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Department of Pharmacology
& Pharmacy
香港大學藥理及藥劑學系

Understanding Drug Abusers and Their Healthcare Pathway: Towards Better Management in Hong Kong

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**Centre for Safe Medication Practice and Research
(CSMPR)**

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Background and objectives

– Background

- Understanding the clinical profiles of patients with substance abuse (drug abusers) and their corresponding utilisation of the public healthcare system in Hong Kong is important to evaluate and plan for the service needs of this population.

– Overall objective

- Describe the current health of substance abusers in Hong Kong requiring medical care in A&E departments.

– Specific objectives:

1. Characterise substance abusers by age group, gender, substance type and with attention to special groups such as school-aged individuals (<21 years old), elderly population (≥ 65 years old), individuals with mental disorders, pregnant women, and ethnic minorities. Describe the medical comorbidities at the time of A&E attendance and the geographical distribution of A&E attendance.
2. Describe the trends of substance abusers having A&E re-attendance due to substance abuse, the number of deaths among substance abusers, and the number of deaths among substance abusers who attended A&E or had hospital admission due to substance abuse.
3. Compare the length of hospitalisations, the number of hospital admissions and A&E attendance due to any causes between substance abusers and non-substance abusers.

Methods of objective 1 & 2

– Data sources:

❖ Clinical Data Analysis and Reporting System (CDARS)

01 Jan 2004 – 31 Dec 2016

❖ Poison Information and Clinical Management System (PICMS)

01 Jul 2008 - 31 Dec 2016

– Cohort identification:

- At least 1 A&E attendance with the diagnosis of substance abuse (ICD-9-CM code: 292.0, 304, 305, 684.3).

– Statistical analysis

- Descriptive analyses were conducted to characterise the sample of substance abusers that require medical attention through A&E attendance and hospital admission.
- Total numbers, percentages, means, and median were used to describe substance abusers by demographic characteristics including age, gender, and drug type.



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Results of objective 1

Results

– Baseline characteristics

Table 1. Baseline characteristics of identified cohort

	All patients with substance abuse (2004-2016), CDARS data	All patients with substance abuse (2008-2016), PICMS data
Total number of A&E attendances due to substance abuse	11,602	2,298
Total number of patients with substance abuse	8,423	1,850
Age, mean (SD), years	35.7 (13.1)	28.7 (8.9)
Number of females (%)	2,378 (28.2)	506 (27.4)
Number of Chinese ethnicity (%)	7,366 (87.5)	NA

– Positive predictive value (PPV) for CDARS:

- **300/11,602** randomly selected
- **272/300** records were classified as substance abuse
- PPV = 90.7% (95% CI: 87.4%-94.0%)

Results

– Trend of substance abuse

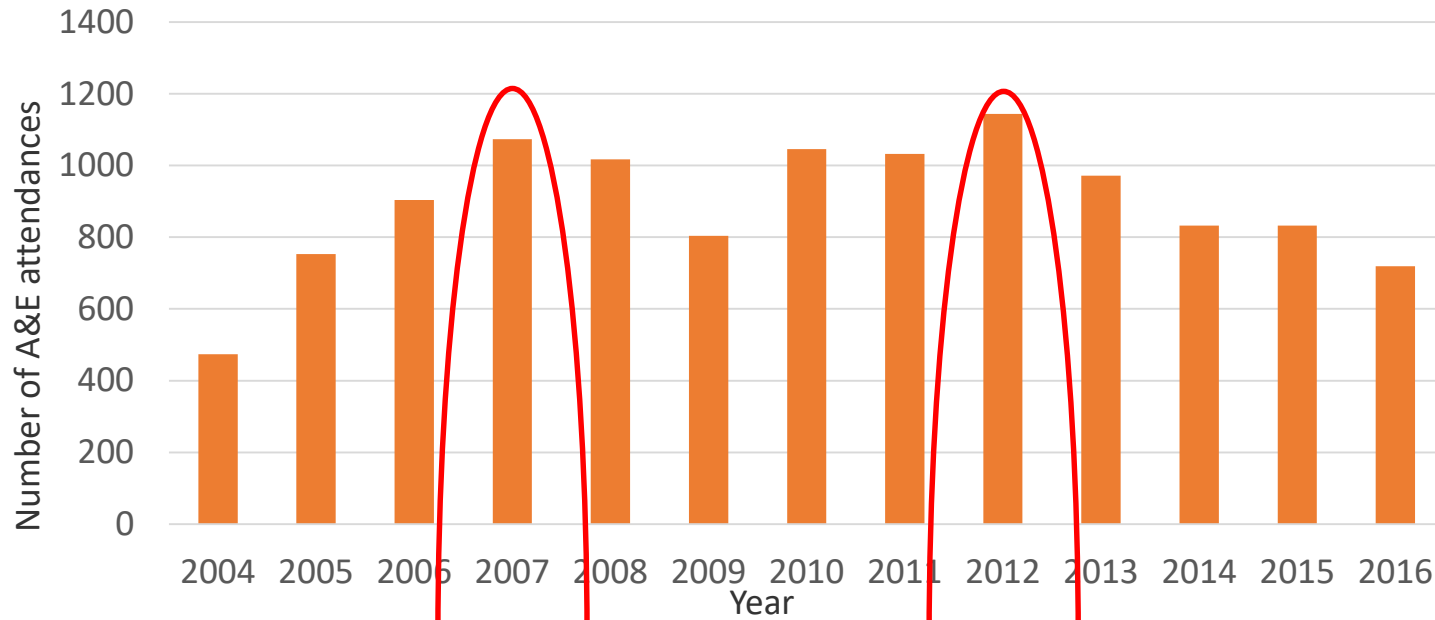


Figure 1. Number of A&E cases due to substance abuse during 2004-2016, CDARS data.

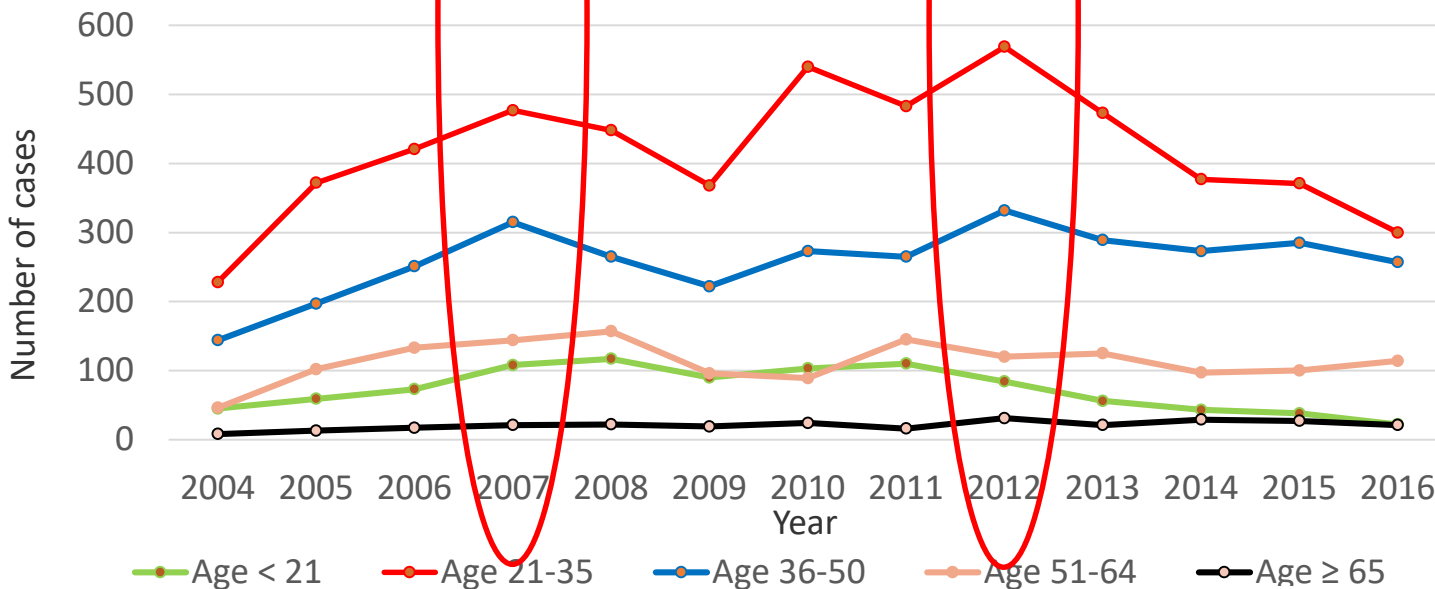


Figure 2. Number of A&E substance abuse cases each year by age group during 2004-2016, CDARS data

Results

– Substance types

Table 2. Number of A&E cases in each substance abuse category between 2004-2016 (CDARS data)

Substance abused	A&E cases	
	N	(%)
Opioid	2,395	(27.1)
Ketamine	2,177	(24.6)
Barbiturate or hypnotic	656	(7.4)
Amphetamine or related acting sympathomimetic	592	(6.7)
Methamphetamine	211	(2.4)
Cocaine	181	(2.0)
Cannabis	104	(1.2)
Hypnotics (including zopiclone/zolpidem)	98	(1.1)
Hallucinogen	93	(1.1)
Inhalant	45	(0.5)
MDMA	8	(0.1)
Cough mixture	7	(0.1)
Midazolam	7	(0.1)
Ecstasy	3	(0.1)
Antidepressant type ^a	1	(0.01)
Unspecified ^b	2,916	(33.0)
Total number	8,838	

^a The antidepressant is reported as dothiepin in the diagnosis comment. MDMA: 3,4-Methylenedioxymethamphetamine.

^b Subcategory was based on the diagnosis comments of that specific A&E case recorded manually by the clinicians in CDARS records. Recording of diagnosis comment was not mandatory.

Table 3. Types of substance abused (Urine test positive/ self-reporting) between 2008-2016 (PICMS data)

Types of substance abused	Number of cases	
	N	(%)
Ketamine	1,404	(61.1)
Amphetamine /Methamphetamine	702	(30.5)
Cannabis	72	(3.1)
Cocaine	53	(2.3)
MDMA	47	(2.0)
Others/Unknown ^a	20	(1.0)
Total number	2,298	

^a Others/Unknown included ecstasy, hash, tetrahydrocannabinol, methoxphenidine, foxy, LSD, and unknown substances. MDMA: 3,4-Methylenedioxymethamphetamine

Results

– Characteristics of special patient groups

Table 4. Characteristics by special patient groups in A&E attendance due to substance abuse during 2004-2016, CDARS data

Special patient groups	Individuals with mental disorder	School-aged individuals ^a	Ethnic minorities	Elderly ^b	Pre-pregnant/Pregnant/Post-delivery women ^c
Mean age ± SD	37.5 ± 12.3	17.7 ± 3.5	34 ± 9.7	73.2 ± 7.2	26.8 ± 6.2
Median age (IQR)	35.7 (17.1)	18.5 (3.1)	32.7 (13.6)	71.5 (10.6)	25.6 (8.6)
Age Range	7.2-97.7	0.6-21.0	2.1-65.5	65.0-97.7	15.9-43.9
Sex ratio M/F	2.09	1.24	3.71	2.76	NA
Mean number of A&E attendances due to substance abuse	1.58	1.32	1.19	1.17	1.19
Race/Ethnicity					
Chinese (%)	2472 (95.2)	744 (90.4)	NA	198 (97.5)	115 (95.8)
Non-Chinese (%)	126 (4.8)	79 (9.6)	401 (100)	5 (2.5)	4 (4.2)
Geographic location of A&E attendance^d					
Hong Kong East Cluster (%)	475 (13.1)	114 (13.9)	95 (23.7)	25 (12.3)	16 (13.4)
Hong Kong West Cluster (%)	204 (5.6)	43 (5.2)	50 (12.4)	14 (6.9)	2 (1.7)
Kowloon Central Cluster (%)	884 (24.3)	126 (15.3)	85 (21.2)	52 (25.6)	23 (19.3)
Kowloon East Cluster (%)	514 (14.14)	176 (21.4)	14 (3.5)	30 (14.8)	16 (13.4)
Kowloon West Cluster (%)	585 (16.1)	90 (10.9)	89 (22.2)	53 (26.1)	17 (14.3)
New Territories East Cluster (%)	393 (10.8)	129 (15.7)	20 (5.0)	10 (4.9)	17 (14.3)
New Territories West Cluster (%)	580 (16.0)	145 (17.6)	48 (12.0)	19 (9.4)	28 (23.5)
Total number	3,635	823	401	203	119

^a Age <21 years on index A&E attendance. ^b Age ≥65 years on index A&E attendance. ^c Defined as female patients who attended A&E due to substance abuse before pregnancy (within 1 year before the start of pregnancy), during the gestation period, and in post-delivery period (within 1 year after delivery). ^d Hong Kong is served by seven clusters of public hospitals and institutions governed by the Hospital Authority. Abbreviations: IQR, interquartile range; SD, standard deviation

Results for special patients groups

– Substance abuse among pregnant women

- Among the 2,378 females, 489 (24.3%) abused drugs during pregnancy

Table 5. Patterns of substance abuse amongst pregnant women during 2004-2016, CDARS data

Time period	Number of women with maternity episode (N = 489)	(%)
Substance abuse during gestation period/pre-pregnancy period/post-delivery period	119	(24.3)
Substance abuse during the gestation period ^a	29	(5.9)
Pregnant ≥ 21 with substance abuse ^b	25	(5.1)
Pregnant < 21 years individuals with substance abuse ^c	4	(0.8)
Substance abuse in the pre-pregnancy period ^d	65	(13.3)
Substance abuse in the post-delivery period ^e	34	(6.9)
Substance abuse <u>not in</u> gestation period/pre-pregnancy period/post-delivery period	370	(75.5)

^a Females having attended A&E due to substance abuse during gestation period are counted. ^b Age ≥ 21 years. ^c Age < 21 years.

^d 1 year period before the start of pregnancy. ^e 1 year period after delivery of the baby

Results

– Chronic medical conditions

Table 6. Most common concurrent chronic medical conditions of substance abusers (CDARS data)

Chronic medical conditions ^a	Number of patients (N = 8,423)	(%)
Mental disorders:	3,635	(43.2)
Depressive disorder	678	(8.0)
Adjustment disorder	591	(7.0)
Schizophrenic disorder	418	(5.0)
Anxiety/ dissociative/ somatoform disorder	377	(4.5)
Personality disorder	325	(3.9)
Bipolar disorder	76	(0.9)
Attention deficit hyperactivity disorder	14	(0.2)
Suicidal attempt and self-inflicted injury	1,721	(20.4)
Cardiovascular diseases:	575	(6.8)
Deep vein thrombosis	313	(3.7)
Hypertension	179	(2.1)
Ischaemic stroke	101	(1.1)
Atrial fibrillation	31	(0.4)
Congestive heart failure	28	(0.3)
Myocardial infarction	21	(0.2)

^a This table was categorised by ICD-9-CM codes (Appendix 4). Some patients may present with one or more comorbidities.

Results -- Geographical distribution of No. of A&E attendance due to substance abuse

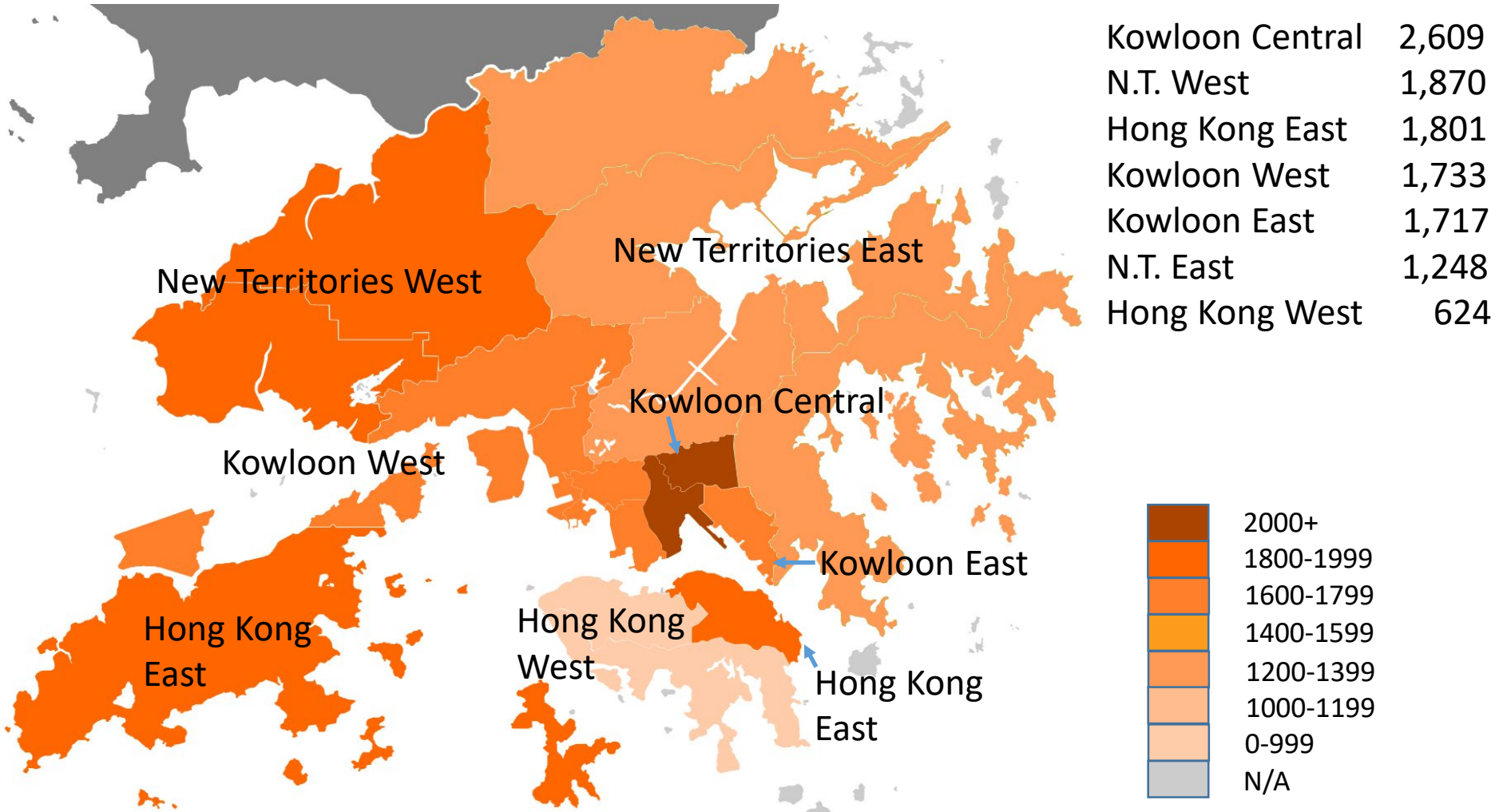


Figure 3. Geographical map with hospital clusters of Hong Kong for number of A&E attendance due to substance abuse during 2004-2016

Results of objective 2

Results

– Trend of A&E re-attendances

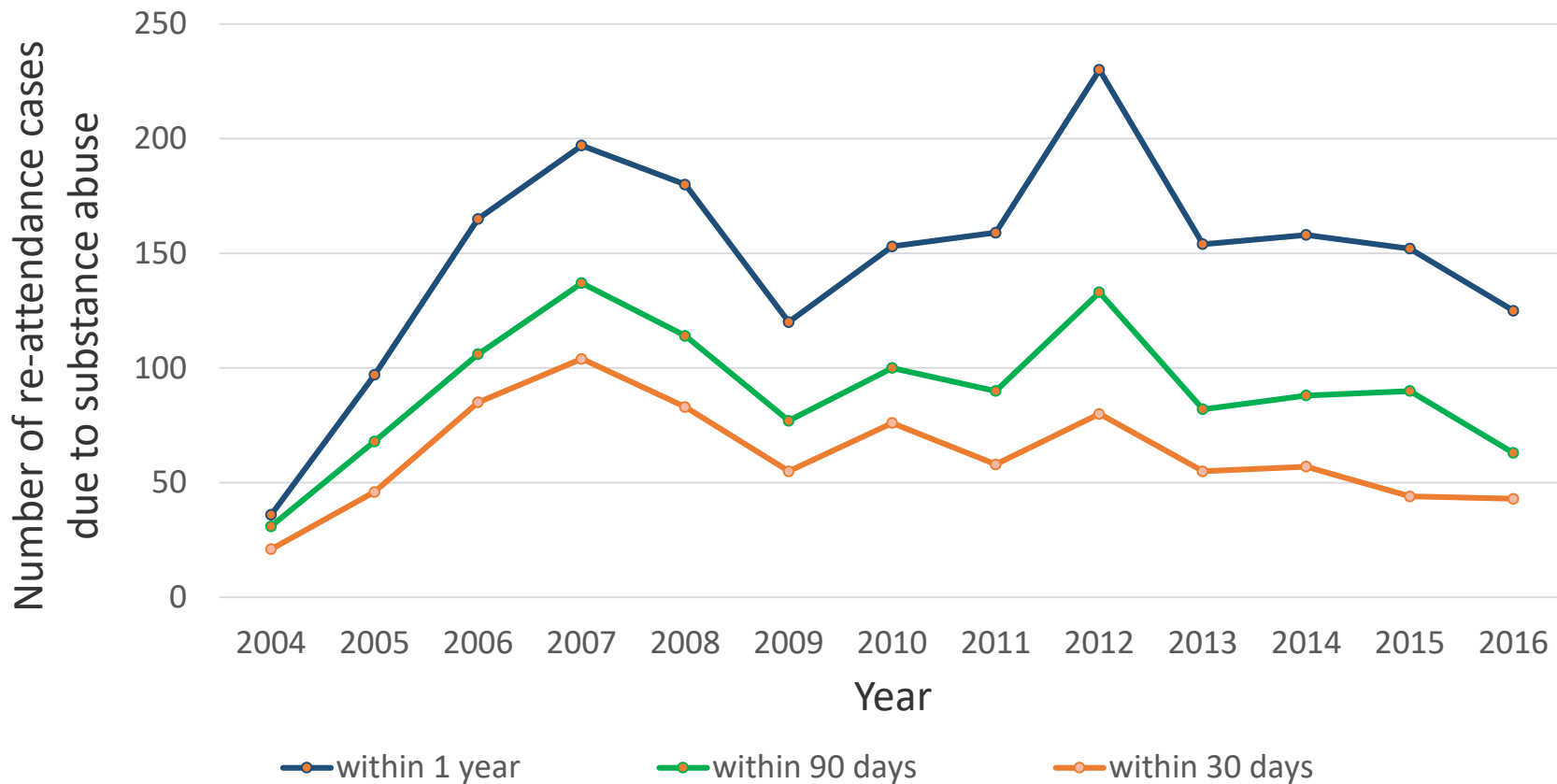


Figure 4. Annual number of A&E re-attendances due to substance abuse during 2004-2016, CDARS data

Results

– A&E re-attendances by substance type

Table 7. Number of A&E re-attendances by substance type during 2004-2016, CDARS data

Primary substance (N=Total number of patients having A&E attendance)	Number of patients having at least ONE A&E re- attendance (%)	Number of patients having at least TWO A&E re-attendance (%)
Opioid (N=1,653)	351 (21.2)	149 (9.0)
Ketamine (N=1,617)	320 (19.8)	120 (7.4)
Barbiturate, sedative, hypnotics (N=617)	27 (4.4)	7 (1.1)
Amphetamine or related acting sympathomimetic (N=523)	49 (9.4)	10 (1.9)
Cocaine (N=167)	13 (7.8)	1 (0.6)
Cannabis (N=101)	2 (2.0)	1 (1.0)
Hallucinogen (N=89)	4 (4.5)	0

Results

– Death

- 1,064 (12.6%) patients died during the study period.
- Mean (SD) age of all cause death was 49.1 (15.3) years, 43.2 (12.0) for death due to substance abuse

Table 8. Number of deaths among substance abusers by cause of death, CDARS data

ICD-10-CM Death cause category	Number of patients (N=1064) ^a	(%)
Toxicity	228	(21.4)
Poison due to heroin	96	(9.0)
Poison due to other opioids	51	(4.8)
Poison due to other/unspecified substances ^b	41	(3.9)
Toxic effect, carbon monoxide	20	(1.9)
Asphyxiation	20	(1.9)
Lower respiratory disease^c	129	(12.1)
Unspecified multiple injuries	88	(8.3)
Cancer^d	86	(8.1)
Cardiovascular diseases^e	79	(7.4)
Sepsis – specified/unspecified	31	(2.9)
Liver diseases^f	17	(1.6)
Others^g	60	(5.6)
Unspecified^a	44	(4.2)
Missing death cause	302	(28.4)

^a 302 patients did not have cause of death recorded in CDARS and this number will be included in the “Unspecified” category, in addition to those recorded as “non-specified cause of mortality”.

^b Including poison – benzodiazepines, other psychotropic substances, poison – others/nonspecified drug/medicine/biological substances, toxic effect – organophosphate/carbamate insecticides, toxic effect – unspecified.

^c Including pneumonia, bronchopneumonia, COPD. Among them, 85 cases died due to pneumonia.

^d Including cancer of liver, nasopharynx, stomach, pancreas, colon, larynx, nasopharynx, cervix uteri, mesothelioma, sec cancer - brain/cerebral meninges.

^e Including myocardial infarction, pulmonary embolism, acute/subacute infect endocarditis, cardiac arrest – unspecified, cerebrovascular accident due to intracerebral haemorrhage, cerebrovascular accident due to stroke.

^f Including hepatic failure, unspecified liver cirrhosis, toxic liver disease.

^g Including cholangitis, anoxic brain damage, pancreatitis, uncertain behaviour tumour brain, focal brain injury, injury of femoral artery, open wound abdomen, chronic viral hepatitis



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Results of objective 3

- **Study design** Retrospective cohort study
- **Study period** 01 Jan 2004 - 31 Dec 2016
- **Index date (start date of following up)**
 - **Patients with substance abuse:** date of 1st A&E attendance with the diagnosis of substance abuse
 - **Patients without substance abuse:** random index date
- **Follow up**
 - From the index date to death or end of study period (31 Dec 2016), which ever came first.
- **Comparison group**
 - Patients with substance abuse vs patients without substance abuse
- **Outcomes**
 - Number of A&E attendances
 - Number of hospitalisations
 - Length of hospitalisations

Methods

– Statistical analyses

– Propensity score matching

- An approach of reducing potential bias due to treatment allocation, based on probability of treatment assignment conditional on observed baseline characteristic

– Confounders

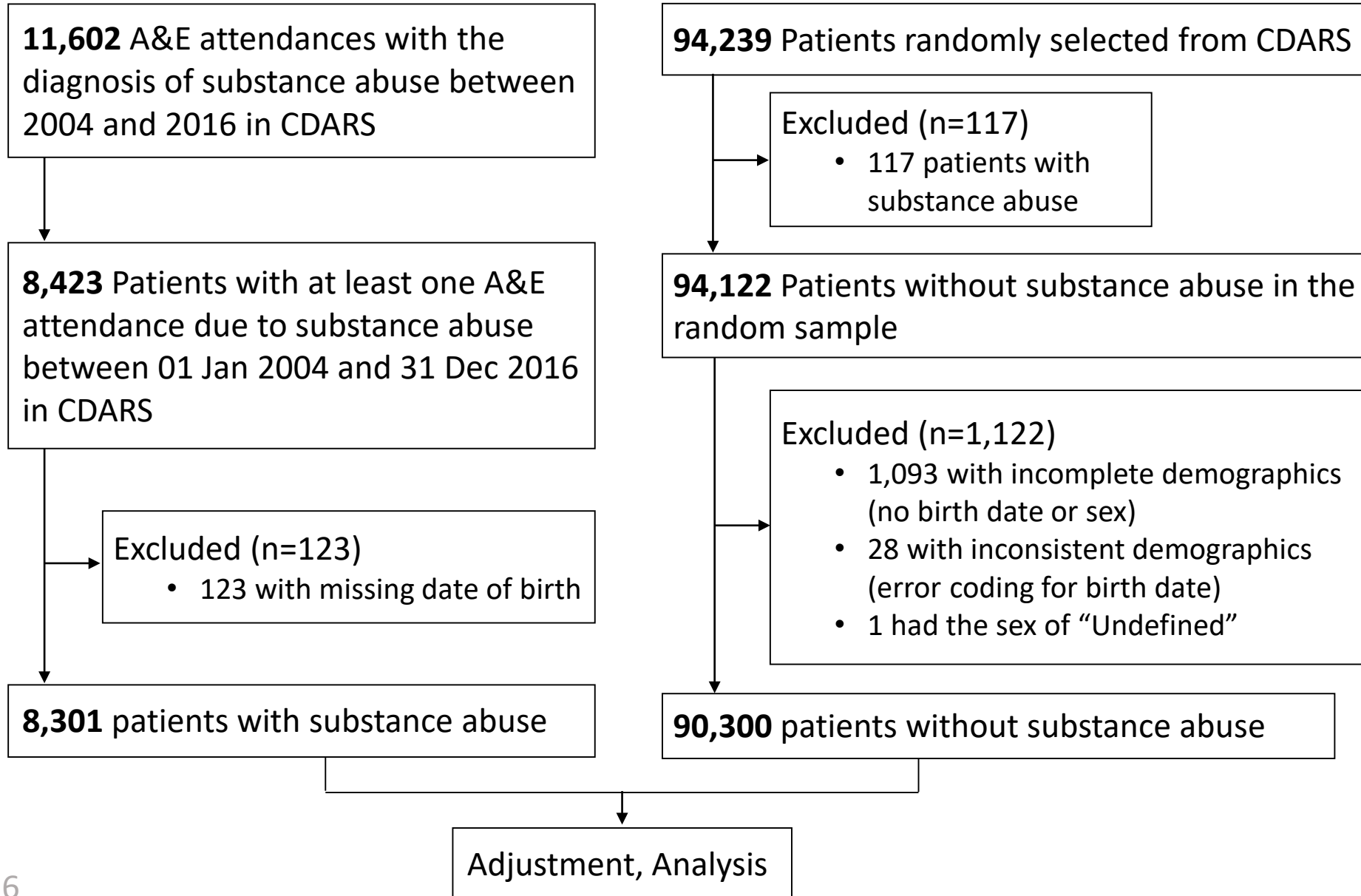
- Demographics: Age, Sex
- Recent (≤ 365 days before the index date) healthcare resource utilisation
 - Number of A&E attendances
 - Number of hospitalisations
- Concurrent medical conditions

– Analyses

- Total numbers, percentages, means, and median were used to describe substance abusers by demographic characteristics including age, gender, and drug type.
- T-test or Wilcoxon test were used to determine whether the length of hospitalisations, number of A&E attendances, and hospital admissions differed in the group of substance abusers with the group of non-substance abusers.
- A significance level of 0.05 was used in all statistical analyses.

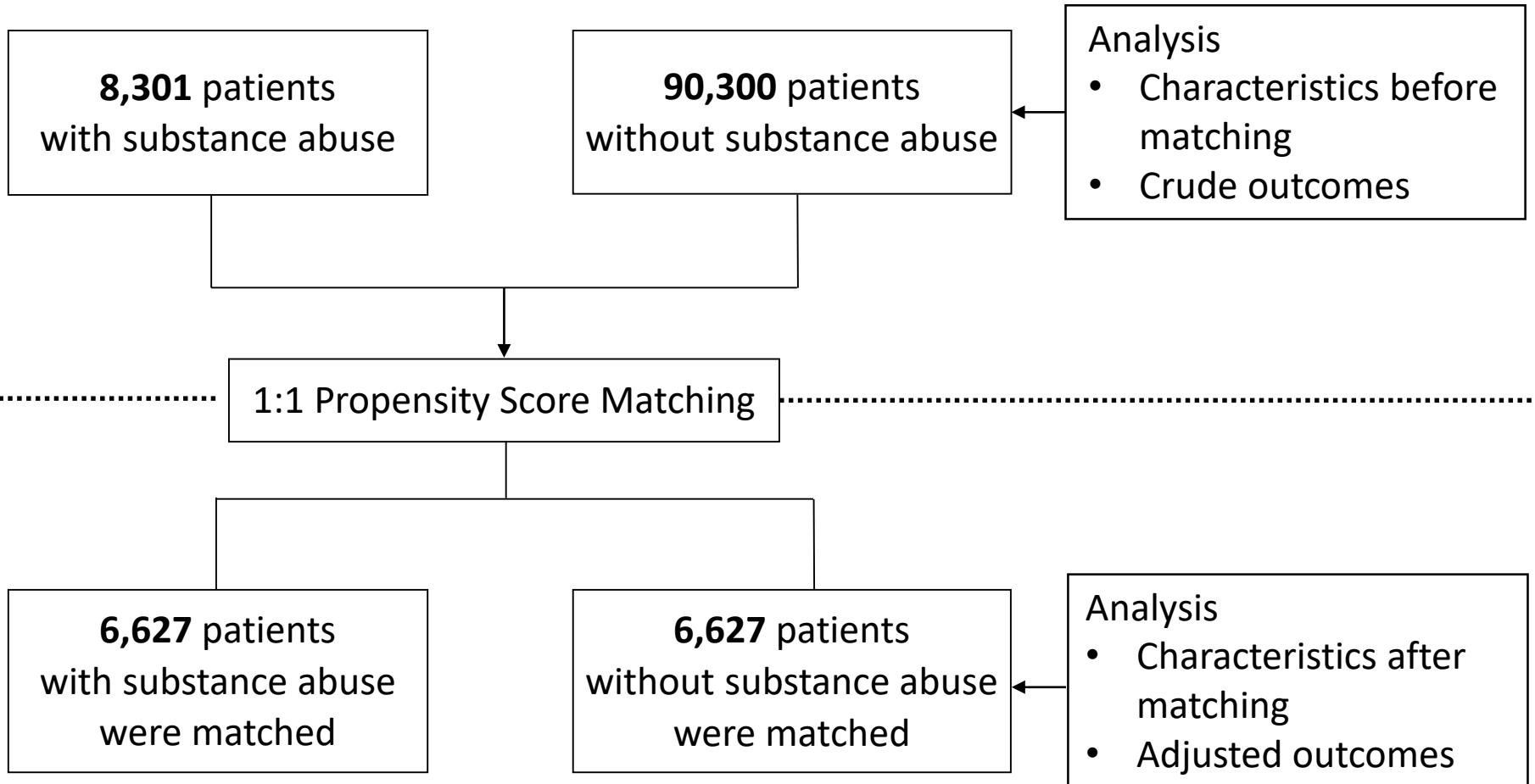
Methods

– Flowchart of cohort identification



Results

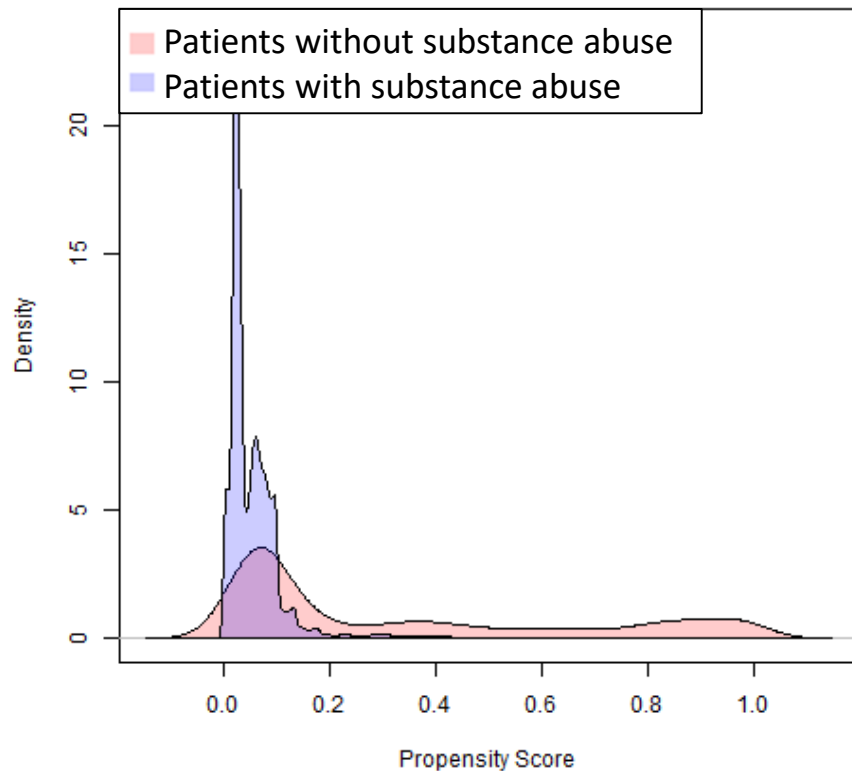
– Flowchart of cohort identification (Con't)



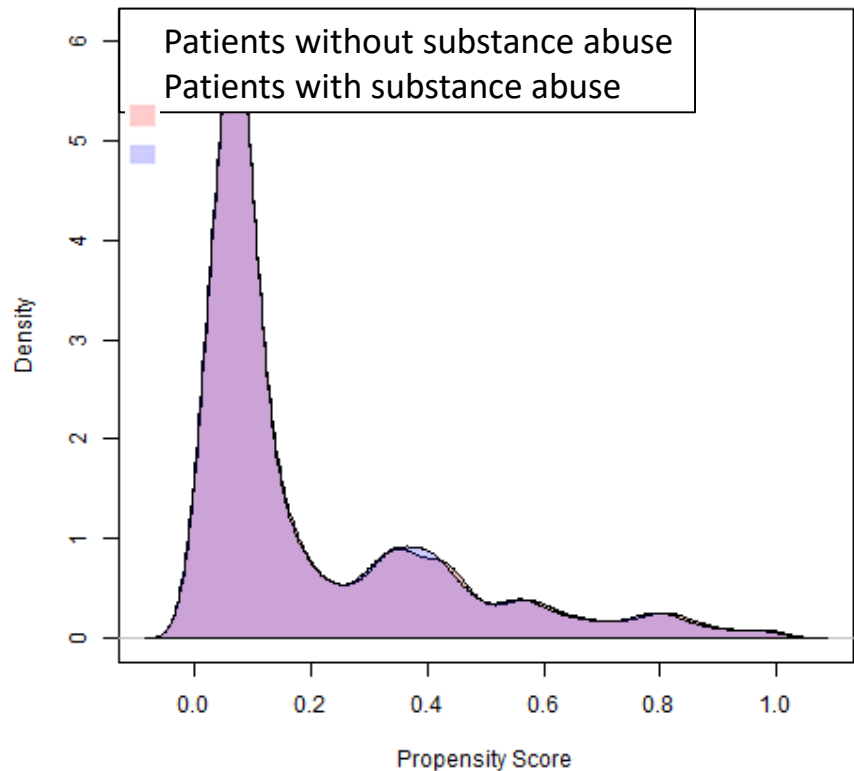
Results

- Distribution of Propensity Score before and after matching

Distribution of propensity score before matching



Distribution of propensity score after matching



After matching, All baseline characteristics had standardized mean difference of less than 0.1, indicating that patients from two groups were well-balanced regarding the observed potential confounders.

Results - Outcomes

Table 9. Number of A&E attendances, hospitalisations and length of hospitalisations among patients with and without substance abuse after the index date (CDARS data)

	Crude Outcomes (Before Matching)			Adjusted Outcome (After Matching)		
	With Substance abuse (n=8,301)	Without Substance abuse (n=90,300)	P-value ^a	With Substance abuse (n=6,627)	Without Substance abuse (n=6,627)	P-value ^a
Mean number of A&E attendance (SD) ^b	1.87 (4.07)	0.34 (1.24)	<0.001	7.49 (19.80)	3.07 (13.46)	<0.001
Mean number of hospitalisations (SD) ^c	0.74 (1.87)	0.22 (1.76)	<0.001	3.32 (6.33)	1.29 (4.65)	<0.001
Length of hospitalisations (days) (SD) ^d	5.44 (21.71)	1.10 (14.99)	<0.001	27.62 (100.79)	8.46 (63.94)	<0.001

^a T-test or Wilcoxon test

^b Number of A&E attendances were counted from the index date to the end of 2016

^c Number of hospitalisations were counted from the index date to the end of 2016

^d Length of hospitalisations was calculated based on mean of all hospitalisations per patients



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Summary, implication and future work

Summary and main findings

- **Trend:** No. of A&E attendances due to substance abuse **decreased** after 2012
- **Substances abused between 2004-2016:**
 - General population: opioid (27.1%), ketamine (24.6%)
 - Pregnant women and young patients <21 years: ketamine (34.6%-44.6%)
 - The elderly ≥65 years: opioid (54.1%)
- **Pregnant women:** **24.5%** were during the gestation, pre-pregnancy or post-delivery period.
- **Comorbidities:** **Mental disorders** (43.2%) and **suicide attempts** (20.4%).
- **Death:** Mean (SD) age of all cause death was only **49.1** (15.3) years, **43.2** (12.0) for death due to substance abuse among substance abusers.
- **Healthcare resource utilisation:** Substance abuse was significantly associated with greater healthcare resource utilisation (higher number of A&E attendance, higher number of hospitalisations, longer length of stay), compared with patients without substance abuse.

Implications and future work

- This is the **first Hong Kong wide, population-based study** using **big data approach** by identifying patients from **all records of A&E attendance** in public hospitals between 2004 and 2016. This cohort is valuable to Hong Kong and can generate much more research in the future.
- **Improve the treatment among substance abusers:** A population-based study will be conducted, to characterise patients with **substance abuse** and comorbid **mental disorders**, and to explore whether patients on long-acting injectable antipsychotics (LAIAs) have better clinical outcomes and reduced healthcare utilisation than patients on oral antipsychotics (OAs).
 - LAIAs is used to improve medication adherence in patients requiring antipsychotic treatment. LAIAs provide similar effects to OAs but with benefits of a controlled, long-lasting duration of action. However, the uptake of LAIAs in Hong Kong is low compared to other regions.
 - BDF 160052: Nearly half of the substance abusers had concurrent mental disorders. Average hospital admission was about 1 month. Death age was only mid-40s.
 - RGC-funded RCT project: 30% of patients with acute agitation need the treatment of antipsychotics medication and nearly 40% of them were not adherent to treatment
- **Influence of substance abuse during pregnancy on the health outcomes of their offspring**
 - 489 (24.3% of the females) patients abused drugs during pregnancy
 - The outcome of children born from the 119 drug-abusing mother at their different ages.
 - Need a longer study period to follow up their offspring to teenagers



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Relation of substance use disorders to mortality, accident and emergency department attendances, and hospital admissions: A 13-year population-based cohort study in Hong Kong

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ABSTRACT

Background: The impact of substance use disorders (SUD) in an Asian population has not been fully explored. We aimed to assess the risk of mortality, accident and emergency (A&E) department attendances, and hospital admissions associated with SUD in a population-based cohort study.

Method: Patients diagnosed with SUD in public A&E departments from 2004 to 2016 (N = 8,423) were identified in the Clinical Database Analysis and Reporting System of the Hong Kong Hospital Authority and 1:1 matched to patients without SUD by propensity score (N = 6,074 in each group). Relative risks of mortality, A&E attendances and hospital admissions were assessed using Cox regression and Hurdle negative binomial regression.

Results: Patients with SUD had higher mortality (hazard ratio=1.43; 95% confidence interval [CI]=1.26-1.62) and more often died from poisoning or toxicity and injuries. The odds ratio (OR) for A&E attendances and all-cause hospital admissions associated with SUD were 2.80 (95% CI=2.58-3.04) and 3.54 (95% CI=3.26-3.83), respectively. The impact of SUD on the above outcomes was greatest among school-aged individuals (<21 years) and decreased with age. The relative risk of mental disorder-related hospital admissions was much higher than that for infections, respiratory diseases, and cardiovascular diseases. In patients with SUD, ketamine and amphetamine use were associated with increased A&E attendances than opioid use.

Conclusions: SUD was associated with increased mortality, A&E attendances and hospital admissions, especially in school-aged individuals. Our findings suggest prioritising early treatment and preventive interventions for school-aged individuals and focusing on the management of comorbid mental disorders and the use of ketamine and amphetamine.

- Substance use disorder (SUD) is related to **higher mortality** in Hong Kong population.
- Patients with SUD have **greater demand for A&E attendances and hospital admissions**.
- The impact of SUD is **greatest** among patients aged **under 21**.
- **Mental disorder** is a major factor related to the increased hospital admissions.
- **Ketamine** and **amphetamine** are related to higher healthcare utilisation than opioids.

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