfulam Road, Hong Kong, patricip@hku.hk, (852) 2255 4090

Financial Disclosure: The authors have no financial relationships relevant to this article to disclose.

Conflict of Interest: The authors have no conflicts of interest relevant to this article to disclose.

1

Abstract

Objective: To examine the incidence and trend of child maltreatment and its associated health problems in Hong Kong by linking health care and social service databases.

Method: Data on 4,816 children, aged under 18, registered with the Child Protection Registry (CPR) and matching health records in public hospitals in Hong Kong from 2003 to 2010 were extracted. Associations between different types of child maltreatment and child's medical diagnosis according to ICD-10 codes including suicidal attempt (X60-X84), non-child maltreatment related injuries (S00-S99; T00-T98, excluding T74 and T76 that are maltreatment related injuries), mental health problems (F00-F99), and congenital malformations/chromosomal abnormalities (CM/CA; Q00-Q99) were examined.

Results: Significant rising trends were found for child physical abuse, neglect, and sexual abuse during the period from 2003 to 2010. Psychological abuse remained stable. Risk of suicide attempts was higher among children suffering from sexual abuse, psychological abuse, and children experiencing multiple abuse; mental health problems were more common in victims of psychological and multiple abuse. Congenital malformations and chromosomal abnormalities (CM/CA) were more commonly found among neglected children.

Conclusion: In contrast to the decreasing trend observed in the West during the study period, there has been an escalating trend in child maltreatment in Hong Kong and child maltreatment is strongly associated with major health problems. This is one of the first studies to demonstrate the power of linking health care and social service databases, which allows for a better understanding of the impact of child maltreatment. It also helps to guide future policy and service planning.

2

Introduction

Child maltreatment is a global public health problem with long term adverse consequences.[1,2] In order to provide a more accurate estimation of incidence, trends, and impact of child maltreatment, public health surveillance is a crucial first step. Although systematic and routine collection of high quality epidemiological data has been recognized as a key priority in child protection work,[3,4] there has been limited literature addressing such a need.[5] A lack in adequate surveillance has resulted in an impediment to developing appropriate, preventive, and remedial responses to child maltreatment.[6]

In response to the call for more work on epidemiological surveillance, researchers in the West have made more effort to identify trends in child maltreatment based on different sources of administrative data. In the United States, a 55% and 64% decline in substantiated child physical abuse and sexual abuse cases from 1992 to 2014 has been observed, whereas child neglect remained relatively stable.[7] The decreasing trend was then followed by a marked increase in child maltreatment referrals and substantiations from 2012 to 2016.[8] England reported a significant decline in overall child maltreatment hospital admissions from 2005 to 2011, with an exception of a 37% increase specific to infants and children aged one to three years.[9] In contrast, Western Australia observed an increase in child maltreatment hospital admissions of 4.3% annually, from 7 per 100,000 children in 1981 to 13 per 100,000 in 2005.[10] Although child maltreatment is a prevalent problem in China,[11] trends of child maltreatment have rarely been studied. A recent study in Hong Kong reported a worrying trend of child maltreatment hospitalizations with increases from 31 per 100,000 children in 2001 to 73.4 per 100,00 children in 2010.[12] Yet, existing understanding of child maltreatment trends cannot adequately address the deleterious health impact on children exposed to maltreatment. Thorough understanding of the negative health consequences associated with

3

maltreatment is crucial to developing effective procedures to allow for early identification and intervention to reduce health risks among victims. A further step is to improve existing data collection through linking databases involving health care and social services to provide more comprehensive information on the health conditions and socio-demographic characteristics of maltreated children.

Being a special administrative region in China, Hong Kong is influenced by traditional Chinese culture but also has its own autonomous executive, legislation, and jurisdiction that makes it different from other cities and provinces in China. Two major administrative databases that house data on child maltreatment in Hong Kong are the Child Protection Registry (CPR) under the Social Welfare Department and the Clinical Data Analysis and Report System (CDARS) that houses data on hospital utilization of all 42 public hospitals and institutions managed under the Hospital Authority (HA), the only statutory body governing public hospitals in Hong Kong. Public hospitals manage almost all child abuse related hospitalizations and provide approximately 90% of in-patient services in Hong Kong.[13] The private hospitals, which are monitored by the Department of Health in Hong Kong, provide medical service choices for those who can afford them. The private hospitals do not manage child abuse cases and will refer suspected cases to public hospitals for further management. The CPR and CDARS databases are well-established and offer reliable data for studying child maltreatment. Due to the complexity of child maltreatment that cuts across social and health dimensions, linking these two major databases could maximize data utilization and broaden the scope of surveillance by providing reliable information on victims' health conditions including mental health problems, suicide attempts, and congenital diseases, which have been found to be associated with child maltreatment.[14-16] In spite of the potential power of linking different existing databases to study child maltreatment, relevant studies are

still lacking. Only a few studies examine the use of data linkage to study the proportion of maltreatment-related hospital admissions reported to the child protection services.[3,17,18]

This study is among the first to demonstrate cross disciplinary efforts in child maltreatment surveillance by drawing on the CPR and public hospital data. The primary study objective is to identify trends of child maltreatment in Hong Kong from 2003 to 2010. The study also aims to examine the feasibility and usefulness of linking the two databases to examine associations between child maltreatment and health problems, particularly suicide attempts, non-maltreatment related injuries, mental health problems, and congenital diseases.

Methods

Subjects

All child abuse cases registered in the Child Protection Registry (CPR) of the Hong Kong Social Welfare Department (SWD) from 2003 to 2010 were included in this study.

Data sets and study variables

Child Protection Registry

All allegations of child maltreatment were subjected to a social investigation and considered by a multi-disciplinary case conference to be: (1) established child abuse; (2) at risk of abuse; (3) potentially at risk of abuse; and (4) suspected victim of child abuse, based on the Procedural Guide for Handling Child Abuse Cases in Hong Kong (Revised 2007).[19] Cases categorized as established child abuse and at risk/ potentially at risk of abuse were included in this study. The CPR consists of detailed data on socio-demographic characteristics of maltreated children aged under 18 and their abusers. Characteristics of the maltreated

children include age, gender, number of times registered with the CPR, presence of psychological and behavioral problems, problems with school or academic performance, mental illness and disability, and whether the child was an unplanned pregnancy. Characteristics of abusers include age, gender, educational attainment, history of childhood abuse, presence of emotional and psychological problems, mental illness, risk behaviors, and financial difficulties. The CPR also provides data on the types of child maltreatment (physical abuse, psychological abuse, sexual abuse, neglect, and multiple abuse) the victims are exposed to.

Health records

Health records at the individual-level were extracted from the CDARS that houses data on hospital utilization for all 42 public hospitals and institutions in Hong Kong. The child's medical diagnosis according to ICD-10 codes, specifically, suicide attempts (X60-X84), non-child maltreatment related injuries (S00-S99; T00-T98, excluding T74 and T76 that are maltreatment related injuries), mental health problems (F00-F99), and congenital malformations/chromosomal abnormalities (CM/CA; Q00-Q99) were retrieved. The CDARS is reported to be a reliable data source by previous epidemiological studies.[20,21]

Data linkage

The records in the CPR were matched with the health data from the CDARS. In order to ensure high quality data linkage without compromising confidentiality, a de-linked identifier method was used.[18,22] This was achieved by giving the SWD retrieved data from the CPR for the period of 2003 to 2010 linked to provided cases' partial Hong Kong Identity (HKID) card numbers, to the HA information technology team for conversion into a unique reference key for each of them. The reference keys were then sent back to the SWD, which could then

provide details of the CPR data (without personal identifiers), matched with the unique

reference keys, to the university research team. Subsequently, the university research team

retrieved medical and health profiles for all the cases by matching the unique reference key

and conducting analysis on the data obtained from both databases.

Statistical analyses

For the descriptive analyses, characteristics of victims and abusers across various types of

child maltreatment were compared using Fisher's exact test and the ANOVA F-test. Annual

incidence rates were calculated by dividing the annual number of CPR registrations by the

total child population in the corresponding calendar year. We also stratified the annual

incidence by age group and gender by dividing the annual number of child maltreatment

registrations with CPR by the age- and gender-specific populations in the same respective

year. Children were stratified into three age groups corresponding to the different educational

stages in Hong Kong: 0 – <6 years (preschool), 6 – <12 years (primary school), and 12 – <18

years (secondary school). All population statistics were retrieved from the Population Census,

Population By-census, and General Household Surveys of the Hong Kong Census and

Statistics Department.[23-25] Annual percentage increases were calculated by assuming

compound growth across the 8 years. Linear trends were examined by using linear regression

models. P-values of the linear trends were controlled using the Holm's Bonferroni procedure

to adjust for multiple statistical testing.[26] Prevalence of health problems were estimated by

dividing the number of patients aged below the age of 19 with the particular diagnoses in the

HA database by the number of residents aged below the age of 19 in Hong Kong. These

figures were computed separately for children registered in the CPR (child maltreatment

victims) and the others. The association between child maltreatment and health problems

were quantified using relative risk (RR), the prevalence ratio between victims and

non-victims. For all analyses, a two-sided p-value less than 0.05 was considered significant.

All analyses were conducted using R statistical software version 3.1.5.

Ethics approval

The study was approved by the Institutional Review Board of The University of Hong

Kong/Hospital Authority Hong Kong West Cluster.

<div align="center">

Results

</div>

Characteristics of the victims and abusers

Records for a total of 4,816 victims and 4,868 abusers were retrieved from the CPR and the

characteristics are summarized in Table 1. The mean age of victims was 9.8 years (SD = 4.47)

and 58.04% of the victims were female. Of the victims, 9.28% had multiple registrations with

the CPR. According to the Fisher's exact test (p < 0.0001), child neglect and multiple abuse

were more related to multiple CPR registrations. Other characteristics of victims such as

behavioral problems, emotional/psychological problems, and mental illness were largely

similar across different types of child maltreatment, as indicated by the non-significant

Fisher's exact tests.

The mean age of the abusers was 38.52 years (SD = 12.05) and 61.26% were male. A

stronger association was found between emotional/ psychological problems of abusers and

child neglect, as shown by the Fisher's exact test (p = 0.03). Although other characteristics of

abusers did not show a significant relationship with type of abuse, it is noteworthy that most

abusers (66.6%) had Secondary 3 education (equivalent to Grade 9) or below, 33.55% had a

history of childhood abuse, and 8.13% had a mental illness.

Trends of child maltreatment

As illustrated in Figure 1, there has been an upsurge in annual incidences of overall child maltreatment, which has increased from 20 per 100,000 children in 2003 to 73.89 per 100,000 children in 2010, with a yearly increase of 17.75% (p = 0.0004). Specific trend patterns varied across types of maltreatment, as shown in Table 2. There has been a striking increase in incidences of sexual abuse, up by 23.57% annually (p < 0.0001), from 4.64 per 100,000 children in 2003 to 25.21 per 100,000 children in 2010. Annual incidences of child physical abuse tripled from 11.01 per 100,000 children in 2003 to 35.03 in 2010, with a yearly increase of 15.56% (p = 0.007). Incidences of child neglect increased four-fold from 2.1 per 100,000 children in 2003 to 8.74 per 100,000 children in 2010, with an annual increase of 19.50% (p = 0.03). Psychological abuse and multiple abuse, however, remained stable during the study period. The trends also reveal a substantial increase in incidences of child maltreatment in the 12-18 year age group, with an annual increase of 64.91% (p = 0.0001) for child sexual abuse, 43.97% (p = 0.002) for child neglect, and 27.27% (p = 0.002) for physical abuse. Gender-specific trends show the highest percentage increase in psychological abuse (25.97%, p = 0.03) and sexual abuse (24.78%, p = 0.0001) among females, and in child neglect among males (23.62%, p = 0.001).

Associations between child maltreatment and health problems

Victims of child maltreatment were at much higher risk of key health problems (Table 3). Their relative risk for having an injury (non-maltreatment related), mental health problems, and suicide attempts were 4.12, 7.65, and 95.56 respectively. The prevalence of attempted suicide for abused children was 1.64%, compared to only 0.02% in the general population. Looking more closely, suicide attempts were more common among children suffering from multiple abuse (2.87%), sexual abuse (2.77%), and psychological abuse (2.44%). The

prevalence of non-maltreatment related injuries was 13.12% for victims, which was much higher than for non-victims (3.2%). Injury was particularly common among victims of neglect (16.98%). Among the neglected children, the prevalence of injuries was 22.6%, 16.5%, and 13.5% for preschoolers (0 – <6 years), primary school students (6 – <12 years) and secondary school students (12 – <18 years) respectively, showing a negative association between age and non-maltreatment related injuries (Spearman's r = -0.10, p=0.02). The prevalence of child maltreatment victims suffering from mental illness and CM/CA was 9.07% and 3.82% respectively, while the prevalence was 1.2% and 1.3% for non-victims. Prevalence of mental health problems were higher in children who had been psychologically abused (10.98%) and had experienced multiple abuse (11.07%). In addition, CM/CA was particularly common among victims of neglect, with a prevalence of 7.45%.

Discussion

This study is among the first to demonstrate the feasibility and power of linking population-based databases to provide a comprehensive picture on the epidemiology and impact of child maltreatment. This method of linking databases could help guide future service planning and policy making. The databases from health care and social service sectors had highly complementary data fields that made the integration feasible. By matching the records, trends of child maltreatment over time were examined and the detailed health problems of victims suffering from different types of child maltreatment and the socio-demographic backgrounds of these families could be identified.

It is alarming to find a much higher prevalence of suicide attempts among victims of child maltreatment, particularly those suffering from sexual abuse and psychological abuse. This

observation is consistent with a previous review showing evidence of the link between child maltreatment and suicide attempts and suggesting that sexual abuse and psychological abuse may be more important in explaining suicidal behavior than physical abuse and neglect.[27] Children suffering from psychological and sexual abuse are more likely to have lower self-esteem, higher levels of depression, and a greater sense of helplessness,[28,29] which contribute to the risk of suicide attempts. Close monitoring and ongoing assessment of suicidal risk of victims, especially these two forms of maltreatment, is warranted. In addition, the strong association between injury and child maltreatment, particularly child neglect, suggests that frontline professionals should conduct child maltreatment screening for children presenting to health care services for suspicious injury incidents. Further, consistent with the literature showing that children with disabilities are more vulnerable to experiencing child maltreatment,[30,31] this study suggests children with congenital malformations/chromosomal abnormalities are at risk of maltreatment, especially child neglect. Caring for children with congenital diseases can be demanding and stressful,[32] providing caregivers with adequate support and education about the disease course may help to reduce their stress and prevent occurrences of child maltreatment. Moreover, 9.07% of the victims in this study suffered from mental health problems. Although the strong association between child maltreatment and mental health problems has been well-established in the adult population,[33,34] there has been limited literature addressing such a link among children and adolescents, using population-based data. This finding highlights the urgent need to improve mental health services for child maltreatment victims.

Despite relatively stable or decreasing trends in child maltreatment observed in many Western countries during the study period, an alarming increasing trend was found in Hong Kong. The overall trend of child maltreatment echoes previous evidence of increased child

maltreatment hospitalizations in Hong Kong in the past decade.[12] A notable increase in child sexual abuse, physical abuse, and neglect during the period between 2003 and 2010 was found. Psychological abuse remained relatively stable during the study period. The increasing trend may be explained by increased public awareness of the child maltreatment issue. Also, the dissemination of the revised version of the procedural guidelines for handling cases at risk of child maltreatment by the Social Welfare Department in 2007[19] may have contributed to an increase in reporting of child maltreatment cases, hence an increased incidence. Although the global economic downturn that began at the end of 2007 did not appear to have impacted on the child maltreatment rates in the U.S.,[7] it may have contributed to the worsening child maltreatment incidence rates in Hong Kong. Financial difficulty is associated with increased parental stress, which increases the likelihood of harsh disciplinary practices.[35,36] The stability of psychological abuse incidences may be explained by the identification difficulty, as psychological abuse does not leave visible wounds on victims. Further exploration to improve the identification and reporting system for psychological abuse is necessary.

Meanwhile, the socio-demographic profiles of families affected by child maltreatment showed that emotional/ psychological problems commonly occurred among the abusers, particularly in the child neglect group. Emotional and psychological problems may have impaired parents' sensitivity to environmental and child cues[37] and impeded parents' capacity to provide adequate care and protection for their children,[38] hence elevating the risk of child neglect. Consistent with the wealth of literature documenting intergenerational continuity of child maltreatment,[39,40] a large proportion of abusers in this study experienced childhood abuse. Individuals with a history of childhood abuse are often characterized by emotional insecurity that will affect their sensitivity to a child's needs.[41] Intervention, helping these individuals establish stable and nurturing relationships with significant others can help break

the cycle of maltreatment.[42,43] Moreover, it is worth noting that 9.8% of all cases had multiple registrations with the CPR and were particularly common among neglected children (20.8%). This finding is consistent with the literature showing maltreated children, especially those who have been neglected, are at heightened risk of subsequent maltreatment.[44,45] More attention and care for these children is needed as re-occurrences of maltreatment has a higher level of harm on victims.[46]

Implications

The serious health impacts on children exposed to maltreatment call for more intensive efforts in epidemiological monitoring of this issue. Child abuse related services and prevention planning can be improved through linking health and social service databases. Given the strengths of administrative data linkages including more objective measures, population-wide samples, continuous data collection, and relatively low expense,[18] it opens up possibilities for further study and surveillance tracking of child maltreatment victims' long-term health and social outcomes. The possibility of further broadening the scope of data to include other relevant databases is worth considering if protection of privacy, database accessibility, and security of data transfer can be carefully handled.

In terms of case management, cases registered with the child protection service could be linked in the hospital clinical management alert system to increase the awareness of health care professionals in managing at-risk children. Data sharing between health and social service departments will facilitate cross-disciplinary collaboration for better case management and monitoring of victims' health and social risks, especially for victims who suffer from mental health problems or are at-risk of attempting suicide. Such collaboration

and close communication between departments would allow earlier detection and more timely and adequate intervention to prevent any further harm to maltreated children.

Finally, child maltreatment prevention should take a broader perspective to enhance the overall well-being of the family by providing support to parents who are challenged by a variety of conditions that may elevate parenting stress. In addition, caring for children with mental health problems and congenital diseases could be difficult for caregivers, and more supportive services and education is needed for these families.

Limitations

Despite the robust methodology and linked data used in this study, some caveats needed to be considered when interpreting the results. First, the present study does not provide a direct investigation to verify our speculations that increased public awareness, increased reporting, and economic crisis may have contributed to the increasing trends in child maltreatment incidences. Second, the high rates of health problems found among child abuse victims could be related to factors other than child maltreatment, hence causal relationships could not be confirmed by this study. Third, this study is confined to child maltreatment cases registered with the CPR and may have underestimated the true incidence rate, as many child maltreatment incidents are unknown to authorities or are not severe enough to bring them to the attention of child protection services. However, studying victims captured by the CPR is important as they represent the most high-risk group that requires social and health care attention and continuing care. Also, the use of administrative records provides increased hard data that can help to minimize reporting biases found in studies using self-report and informant-report strategies.

Conclusion

This study demonstrated the use of linked administrative data from the child protection

services and health care systems to produce a powerful resource of data for child

maltreatment research. Using this method, we identified increasing trends of child

maltreatment in Hong Kong and high occurrences of health problems in maltreated children.

CONTRIBUTORS

CKML interpreted the data and drafted the manuscript. FKWH analyzed and interpreted the

data and drafted the manuscript. KLC assisted in study design, interpreted the data, and

critically revised the manuscript. WHSW assisted study design, collected and analyzed the

data, and critically revised the manuscript. RSMW, AMCT and WT interpreted the data and

critically revised the manuscript. CBC assisted in study conceptualization, interpreted the

data, and critically revised the manuscript. PI conceptualized and designed the study,

interpreted the data, and critically revised the manuscript. All authors approved the final

manuscript as submitted. FKWH is the co-first author and KLC is the co-corresponding

author for this paper.

REFERENCES

1.   Ip P, Wong RS, Li SL, Chan KL, Ho FK, Chow CB. Mental health consequences of

       childhood physical abuse in Chinese populations A meta-analysis. *Trauma Violence*

Abuse. 2015;17(5):571-584.

2. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. *PLOS Med.* 2012;9(11):e1001349.

3. O'Donnell M, Nassar N, Jacoby P, Stanley F. Western Australian Emergency Department presentations related to child maltreatment and intentional injury: Population level study utilising linked Health and Child Protection data. *J Paediatr Child Health.* 2012;48(1):57-65.

4. Gilbert R, Fluke J, O'Donnell M, et al. Child maltreatment: variation in trends and policies in six developed countries. *Lancet.* 2012;379(9817):758-772.

5. Finkelhor D, Shattuck A, Turner HA, Hamby SL. Trends in children's exposure to violence, 2003 to 2011. *JAMA Pediatrics.* 2014;168(6):540-546.

6. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *Lancet.* 2002;360(9339):1083-1088.

7. Finkelhor D, Saito K, Jones L. *Updated Trends in Child Maltreatment, 2014.* Durham, NH: Crimes against Children Research Center.; 2016.

8. U.S. Department of Health & Human Services. *Child Maltreatment 2016.* Washington, D.C.: U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's

Bureau; 2018.

9. Gonzalez-Izquierdo A, Cortina-Borja M, Woodman J, et al. Maltreatment or violence-related injury in children and adolescents admitted to the NHS: comparison of trends in England and Scotland between 2005 and 2011. *BMJ Open.* 2014;4(4):e004474.

10. O'Donnell M, Nassar N, Leonard H, Mathews R, Patterson Y, Stanley F. Monitoring child abuse and neglect at a population level: patterns of hospital admissions for maltreatment and assault. *Child Abuse Negl.* 2010;34(11):823-832.

11. Chan KL, Yan E, Brownridge DA, Ip P. Associating child sexual abuse with child victimization in China. *J Pediatr.* 2013;162(5):1028-1034.

12. Ip P, Ho FKW, Chan KL, et al. Child maltreatment hospitalisations in Hong Kong: incidence rate and seasonal pattern. *Arch Dis Child.* 2016;101(12):1107-1113.

13. Kong X, Yang Y, Gao J, et al. Overview of the health care system in Hong Kong and its referential significance to mainland China. *J Chin Med Assoc.* 2015;78(10):569-573.

14. Maniglio R. The role of child sexual abuse in the etiology of suicide and non-suicidal self-injury. *Acta Psychiatrica Scandinavica.* 2011;124(1):30–41.

15. Maniglio R. Child sexual abuse in the etiology of anxiety disorders: A systematic review of reviews. *Trauma Violence Abuse.* 2013;14(2):96-112.

16. Lindert J, von Ehrenstein OS, Grashow R, Gal G, Braehler E, Weisskopf MG. Sexual and physical abuse in childhood is associated with depression and anxiety over the life course: systematic review and meta-analysis. *Int J Public Health.* 2014;59(2):359-372.

17. Spivey MI, Schnitzer PG, Kruse RL, Slusher P, Jaffe DM. Association of injury visits in children and child maltreatment reports. *J Emerg Med.* 2009;36(2):207-214.

18. Brownell MD, Jutte DP. Administrative data linkage as a tool for child maltreatment research. *Child Abuse Negl.* 2013;37(2):120-124.

19. Social Welfare Department of the HKSAR Government. *Procedural Guide for Handling Child Abuse Cases Revised 2007.* Hong Kong: Social Welfare Department of the HKSAR Government. 2007.

20. Yim VW, Graham CA, Rainer TH. A comparison of emergency department utilization by elderly and younger adult patients presenting to three hospitals in Hong Kong. *Int J Emerg Med.* 2009;2(1):19-24.

21. Mok C. Epidemiology and survival of systemic lupus erythematosus in Hong Kong Chinese. *Lupus.* 2011;20(7):767-771.

22. Roos LL, Brownell M, Lix L, Roos NP, Wald R, MacWilliam L. From health research to social research: privacy, methods, approaches. *Social Science & Medicine.* 2008;66(1):117-129.

23. Census and Statistics Department of the HKSAR Government. *Hong Kong 2001 Population Census - Main Report - Volume I.* Hong Kong: Census and Statistics Department of the HKSAR Government. 2002.

24. Census and Statistics Department of the HKSAR Government. *Hong Kong 2006 Population By-census - Summary Results.* Hong Kong: Census and Statistics Department of the HKSAR Government. 2007.

25. Census and Statistics Department of the HKSAR Government. *The Profile of Hong Kong Population Analysed by District Council District.* Hong Kong: Census and Statistics Department of the HKSAR Government. 2001-2010.

26. Aickin M, Gensler H. Adjusting for multiple testing when reporting research results: the Bonferroni vs Holm methods. *Am J Public Health.* 1996;86(5):726-728.

27. Miller AB, Esposito-Smythers C, Weismoore JT, Renshaw KD. The Relation Between Child Maltreatment and Adolescent Suicidal Behavior: A Systematic Review and Critical Examination of the Literature. *Clinical Child and Family Psychology Review.* 2013;16(2):146-172.

28. Al-Fayez GA, Ohaeri JU, Gado OM. Prevalence of physical, psychological, and sexual abuse among a nationwide sample of Arab high school students: association with family characteristics, anxiety, depression, self-esteem, and quality of life. *Soc Psychiatry Psychiatr Epidemiol.* 2012;47(1):53-66.

29. Meadows LA, Kaslow NJ. Hopelessness as mediator of the link between reports of a history of child maltreatment and suicidality in African American women. *Cognit Ther Res.* 2002;26(5):657-674.

30. Jones L, Bellis MA, Wood S, et al. Prevalence and risk of violence against children with disabilities: a systematic review and meta-analysis of observational studies. *The Lancet.* 2012;380(9845):899-907.

31. Chan KL, Emery CR, Ip P. Children With Disability Are More at Risk of Violence Victimization Evidence From a Study of School-Aged Chinese Children. *J Interpers Violence.* 2016;31(6):1026-1046.

32. Fonseca A, Nazaré B, Canavarro MC. Parenting an infant with a congenital anomaly: How are perceived burden and perceived personal benefits related to parenting stress? *J Clin Psychol Med Settings.* 2015;22(1):64-76.

33. Afifi TO, MacMillan HL, Boyle M, Taillieu T, Cheung K, Sareen J. Child abuse and mental disorders in Canada. *Canadian Medical Association Journal.* 2014;186(9):324-332.

34. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The Long-Term Health Consequences of Child Physical Abuse, Emotional Abuse, and Neglect: A Systematic Review and Meta-Analysis. *PLOS Medicine.* 2012;9(11):e1001349.

35. Chan KL. Child victims and poly-victims in China: Are they more at-risk of family

violence? *Child Abuse Negl.* 2014;38(11):1832-1839.

36.   Garbarino J. Socioeconomic forces and the problem of counting in understanding child abuse and neglect: Commentary on "The great recession and the risk for child maltreatment". *Child Abuse Negl.* 2013;37(10):730-734.

37.   Mayes L, Truman S. Substance abuse and parenting. *Handbook of parenting.* Vol 4. Mahwah, NJ: Lawrence Erlbaum Associates, Inc. 2002:329-359.

38.   Widom CS, Hiller-Sturmhofel S. Alcohol abuse as a risk factor for and consequence of child abuse. *Alcohol Res Health.* 2001;25(1):52-52.

39.   Kwako LE, Noll JG, Putnam FW, Trickett PK. Childhood sexual abuse and attachment: An intergenerational perspective. *Clinical Child Psychology and Psychiatry.* 2010;15(3):407-422.

40.   Oliver JE. Intergenerational transmission of child abuse: rates, research, and clinical implications. *Am J Psychiatry.* 1993;150(9):1315-1324.

41.   Lindhiem O, Bernard K, Dozier M. Maternal sensitivity: Within-person variability and the utility of multiple assessments. *Child Maltreat.* 2010;16(1):41-50.

42.   Schofield TJ, Lee RD, Merrick MT. Safe, stable, nurturing relationships as a moderator of intergenerational continuity of child maltreatment: a meta-analysis. *The Journal of Adolescent Health.* 2013;53(4 Suppl):S32-S38.

43.   Centers for Disease Control Prevention. *Promoting safe, stable, and nurturing*

relationships: A strategic direction for child maltreatment prevention. Atlanta, GA: Centers for Disease Control and Prevention, National Center on Injury Prevention and Control. 2014.

44. Finkelhor D, Ormrod RK, Turner HA. Re-victimization patterns in a national longitudinal sample of children and youth. *Child Abuse Negl.* 2007;31(5):479-502.

45. Hindley N, Ramchandani PG, Jones DP. Risk factors for recurrence of maltreatment: a systematic review. *Archives of Disease in Childhood.* 2006;91(9):744-752.

46. Finkelhor D, Ormrod RK, Turner HA. Poly-victimization: A neglected component in child victimization. *Child Abuse Negl.* 2007;31(1):7-26.

Table 1. Characteristics of victims and abusers in CPR by type of maltreatment

	Physical abuse	Child neglect	Sexual abuse	Psychological abuse	Multiple abuse	Overall	*p*-value
Characteristics of victims (n=4816)							
Mean age (SD)	9.8 (4.46)	10.07 (4.74)	9.8 (4.42)	9.61 (4.06)	9.4 (4.42)	9.8 (4.47)	0.33
Gender							< 0.0001
Female	1201 (46.88)	209 (43.91)	1214 (84.25)	42 (50.6)	129 (50.79)	2795 (58.04)	
Male	1361 (53.12)	267 (56.09)	227 (15.75)	41 (49.4)	125 (49.21)	2021 (41.96)	
No. of registrations with SWD							< 0.0001
1	2383 (93.01)	377 (79.2)	1348 (93.55)	73 (87.95)	188 (74.02)	4369 (90.72)	
2	163 (6.36)	92 (19.33)	76 (5.27)	7 (8.43)	51 (20.08)	389 (8.08)	
3 or more	16 (0.62)	7 (1.47)	17 (1.18)	3 (3.61)	15 (5.91)	58 (1.2)	
School performance issues	504 (19.67)	94 (19.75)	266 (18.46)	19 (22.89)	49 (19.29)	932 (19.35)	0.78
Behavioural problems	1063 (41.49)	204 (42.86)	562 (39)	36 (43.37)	96 (37.8)	1961 (40.72)	0.34
Emotional/psychological problems	255 (9.95)	56 (11.76)	158 (10.96)	5 (6.02)	23 (9.06)	497 (10.32)	0.41
Record of mental illness	137 (5.35)	28 (5.88)	81 (5.62)	5 (6.02)	7 (2.76)	258 (5.36)	0.39
Illness/disability	29 (1.13)	4 (0.84)	11 (0.76)	1 (1.2)	2 (0.79)	47 (0.98)	0.75
Unplanned child	24 (0.94)	5 (1.05)	15 (1.04)	2 (2.41)	5 (1.97)	51 (1.06)	0.31
Characteristics of abusers (n=4868)							
Mean age (SD) (n=3359)	38.51 (11.84)	38.7 (12.58)	38.46 (12.09)	38.21 (12.54)	38.38 (12.72)	38.5 (12.06)	0.84
Gender (n=4695)							0.16
Female	987 (40.11)	184 (34.85)	518 (38.6)	30 (35.71)	100 (35.71)	1819 (38.74)	
Male	1474 (59.89)	344 (65.15)	824 (61.4)	54 (64.29)	180 (64.29)	2876 (61.26)	
Highest education level (n=3162)							0.47
No schooling / below primary	71 (4.27)	12 (3.49)	39 (4.29)	2 (3.77)	8 (4.17)	132 (4.17)	
Primary (grades 1–6)	404 (24.29)	93 (27.03)	229 (25.16)	13 (24.53)	48 (25)	787 (24.89)	
Lower secondary (grades 7–9)	620 (37.28)	128 (37.21)	349 (38.35)	23 (43.4)	67 (34.9)	1187 (37.54)	
Upper secondary (grades 10–11)	399 (23.99)	74 (21.51)	215 (23.63)	5 (9.43)	47 (24.48)	740 (23.4)	
Matriculation (grades 12–13)	63 (3.79)	14 (4.07)	21 (2.31)	2 (3.77)	9 (4.69)	109 (3.45)	
Post-secondary / Tertiary	106 (6.37)	23 (6.69)	57 (6.26)	8 (15.09)	13 (6.77)	207 (6.55)	
Record of being abused in childhood (n=4868)	211 (35.28)	44 (36.67)	82 (28.37)	8 (30.77)	24 (35.82)	369 (33.55)	0.28
Emotional/psychological problems (n=4868)	731 (28.66)	174 (32.16)	369 (26.36)	17 (19.54)	75 (25.95)	1366 (28.06)	0.03
Record of mental illness (n=4868)	207 (8.11)	44 (8.13)	115 (8.21)	7 (8.05)	23 (7.96)	396 (8.13)	0.99
Undesirable activities[1] (n=4868)	29 (1.14)	7 (1.29)	18 (1.29)	1 (1.15)	1 (0.35)	56 (1.15)	0.70
Financial difficulties (n=4868)	451 (17.68)	75 (13.86)	235 (16.79)	16 (18.39)	48 (16.61)	825 (16.95)	0.29

[1]Undesirable activities included gambling, alcohol abuse, substance abuse, etc.

Table 2. Annual incidence rate of child maltreatment (per 100,000) by type of child maltreatment, gender, and age group over the period of 2003 to 2010

| | Annual incidence rate (per 100,000) | | | | | | | | Summary statistics | | |
	2003	2004	2005	2006	2007	2008	2009	2010	8-year average	Annual percentage increase (%)	*p*-value for linear trend
All maltreatment											
All children	20.00	29.97	40.45	47.93	62.00	62.32	73.07	73.89	51.20	17.75	0.0004
Gender											
Female	23.10	30.86	45.89	57.42	74.49	75.36	90.59	95.89	61.70	19.47	0.0001
Male	17.07	29.13	35.27	38.98	50.28	50.11	56.64	53.23	41.34	15.28	0.007
Age											
0–<6 years	30.62	39.83	38.67	60.02	61.29	47.74	62.00	59.21	49.92	8.59	0.22
6–<12 years	30.30	42.46	61.75	60.36	78.35	80.90	85.85	84.68	65.58	13.71	0.01
12–<18 years	6.62	15.74	25.68	33.93	51.41	57.18	70.66	75.05	42.03	35.46	< 0.0001
Child Physical Abuse											
All children	11.01	19.83	21.52	23.62	32.92	32.52	37.03	35.03	26.68	15.56	0.007
Gender											
Female	11.03	18.24	19.83	22.33	31.58	32.56	35.11	36.95	25.95	16.31	0.001
Male	11.00	21.34	23.12	24.83	34.18	32.48	38.82	33.23	27.38	14.82	0.032
Age											
0–<6 years	18.30	24.81	18.43	27.79	32.54	26.07	33.36	30.64	26.49	6.65	0.25
6–<12 years	14.31	27.73	32.35	28.50	41.03	40.58	41.36	42.34	33.53	14.52	0.04
12–<18 years	4.80	11.43	15.01	18.37	27.68	30.34	36.17	33.03	22.10	27.27	0.002
Child Neglect											
All children	2.10	1.92	2.89	6.27	8.15	7.27	7.39	8.74	5.59	19.50	0.03
Gender											
Female	2.38	0.76	2.19	6.54	9.23	6.11	7.12	7.39	5.22	15.19	0.25
Male	1.83	3.03	3.56	6.02	7.14	8.35	7.64	10.00	5.95	23.62	0.001
Age											
0–<6 years	3.66	1.75	2.17	10.74	7.19	3.67	4.71	7.23	5.14	8.88	1.00
6–<12 years	3.16	3.68	5.01	5.03	10.87	11.07	8.84	9.31	7.12	14.48	0.14
12–<18 years	0.50	0.66	1.67	5.13	6.76	6.50	7.78	9.16	4.77	43.97	0.002
Child Sexual Abuse											
All children	4.64	5.77	11.56	13.70	16.70	18.93	24.06	25.21	15.07	23.57	< 0.0001
Gender											
Female	7.75	9.12	19.36	23.60	29.15	32.39	43.26	45.54	26.27	24.78	0.0001
Male	1.69	2.60	4.15	4.36	5.01	6.34	6.05	6.13	4.54	17.45	0.007
Age											
0–<6 years	5.66	10.13	12.65	15.93	18.16	15.42	18.85	18.24	14.38	15.76	0.04
6–<12 years	9.26	7.15	17.32	20.84	21.75	23.72	30.52	27.93	19.81	14.80	0.01

12–<18 years	0.50	2.65	6.84	7.78	12.69	17.50	22.65	27.15	12.22	64.91	0.0001
Child Psychological Abuse											
All children	0.36	0.07	1.06	1.08	1.33	1.04	1.15	1.25	0.92	16.72	0.27
Gender											
Female	0.30	0.15	0.62	0.96	1.62	1.16	1.36	1.89	1.01	25.97	0.03
Male	0.42	0.00	1.48	1.20	1.06	0.93	0.95	0.65	0.84	5.42	1.00
Age											
0–<6 years	0.67	0.00	1.81	1.11	1.14	0.73	1.09	0.34	0.86	-7.91	1.00
6–<12 years	0.63	0.00	1.37	1.68	1.48	2.11	1.14	1.80	1.28	14.01	0.50
12–<18 years	0.00	0.17	0.50	0.66	1.32	0.50	1.18	1.38	0.71	30.38	0.10
Child Multiple Abuse											
All children	1.88	2.37	3.42	3.25	2.90	2.56	3.45	3.66	2.94	8.66	0.47
Gender											
Female	1.64	2.58	3.90	3.99	2.91	3.14	3.73	4.12	3.25	12.22	0.50
Male	2.12	2.16	2.96	2.56	2.89	2.01	3.18	3.23	2.64	5.42	0.65
Age											
0–<6 years	2.33	3.14	3.61	4.45	2.27	1.84	3.99	2.75	3.05	2.11	1.00
6–<12 years	2.95	3.90	5.70	4.31	3.21	3.43	3.99	3.30	3.85	1.44	1.00
12–<18 years	0.83	0.83	1.67	1.99	2.97	2.33	2.87	4.32	2.23	22.96	0.01

Table 3. Association between child maltreatment and health problems

	Injury[a]	Mental health problems	Suicidal attempt	CM/CA[b]
Prevalence (%)				
Non-victims	3.2	1.2	0.02	1.3
All victims	13.12	9.07	1.64	3.82
Physical abuse	13.73	9.52	1.01	3.75
Neglect	16.98[e]	6.42	0.83	7.45
Sexual abuse	10.32	8.73	2.77	2.77
Psychological abuse	13.41	10.98	2.44	3.66
Multiple abuse	15.57	11.07	2.87	3.69
PR[c] (95% CI)				
All victims				
Overall	4.12 (3.79–4.48)	7.65 (6.93–8.44)	95.56 (75.18–121.47)	2.95 (2.54–3.42)
Without FD[d]	4.12 (3.80–4.48)	7.60 (6.88–8.39)	92.19 (72.30–117.55)	2.79 (2.39–3.24)
With FD[d]	4.12 (3.79–4.47)	7.89 (7.16–8.70)	111.65 (88.93–140.17)	3.71 (3.25–4.23)
Physical abuse				
Overall	4.31 (3.85–4.81)	7.98 (7.00–9.11)	53.18 (35.80–79.00)	2.89 (2.35–3.54)
Without FD[d]	4.34 (3.88–4.85)	8.03 (7.05–9.16)	52.70 (35.42–78.41)	2.77 (2.25–3.41)
With FD[d]	4.16 (3.71–4.66)	7.77 (6.80–8.88)	55.29 (37.47–81.57)	3.41 (2.82–4.12)
Neglect				
Overall	5.31 (4.20–6.71)	5.35 (3.72–7.70)	41.70 (15.53–111.96)	5.74 (4.09–8.05)
Without FD[d]	5.16 (4.07–6.54)	5.19 (3.59–7.50)	48.24 (19.23–121.04)	5.16 (3.61–7.36)
With FD[d]	6.26 (5.03–7.78)	6.42 (4.60–8.96)	Insufficient data	9.48 (7.24–12.42)
Sexual abuse				
Overall	3.23 (2.73–3.82)	7.30 (6.08–8.76)	149.26 (107.74–206.76)	2.13 (1.56–2.92)
Without FD[d]	3.20 (2.70–3.79)	7.14 (5.94–8.59)	144.04 (103.47–200.51)	2.06 (1.50–2.84)
With FD[d]	3.38 (2.86–3.99)	8.03 (6.74–9.56)	174.54 (128.58–236.93)	2.46 (1.84–3.30)
Psychological abuse				
Overall	4.19 (2.23–7.87)	9.15 (4.60–18.21)	122.39 (30.02–498.92)	2.81 (0.89–8.91)
Without FD[d]	4.33 (2.33–8.05)	8.98 (4.48–17.97)	77.10 (13.26–448.30)	2.37 (0.68–8.28)
With FD[d]	3.68 (1.89–7.16)	9.81 (5.03–19.11)	296.70 (117.99–746.10)	4.53 (1.81–11.34)
Multiple abuse				
Overall	4.87 (3.46–6.85)	9.23 (6.20–13.73)	145.27 (68.21–309.41)	2.84 (1.46–5.52)
Without FD[d]	4.94 (3.52–6.94)	9.36 (6.31–13.90)	129.00 (57.96–287.08)	2.36 (1.14–4.88)
With FD[d]	4.56 (3.21–6.48)	8.69 (5.77–13.07)	212.23 (112.69–399.68)	4.81 (2.87–8.07)

[a] Except child maltreatment-related injuries (ICD-10 codes: T74 & T76)

[b] Congenital malformations/Chromosomal abnormalities

[c] Prevalence ratio comparing child maltreatment victims with children not registered in SWD database

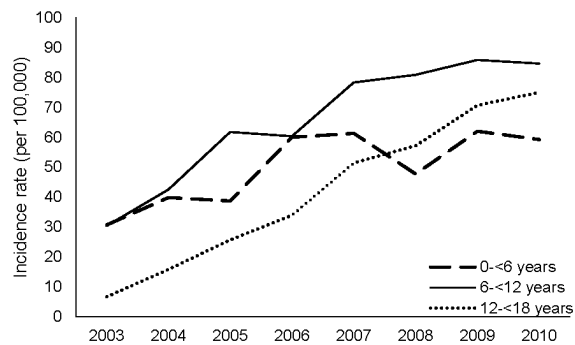[d] Financial difficulties as reported by social workers

[e] Prevalence of injury in neglected children is 22.6%, 16.5%, and 13.5% for preschoolers (0 – <6 years), primary school students (6 – <12 years) and secondary school students (12 – <18 years) respectively

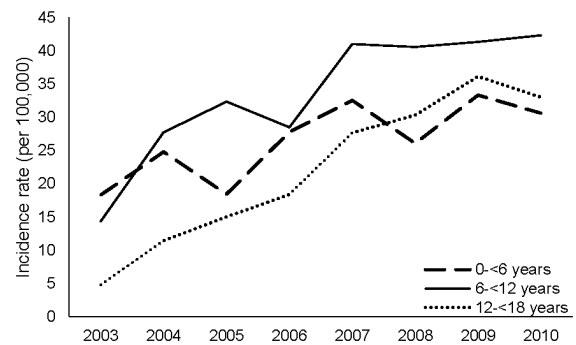Figure 1. Annual incidence rate by type of maltreatment from 2003 to 2010

27
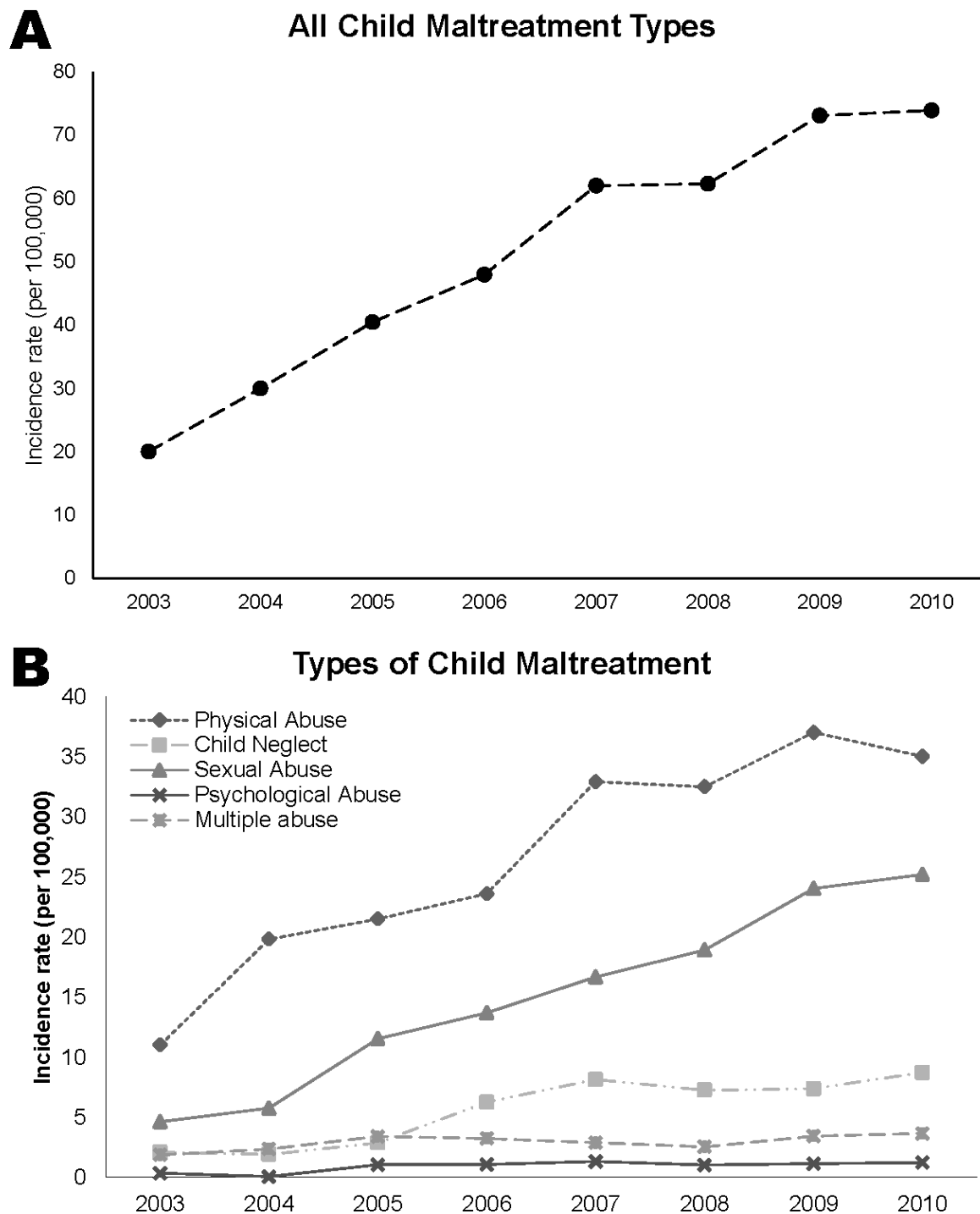
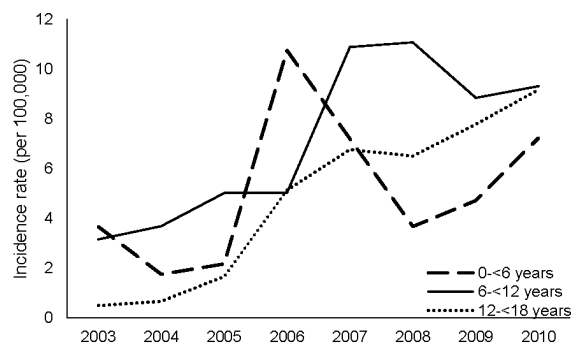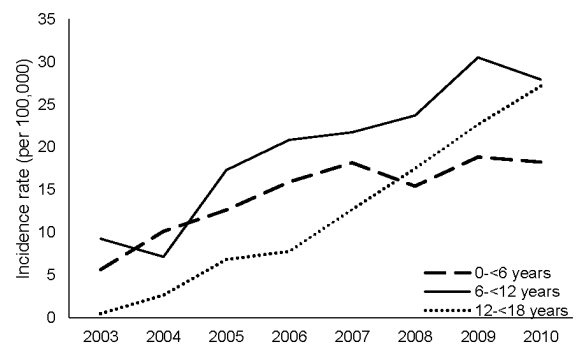Appendix 1. Annual incidence rate of child maltreatment by age group and type of maltreatment