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Original Article

Child Maltreatment in a Cohort of Children with Prenatal Substance Exposure Under Hong Kong East Comprehensive Child Development Service

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Abstract ***Aim:*** To investigate the neonatal and child maltreatment outcomes of babies born to mothers who took illicit drug during pregnancy. ***Methods:*** We retrospectively reviewed the babies with prenatal substance exposure under Comprehensive Child Development Service (CCDS) born from 2012 to 2019. Medical records were reviewed with information supplemented by territory-wide child protection registry. ***Results:*** One hundred and three babies born from mothers with active history of illicit drug were included for analysis. Overall, 20.4% of babies were premature and 44.7% had been neglected at birth with further 6.8% child maltreatment records by 5 years old. Prematurity (p-values <0.05) was higher in child maltreatment group. Child maltreatment was less identified in babies whose mother attended CCDS antenatal care (p<0.001). ***Conclusions:*** Prenatal substance exposure had high risk of prematurity and child maltreatment. Antenatal involvement of CCDS with multidisciplinary collaboration for pregnant illicit drug users may be a protective factor for child maltreatment.

Key words Child maltreatment; Comprehensive child development service; Prenatal substance exposure

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Introduction

Prenatal substance abuse and maternal illicit drug use are long-standing and significant problems which cause public health concern.[1,2] Babies born to mother who abuse(d) illicit drug namely marijuana, amphetamine and cocaine during pregnancy, have higher risk of prematurity, low birth weight, microcephaly, abnormal neurobehavioural symptoms and long-term cognitive delays. Opioid-exposed newborns are at increased risk for drug withdrawal symptoms.[3-5] Earlier studies showed parental substance misuse as an important risk factor in subsequent abuse and neglect but inconclusive findings of linking substance misuse during pregnancy with child protection outcomes.[6,7] A recent systematic review on prenatal substance exposure and child maltreatment found that substance exposed infants have an increase likelihood of child protection service involvement, hospitalisations and clinical visits for suspected maltreatment.[8]

Comprehensive Child Development Service (CCDS) aims to early identify at-risk pregnant women with substance abuse or mental illness, or pregnant teenagers and provide timely intervention to children born to them.[9] Interventions including modifying risk factors of child maltreatment are provided at various stages along the patient journey before and after birth of the child till five years old. Hong Kong East Cluster (HKEC) is one of the seven clusters of the Hospital Authority in Hong Kong provides CCDS. Routine antenatal care at Pamela Youde Nethersole Eastern Hospital (PYNEH) was enhanced by CCDS with the intersectoral (Hospital Authority, Department of Health, Social Welfare Department and NGOs) and multidisciplinary (hospital obstetrics, psychiatry, paediatrics and social) collaboration since 2012.

Unlike other developed countries, local figures on pregnant substance abuser in central registry of drug abuse is not available and there is also lack of local data on prenatal illicit drug exposed babies.[10] To the best of our knowledge, there have been no previous local studies focusing on child maltreatment of children suffering from prenatal substance exposure.[11,12] This study was performed to investigate the neonatal and child maltreatment outcomes of prenatal illicit drug-exposed babies, and to analyse the possible factors associated with child maltreatment.

Methods

Data Source and Subjects

A retrospective cohort of all babies who had prenatal substance exposure under HKEC CCDS in February 2012 to December 2019 was set up according to HKEC CCDS database. Data was censored in December 2021. All new cases of pregnant substance abuser who met the standard territory wide CCDS criteria - maternal self-report of illicit drug use within one year of the expected date of delivery were included. No maternal self-report but positive maternal/newborn toxicology for illicit substance cases were also recruited. Subjects who had termination of pregnancy or delivery of babies in hospitals other than PYNEH were excluded.

Data on maternal illicit drug use, socio-demographic characteristics, antenatal clinic attendance, neonatal and multidisciplinary case conference (MDCC) outcomes of babies from birth to five years old were retrieved and analysed. Details were further retrieved and verified with the use of the Hospital Authority Clinical Management System and Electronic Patient Record System by principal investigator. The child maltreatment outcome during follow up was supplemented by territory wide Child Protection Registry of Hong Kong under Social Welfare Department.

HKEC Comprehensive Child Development Service

CCDS is a territory wide, government-funded and community-based service which aimed at early identification of at-risk children (maternal mental illness, perinatal mood disorder, substance abuse and teenage pregnancy) and timely provision of clinical and social support to babies with potential risk of child abuse. Active illicit drug use pregnant women were identified by questionnaire when they attended the first routine antenatal visit. Then CCDS antenatal care rather than routine one was arranged with consent for those identified.

At PYNEH, CCDS antenatal care was comprised of three components: (1) CCDS midwife who act as case manager, provided obstetric & baby delivery advice and direct referral to community social services at antenatal clinic monthly at first trimester, biweekly at second trimester and weekly at third trimester. CCDS psychiatric team at joint midwife-psychiatric clinic managed expectant mothers with psychiatric co-morbidity and detoxification. In the joint midwife-paediatric clinic at third trimester, CCDS paediatrician held a multidisciplinary baby welfare meeting to formulate the comprehensive childcare and detoxification plan. (2) For close monitoring and timely intervention, bimonthly case review meeting at hospital involving paediatrician, midwife, psychiatrist, community psychiatric nurse and medical social worker and a quarterly case review meeting at Integrated Family Service Centre involving MCHC clinical staff and community social workers. (3) For engaging, empowering expectant mother on parent-child attachment and community integration, CCDS clinical teams in collaboration with Patient Resource Centre and NGOs organised the medical social collaboration project which included antenatal talks on reading aloud and interfacing programs on parenting.

After delivery, visiting CCDS paediatrician at Maternal and Child Health Centres (MCHCs) provided ongoing risk assessment of child maltreatment, monitor growth and development with anticipatory guidance on parenting of the born child from two months old until the age of five.

Outcome Measures

Neonatal outcomes, namely prematurity, low birth weight, type of illicit drug exposed, neonatal withdrawal symptoms at birth and urine toxicology result were recorded. Prenatal substance exposure to babies is defined as maternal self-report or maternal/newborn urine toxicology positive for substances.[7] Newborn neglect is defined as baby urine positive for illicit drug at delivery. Child maltreatment during follow up included children having been harm or at risk of harm as a conclusion of MDCC. Out of home care after delivery is also recorded. Number of clinical visits under CCDS antenatal care for pregnant substance abusers were treated as an indicator to reflect the effectiveness of the CCDS. A secondary database dividing subjects into child maltreatment group including newborn neglect and subsequent child maltreatment during follow up and non-child maltreatment group was set up for further analyses on potential associated factors of maltreatment including prematurity, low birth weight, maternal co-morbid mental condition, paternal substance abuse, teenage pregnancy and clinical visits under CCDS antenatal care.

Statistical Analyses

Descriptive statistics of maternal, neonatal characteristics and maltreatment were summarised in terms of frequencies, proportions, means and standard deviations if appropriate. Comparison of the characteristics between maltreatment and non-maltreatment group were examined by Chi-square tests or independent t-tests. Multiple logistic regression of child maltreatment with potential associated factors were further analysed. All analyses were performed in SPSS v.23. Significant tests were determined by p-values ≤ 0.05. A total of 90 subjects is required as sample size in order to detect a significant difference of risk ratio of 2.5 at 0.05 level of significance at two-sided with 80% power by Open Epi v.3.[13]

Results

From February 2012 to December 2019, 130 unborn babies were identified at CCDS dataset. Twenty-seven of them were excluded because of incomplete data, delivery outside PYNEH or termination of pregnancy. Eighty-nine active illicit drug use mothers and their 103 babies born in the study period were included for analysis. Sixty-eight and 35 babies were recruited before and after birth respectively. Total number of live-birth in PYNEH from 2012 to 2019 was 22802. The incidence of babies with prenatal substance exposure was 0.45% (103/22802). After hospital discharge, all babies attended MCHCs and received vaccination. Forty-six (44.7%) babies follow up at HKEC CCDS paediatric outreach clinics at median clinical follow up interval of 3.7 years (3.8 months to 6.5 years) and the remaining babies were under CCDS at the other clusters.

Fifty-four percent of babies were male. Over half of babies were exposed to one illicit drug and 24.3% exposed to two or more types of drugs. The most common illicit drug exposed was amphetamine (56.3%), followed by ketamine (37.9%) and cannabis (15.5%) (Table 1).

Majority of babies (91.3%) were born by Chinese mothers. 68.9% mothers were single, 19.4% had known mental illness and 41.7% had perinatal mood problem. 3.9% were teenage pregnancy. Twenty three percent was in lower social-economic class with Comprehensive Social Security Assistance (CSSA). For the 103 deliveries, 68 received CCDS antenatal care, 21 received routine antenatal care and 14 had never attended any antenatal visits. The mean of total number of clinical visits under CCDS antenatal care was 12.6 (3 to 20 visits) (Table 1).

Overall, 20.4% of babies were premature, 16.5% low birth weight and 12.6% required NICU stay. Six babies (5.8%) exposed to opiate and all developed neonatal abstinence syndrome with Finnegan score ranging from four to thirteen. Three (2.9%) had congenital anomalies (1 polydactyly, 1 aberrant coronary artery and 1 pulmonary stenosis). Forty-six (44.7%) of babies' urine toxicology was positive for illicit drug of mother as evidence of neglect at birth and 30 of them were out of home care. Thirty-four (33%) babies including four babies with urine toxicology negative result were out of home care and 3.9% were arranged for adoption after birth. Further seven (6.8%) prenatal drug exposed babies had substantiated or high-risk child maltreatment record by age of five. Four substantiated neglect cases during follow up included three babies with urine toxicology test positive and one being left alone at home. One substantiated physical abuse case suffered from fracture of femur. The remaining two cases though not substantiated but at high risk of baby harm (Table 2). No babies under out of home care at neonatal period developed subsequent child maltreatment.

Among 103 subjects, 53 (maltreatment group) had history of child maltreatment at birth or during follow up

and 50 (non-maltreatment group) had no history of child maltreatment. Fifteen (28.3%) and six (12%) premature babies were born in maltreatment group and non-maltreatment group respectively. Prematurity (p=0.04) was associated with higher chance of being the child maltreatment victim. Twenty-five (47.2%) and forty-three (86%) substance use pregnant mothers had attended CCDS antenatal care in maltreatment group and non-maltreatment group respectively. Mothers with CCDS antenatal care (p<0.001) were associated with less chance of being the child maltreatment (Table 3). In further analysis, CCDS antenatal care associated with less child maltreatment was significant (OR 0.05, p<0.002) from multiple logistic regression with adjustment of baby's sex, maternal age and prematurity. This association was significant (p<0.006) when compared without those with routine antenatal care. Routine antenatal care did not show this association (OR 0.2, p=0.166).

Table 1 Maternal and neonatal characteristics of prenatal substance abuse (n=103)

Item	N (Col %)
Neonate	
Sex	
Female	47 (45.6%)
Male	56 (54.4%)
Exposure to drug at prenatal period	
One type	78 (75.7%)
Two types or more	25 (24.3%)
Types of drug*	
Opiate	6 (5.8%)
Amphetamine	58 (56.3%)
Ketamine	39 (37.9%)
MDMA	3 (2.9%)
Benzodiazepine	3 (2.9%)
Cocaine	12 (11.7%)
Cannabis	16 (15.5%)
Maternal background	
Maternal age, mean (min, max)	27.6 (16, 42)
Chinese	94 (91.3%)
Lower social-economic status†	24 (23.3%)
Single parent	71 (68.9%)
Teenage pregnancy	4 (3.9%)
Paternal history of substance abuse	38 (36.9%)
Maternal mental condition	
Known mental illness	20 (19.4%)
Perinatal mood	43 (41.7%)
Antenatal care	
CCDS	68 (66.0%)
Routine	21 (20.4%)
None	14 (13.6%)

*Total number of drug exposure was 133 and mothers may take multiple drugs; †Mothers of babies who were CSSA recipient were grouped into lower social-economic status

Discussion

Newborn Adverse Outcome Secondary to Prenatal Substance Exposure

In our study, the incidence of babies with illicit drug exposure was 0.45%. The prevalence of illicit substance misuse in pregnant women in other developed countries ranged from 0.2% to 0.75%.[14,15] The total number of live-birth in public hospitals from 2012 to 2019 was 310196 and the estimated number of illicit drugs babies exposed in utero is estimated to be more than 170 per year which implied that prenatal substance exposure in Hong Kong is considered a significant public health and clinical issue.

Table 2 Neonatal and maltreatment outcomes of the babies exposed to illicit drugs (n=103)

Item	N (Col %)
Neonatal outcomes	
Prematurity	21 (20.4%)
Low birth weight	17 (16.5%)
Small head	7 (6.8%)
NICU stay	13 (12.6%)
Neonatal abstinence syndrome	6 (5.8%)
Congenital anomalies	3 (2.9%)
Maltreatment outcomes	
Neglect at birth (positive urine toxicology)	46 (44.7%)
Maltreatment at follow up	7 (6.8%)
Neglect	4 (3.9%)
Physical/harm abuse	1 (1.0%)
Sexual abuse	0 --
Psychological harm/abuse	0 --
Multiple harm/abuse	0 --
At risk of harm/maltreatment	2 (1.9%)
Out-of-home care at neonatal period	34 (33.0%)
Adoption	4 (3.9%)

In our cohort, the preterm delivery was 20.4% which was more than three times higher than the general population of 6.5% in a local study[16] and comparable with the findings in previous studies on subjects under CCDS.[11,12] The incidence of low birth weight in our cohort (16.5%) was higher than the general population (6.4%) but lower than a previous local study on narcotic addiction (41%).[17,18] Our results are consistent with a published meta-analysis in Western countries showing that prenatal cannabis exposure was associated with higher risk of preterm birth[19] and amphetamine exposure significantly increased preterm birth risk and low birth weight.[20] Notably, cocaine and marijuana increase risk of congenital malformation which was compatible with our findings of three (2.9%) congenital malformations.[4,21,22]

Table 3 Potential factors associated with child maltreatment in prenatal substance exposed children

	Maltreatment	Non-maltreatment	
Item	**N (Col %)**	**N (Col %)**	**P**
Neonate	53	50	
Sex			0.639
Female	23 (43.4%)	24 (48.0%)	
Male	30 (56.6%)	26 (52.0%)	
Exposure to drug at prenatal period			0.691
One	41 (77.4%)	37 (74.0%)	
Two or above	12 (22.6%)	13 (26.0%)	
Low birth weight	12 (22.6%)	5 (10.0%)	0.084
Preterm	15 (28.3%)	6 (12.0%)	0.040
Maternal background			
Maternal age, Mean (SD)	27.9 (6.2)	27.2 (5.61)	0.581
Lower socioeconomic status			0.441
Yes	14 (26.4%)	10 (20.0%)	
No	39 (73.6%)	40 (80.0%)	
Single parent			0.057
Yes	41 (77.4%)	30 (60.0%)	
No	12 (22.6%)	20 (40.0%)	
Teenage pregnancy	3 (5.7%)	1 (2.0%)	0.337
Paternal history of substance abuse			0.159
Yes	23 (43.4%)	15 (30.0%)	
No	30 (56.6%)	35 (70.0%)	
Maternal mental condition			
Known mental illness	12 (22.6%)	8 (16.0%)	0.394
Perinatal mood	25 (47.2%)	18 (36.0%)	0.251
Antenatal care			<0.001
CCDS	25 (47.2%)	43 (86.0%)	
Routine	15 (28.3%)	6 (12.0%)	
None	13 (24.5%)	1 (2.0%)	

Association of Prenatal Substance Exposure and Child Maltreatment

In a broad sense, child maltreatment is defined as any act of commission or omission that endangers or impairs the physical/psychological health and development of an individual under the age of 18. Child maltreatment can be classified as physical, emotional, sexual or neglect. Neglect refers to a severe or repeated pattern of lack of attention to a child's basic need that endangers or impairs the child's health or development.[23] Yearly number of neglects before two years old ranged from 12 to 167 and the total number of child abuse ranged from 58 to 222 in 2012-2019.[24] A sharp rise in neglect case is noted since drug testing of newborns of mothers as substance abuser becomes a standard local practice since 2015.[24] Similar to some US studies,[7] our results show that the commonest type of maltreatment was neglect which was followed by physical abuse. Further research on associations of prenatal substance exposure with various types of maltreatment with longer follow up is warranted.

Definition of child maltreatment for "fetus" exposing to illicit drug are not standardised in different countries. In US, some States consider substance use during pregnancy as criminal child abuse, some consider substance exposure to fetus as ground for civil commitment and some requires health care professionals mandatory reporting.[25] Unlike some international jurisdictions, Australia and UK do not recognise the legal personhood of a fetus in utero. In UK, to protect the unborn baby, a pre-proceeding process involving legal representative secure parental cooperation for pre-birth assessment.[26] In some States of Australia, statutory provisions for investigation during pregnancy are required.[27] In HK, "fetus" protection is not recognised at legal or policy level. Child protection started only after delivery. According to the local guideline under Social Welfare Department, newborn's urine sample tested positive for dangerous drugs, a MDCC on Protection of Child with Suspected Maltreatment can be convened.[23]

In the current cohort, 44.7% babies of prenatal substance exposure at birth and further 6.8% before age of five required reporting to child protection service and MDCC according to local child protection guideline.

Similarly, in a recent study, 1.45% (n=7994) who had prenatal substance exposure, 61.2% were reported to child protection service before age of one.[28] Several other studies also revealed the significant risk of substance-exposed infants who disproportionately represented among child abuse and neglect victim.[7,29] Our findings indicated the need of reviewing the local child protection policy in responding to high child protection service demand of substance exposed infants.[30]

In spite of the inconsistent local definition of maltreatment for fetus and differences in child protection policy with other countries, the present study showed that 33% prenatal substance exposure babies were out of home care, which was consistent with findings of studies in Western countries.[28,31] All babies under out of home care at neonatal period were protected from subsequent child maltreatment during follow up. Removal of children at birth is always a controversial area of practice to balance safety, maternal human right and baby attachment issue. The aim of all babies under out of home care at neonatal period was to protect them from subsequent child maltreatment. However, our data relating to out-of-home includes out-of-home care of the babies before and after child maltreatment. Though out of home care may be regarded as protective in subsequent child maltreatment, such high percentage of removal warrants comprehensive investigation of the reasons behind, the adequacy of existing residential service and the solutions like program[32] to promote permanency care for substance-exposed infant.

Risk Factors of Child Maltreatment in Prenatal Substance Exposed Babies

Maternal substance use was well known to be a significant risk for child maltreatment.[8] Previous research suggested a set of rather than isolated demographic factors, psychological factors and environmental factors mediating the relationship between maternal substance abuse and child maltreatment. The risk factors identified in this review included maternal low socioeconomic status, criminal justice involvement, mental health co-morbidity, adverse childhood experiences, injection drug use, not receiving treatment for substance use and fewer antenatal visits.[33] Unlike this review, our study did not reveal the association between CSSA status and maternal psychiatric co-morbidity with child maltreatment ($p>0.05$).

For baby's factor, prematurity was positively associated with child maltreatment ($p=0.04$). Previous studies found that women with reported drug abuse during pregnancy were at increased risk of having a preterm birth which in turn was an important risk factor for subsequent maltreatment-related hospitalisation.[34,35] Our finding supports prematurity as a risk factor of child maltreatment in addition to maternal substance use.

Protective Factors of Child Maltreatment in Prenatal Substance Exposed Babies

The CCDS antenatal care in PYNEH matched the strategies under WHO framework on the integrated, people-centred service model which focus on treating whole person and family.[36] The unique care pathways for drug abuse and child protection started from pregnancy at one-stop obstetric special outpatient clinic by professionals of different disciplines, namely psychiatry, paediatrics, social service responsible for family welfare and detoxification. The focus is on stopping fetus exposing to illicit drug, maternal mental health and safety after baby delivery during antenatal visits where clinical consultation and pre-birth high risk baby welfare meeting took place. This multi-professional team working across organisation boundaries in one stop clinic-based approach facilitates information flows, role delineation and maintenance of trustworthy relationships with substance abuse mother. Previous review identified poor compliance to treatment for substance use and fewer prenatal visits as risk factor of child maltreatment.[33] Our findings supported no antenatal care was a risk factor as routine or CCDS antenatal care were negatively associated with child maltreatment ($p<0.001$). The beneficial effect of CCDS antenatal care was illustrated by our study result of less child maltreatment in babies by 20 percent when compared with those never attending antenatal visits (OR 0.05, $p<0.002$). The routine antenatal care did not show this beneficial effect (OR 0.2, $p=0.166$). After attending CCDS antenatal care, twenty-five (47.2%) of babies still fall into the maltreatment group. It may reflect the complexity of managing these high-risk pregnant women who had multiple psychosocial problems. The improvement of CCDS antenatal care by better clinical team integration and medical social collaboration can be explored.

Although the number of clinical visits was a proxy measure on CCDS effectiveness, our findings provide a basis for future research on evaluation of service improvement in terms of access, acceptability and equity.

CCDS paediatrician oversees CCDS at both antenatal care and postnatal part. Visiting paediatrician at outreach clinics in MCHCs not only closely monitored child abuse

cases but also provided measures to prevent child abuse like guidance of parenting and mother infant interaction including book prescription which were found to be effective.[37] A recent systemic review found the importance of community-based program on parenting for child protection.[38] With larger sample size, we may further investigate the protective effect of different components of CCDS on child maltreatment.

Strengths and Limitations

To our knowledge, this is the first local study on child maltreatment in a cohort of babies born from mother actively using illicit drug during pregnancy. The computerised database of the Hospital Authority and Child Protection Registry under Social welfare department provided concrete information concerning maltreatment from birth to 5 years old. Additionally, comprehensive clinical adverse outcomes at birth were investigated. We acknowledge that this study was limited by its retrospective in nature and comparison group cannot prove the confounding factors. Besides, self-report drug use by mother may not be accurate. We had difficulty in collecting data (maternal criminal record, adverse childhood experience and compliance to treatment of substance use) which were important potential factors leading to child maltreatment. Though it is expected that children with drug addict parents are at risk of maltreatment, this study captures the real-world figure of such association. However, since the antenatal visit to CCDS is on a voluntary basis and not a compulsory requirement, it is natural to assume that those giving consent to attend CCDS are those who care about their children so maltreatment should be less common. This association can be due to selection bias. In response to the selection and information bias, future research should attempt to get additional data for prospective cohort study.

Conclusion

We observed the high incidence of prenatal substance exposure with a high risk of prematurity and child maltreatment. Antenatal CCDS involving different multidisciplinary collaboration during pregnancy may be a protective factor of child maltreatment. Based on this encouraging result, pregnant substance abusers and their babies should be encouraged to attend CCDS which protect babies from maltreatment at least up to age of five. Our findings provide a basis for future research on evaluation of other parts of CCDS and territory-wide reviews of maltreatment outcome for better child protection of this high-risk population.

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Ethical Approval

The study was approved by the Ethics Committee of Hospital Authority Hong Kong East Cluster (Ref HKECREC-2021-079).

Declaration

The author has no conflicts of interest to disclose. The author had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

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