

Risk of self-harm after the diagnosis of psychiatric disorders: A nested case-control study in Hong Kong, 2000-2010

Yi Chai, Hao Luo*, Gloria H.Y. Wong, Jennifer Y.S. Tang, Tai-Chuang Lam, Ian C.K. Wong, Paul S.F. Yip

Yi Chai, MSc, PhD student, Department of Social Work and Social Administration, The University of Hong Kong, Hong Kong, China

Hao Luo, PhD, Assistant Professor, Department of Social Work and Social Administration; and Department of Computer Science, The University of Hong Kong, Hong Kong, China

Gloria H.Y. Wong, PhD, Assistant Professor, Department of Social Work and Social Administration; and Sau Po Centre on Ageing; and Department of Psychiatry, The University of Hong Kong, Hong Kong, China

Jennifer Y.S. Tang, PhD, Research Assistant Professor, Sau Po Centre on Ageing, The University of Hong Kong, Hong Kong, China

Tai-Chuang Lam, MBBS, Clinical Assistant Professor, Department of Clinical Oncology, The University of Hong Kong, Hong Kong, China

Ian C.K. Wong, PhD, **Professor**, Head, Department of Pharmacology and Pharmacy; and Lo Shiu Kwan Kan Po Ling Professorship in Pharmacy, The University of Hong Kong, Hong Kong, China; and School of Pharmacy, University College London, London, UK

Paul S.F. Yip, PhD, **Professor**, Chair of Population Health, Department of Social Work and Social Administration; and Associate Dean, Faculty of Social Sciences; and Director of Centre for Suicide Research and Prevention, The University of Hong Kong, Hong Kong, China

Correspondence: Hao Luo, Room 521, The Jockey Club Tower, The Centennial Campus, The University of Hong Kong, Pokfulam Road, Hong Kong, China.

E-mail address: haoluo@hku.hk

Abstract

Background

Psychiatric disorders are established risk factors for self-harm. However, variation in risk of self-harm by specific psychiatric disorder, stratified by gender and age, is rarely examined using population representative samples. This study aims to investigate the risk of self-harm following the diagnosis of different psychiatric disorders based on inpatient records retrieved from the Hong Kong Clinical Data Analysis and Reporting System (CDARS).

Method

A cohort of 86,353 people with a first-recorded diagnosis of depression, alcohol abuse/dependence, personality disorders, bipolar disorders, anxiety disorders, schizophrenia, or substance abuse/dependence, along with 134,857 matched controls, were followed between 2000 and 2010. For each diagnostic category, a Cox proportional hazard regression model was fitted to estimate the adjusted hazard ratio (aHR) (95% confidence intervals) of associated self-harm, adjusting for gender, age, admission time, district of residence, and comorbidities.

Outcomes

The personality disorders and substance abuse/dependence groups had the highest self-harm incidences of 3,174 and 3,018 per 100,000 patient-years, respectively. The highest risk of self-harm was found in the substance abuse/dependence group (aHR, 9.6; 95% CI, 8.4-11.0), followed by the groups with personality disorders (3.7; 2.8-4.9) and alcohol abuse/dependence (3.2; 2.9-3.7). When stratified by gender and age, the highest risk was found in substance abuse/dependence group for both genders (female: aHR, 7.7; 95% CI, 6.0-9.8; male: 10.5; 95% CI, 8.9-12.4) and all age groups (adolescent: aHR, 9.6; 95% CI, 7.2-12.7; young: 10.2; 95% CI, 8.4-12.3; middle-aged: 11.2; 95% CI, 8.0-15.6; Elderly: 3.2; 95% CI, 1.7-6.1).

Interpretation

First-recorded diagnosis of psychiatric disorders were significantly associated with elevated risks of subsequent self-harm. The associations varied considerably by diagnostic categories across gender-age subgroups. This finding highlighted the needs to develop more efficient and targeted preventive measures in psychiatric care management. Specific attention should be paid to demographic characteristics linked to increased risk within the same diagnostic category.

Funding

Nil

Keywords: Psychiatric disorder; Self-harm; Inpatient records; CDARS; Survival analysis

Research in context

Evidence before this study

Psychiatric disorder is one of the strongest risk factors of subsequent self-harm. We searched PubMed for research articles in English, published before Mar 31, 2019, using the search term [(self-harm) OR (self harm) OR (self-injur*) OR (suicid*)] AND [(psychiatr*) OR (mental) OR (mood)]. When investigating the links between psychiatric disorders and self-harm, the majority of research was limited to small samples of limited demographical groups and cross-sectional designs. There was also a lack of consideration of psychiatric and physical comorbidities. An emerging body of research was interested in estimating the absolute risk of self-harm or suicide after the onset of psychiatric disorders. This type of study usually requires longitudinal health records with a sufficiently long observational period and, ideally, population representativeness. Evidence on the relative importance of a specific psychiatric disorder in terms of the absolute risk is hence limited to countries with well-established health registries such as Denmark, Sweden, England, and the United States. More than half of all self-harm disability-adjusted life years occur in East and South Asia. However, few longitudinal studies have systematically examined in detail how self-harm risk varies according to specific psychiatric disorders, in Asian communities, using a single population-representative sample.

Added value of this study

This study used the dataset based on longitudinal data from comprehensive territory-wide electronic health records over ten years, covering a population of 3,397,795 patients in Hong Kong. To our best knowledge, this paper is the first attempt to systematically investigate the subsequent risk of self-harm after the first-recorded diagnosis of psychiatric disorder in Chinese society. A particular strength is that risks of self-harm for people with specific psychiatric disorders were estimated using the same dataset and hence are directly comparable. All selected psychiatric disorders had significantly increased risk of subsequent self-harm after adjusting for gender, age, admission time, district of residence, and comorbid physical illnesses and psychiatric disorders.

Implications of all the available evidence

Patients with hospital admission history who had a psychiatric diagnosis have up to nearly 10-fold risk of newly occurring self-harm behaviour than their non-psychiatric counterpart. This finding highlighted the needs to strengthen preventive measures in psychiatric care management, even in patients with no self-harm history. In addition to the conventional focus on patients with depression and schizophrenia, our findings provided basis for giving more weight to the substance abuse/dependence and personality disorders groups.

Text

Introduction

Self-harm, the second leading cause of injury death, is significantly associated with increased risk of adverse outcomes, including suicide.¹ Established risk factors of self-harm include demographical profile, social and family environment, previous self-harm behavior, physical illnesses, and psychiatric disorders.² Among them, a history of psychiatric disorders has repetitively been shown to be one of the strongest risk factors for self-harm and suicidal behavior in the general population.³⁻⁵ Most commonly-documented psychiatric disorders prior to self-harm are depression, followed by substance abuse and anxiety disorders.² A growing number of studies has also identified schizophrenia, bipolar disorders and personality disorders as significant predictors of subsequent self-harm and suicidal behaviour.²⁻⁶ However, the majority of research is limited to small samples of limited demographical groups (such as adolescents, lesbian, gay, bisexual and transgender (LGBT) community, and prisoners), cross-sectional designs, and a lack of consideration of psychiatric and physical comorbidities. Moreover, despite the fact that more than half of all self-harm disability-adjusted life years occurs in East and South Asia,¹ few studies have examined in detail how self-harm risk varies according to specific psychiatric disorders, in Asian populations, stratified by gender and age. To fill this gap, we conducted the first study in a Chinese population based on a review of a decade of electronic health records of all patients admitted to Hong Kong public hospitals, using the Hong Kong Clinical Data Analysis and Reporting System (CDARS). This paper reports on an interrogation of a territory-wide health registry dataset, to compare risk of self-harm in 86,353 people admitted to Hong Kong public hospitals with a first-recorded diagnosis of psychiatric disorders, with 134,857 matched controls.

The objectives of this study are to: 1) report on the incidence of self-harm for different psychiatric diagnostic groups; 2) investigate the subsequent risk of self-harm associated with each specific psychiatric disorder, adjusting for gender, age, admission time, district of residence, in addition to comorbid physical illnesses and psychiatric disorders, and examine variation in risks across gender-age subgroups.

Methods

Data source: Inpatient data (from patients who were admitted to hospitals due to any reason) between Jan 1, 2000 and Dec 31, 2010, were extracted from the CDARS, a territory-wide database in Hong Kong. Data from the CDARS have been used in several earlier epidemiological studies and proven to be reliable.^{7,8} CDARS contains electronic health records from the Hong Kong Hospital Authority (HA), a statutory body managing all public hospitals and serving seven million residents in Hong Kong. The current healthcare system in Hong

Kong provides three levels of medical care (primary, secondary and tertiary medical care) through both public and private sectors.⁹ Public healthcare services are provided by Department of Health and the HA, which are in charge of the management of public health and public hospitals, respectively. The HA currently provides services for approximately 80% of in-patients' visits and 30% of out-patients' visits.¹⁰ Mental health services in Hong Kong are mainly supported by the HA, the Social Welfare Department, and subvented non-governmental organizations in the community, with the HA being the predominant provider of inpatient services, specialist out-patient services, psychiatric day hospitals and community services.¹¹ After excluding 988 recodes with missing data, our current dataset contains a total of 13,177,999 inpatient records of 3,397,795 patients of basic demographic information, diagnoses stored in International Classification of Disease, Ninth revision (ICD-9) code, and admission/discharge dates. In this database, patients' records are anonymised to protect privacy. During this study period, 9.8% of patients died (n = 333,565), whereas 90.2% (n=3,064,230) remained in the study until 2010.

Case identification: We identified cases as people aged 10 years or older who had been admitted to inpatient care with a first-listed record of psychiatric disorder during the study period (January 1, 2000 to December 31, 2010). We used year 2000 as screening period to identify incident cases. Patients who received their first diagnosis in 2000 could represent an existing hospital record (prevalent case), rather than a new case and these people were excluded.¹² For each selected psychiatric disorder, the date of the first-ever diagnosis was defined as the start 'follow-up' date.

The seven psychiatric disorders of interest were: depression (ICD-9: 296.2-296.26, 296.3-296.36, 300.4, 311), alcohol abuse/dependence (291-291.9, 303-303.93, 305.0-305.03), personality disorders (301-301.9), bipolar disorders (296.0-296.03, 296.4-296.89), anxiety disorders (293.84, 300.0-300.09, 300.2-300.29, 300.3, 300.9, 308.3, 309.21, 309.81, 313.0, 313.21, 313.23), schizophrenia (295) and substance abuse/dependence (292-292.9, 304-304.93, 305.1-305.93).

To ensure that the psychiatric disorders preceded the self-harm presentation, patients with a history of self-harm diagnosis before, or at the same time as, the first diagnosis of psychiatric disorder, were excluded.

Control identification: We randomly selected two control subjects per case (without replacement) from a subsample of all individuals with the same gender, age, and admission time (quantified as calendar year and month), who did not have 1) a history of self-harm diagnosis before or at the time of admission date, and 2) any record of the psychiatric disorders

of interest. The admission time is defined based on the cases' dates of first-recorded psychiatric disorders. In two extreme cases where patients with depression and schizophrenia were 107 and 106 years old, respectively, controls were not available. We relaxed the same calendar year and month restriction to the same calendar year in these instances. For all controls, the matched admission date was the start 'follow-up' date. The case and control identification procedures for each diagnostic group are showed in Figure 1.

Self-harm identification: All case and control records were interrogated for episodes of self-harm as the event of interest. Given the fact that self-harm are generally under-reported and under-diagnosed in hospital administrative dataset due to stigma and difficulties in determining the intent,¹³ a broader definition of self-harm, which includes all self-injurious behaviours with and without suicidal intent, unintentionally and intentionally inflicted, was adopted. The codes used to identify self-harm were E950-E959 (self-harm) and E980-E989 (self-harm undetermined whether unintentionally or intentionally inflicted).

Survival time: Cases were followed from the onset of psychiatric disorder diagnoses until the first record of self-harm, death (all cause), or December 31, 2010, whichever came first. Controls were followed from their matched admission dates.

Gender-age stratification: We stratified the study cohort (cases and controls) into six subgroups by age at diagnosis (adolescent: 10-24 years; young adult: 25-44 years; middle-aged: 45-64 years; and older persons: 65 years and older) and then gender.

Statistical analysis: The subsample characteristics are tabulated for each psychiatric diagnosis. Cumulative incidence curves were applied to demonstrate different temporal patterns of self-harm after the first-recorded onset of a psychiatric disorder.

The number (and proportion of total) of self-harmers, in addition to the crude incidence of self-harm, was calculated for both cases and controls. The incidence of self-harm per 100,000 patient-year was calculated using Poisson distribution with exact 95% confidence intervals (CIs). For each of the seven diagnostic categories, Cox proportional hazard regression models were fitted to estimate the hazard ratios (HRs) (95% confidence intervals) of self-harm since the onset of psychiatric disorders, taking the time at risk into account. The crude HRs were adjusted for gender, age, and admission time through matching. Adjusted HRs were further adjusted for twenty districts of residence, six physical illnesses, and the presence of the other six psychiatric disorders. The coexisting psychiatric disorder being controlled for can be either the first diagnosis or recurrent diagnosis. The dependent variable is the hazard function calculated based on the time (measured in days) until the first record of self-harm or censoring

during follow-up. The physical illnesses of interest were established risk factors of self-harm, including diabetes (ICD-9: 250-250.93), asthma (493-493.92), migraine (346-346.93), epilepsy (345-345.91), HIV (042) and cancer (140-239).^{2,3,14} The same analyses were conducted for the six gender-age specific subgroups. Since up to 28 groups (seven disease cohorts by four age groups) were examined in this study, we computed the multiple comparison adjusted confidence intervals and *p*-values using the Bonferroni correction method to account for the problem of inflated false positive rate. In a separate analysis, the interactions between specific psychiatric disorders and gender/age groups were added to the Cox models to additionally test the effect of gender and age on the risk of self-harm associated with each disease group. The packages, “survival” and “survminer” in statistical software R (version 3.5.3), were used for statistical analysis.¹⁵ Sensitivity analysis was also conducted using a narrower definition of self-harm (ICD-9: E950-9) to examine the coding effect on the robustness of the results.

Ethics approval: This study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong Western Cluster (UW 11-459).

Results

The sample characteristics of the seven study groups are summarized in Table 1. The most prevalent psychiatric disorder was depression (n=27,935), followed by schizophrenia (26,658) and anxiety disorders (11,955). The depression group had the highest proportion of older persons (39.5%, n=11,037) and second highest proportion of females (68.4%, 19,109). Considerable differences in frequencies by gender were also found in the alcohol abuse/dependence and substance abuse/dependence groups, where percentages of males were 80.1% (n=8,714) and 61.9% (5,372), respectively. The highest percentage of all psychiatric disorders was in the 25-44 years group except for depression, ranging from 55.2% (4,792) for substance abuse/dependence to 32.1% (3,842) for anxiety disorders. The substance abuse/dependence and personality disorders groups both had relatively higher proportion of people in the youngest age group compared with other disorders, which provided 24.2% (2,096) and 23.4% (577) of cases in each group, respectively. The youngest diagnostic group was the substance abuse/dependence group with a mean age at diagnosis of 34.7 years (SD, 13.9), while oldest diagnostic group was found for depression with a mean age of 56.4 years (SD, 20.6).

Concerning the subjects with subsequent self-harm behaviour (after psychiatric case identification), significant differences were observed between the case and control groups, for all seven psychiatric disorders (see Table 2). Largest differences were found for substance

abuse/dependence (15.0%, n=1,298) and personality disorders (12.1%, 297), and lowest for anxiety disorders (3.1%, 365), where corresponding percentages for the control groups all ranged from 1.6% (depression, n=902; substance abuse/dependence, 270) to 1.9% (alcohol abuse/dependence, 414; schizophrenia, 989).

The crude incidence of self-harm for each psychiatric disorder is summarized in Table 2. Self-harm incidence in the personality disorders and substance abuse/dependence groups was 3,174 (95% CI, 2,827-3,549) and 3,018 (95% CI, 2,857-3,185) per 100,000 patient-years respectively, and the highest among all studied disorders. Incidence was much lower in the bipolar disorders, anxiety disorders, and schizophrenia groups, ranging from 676 (95% CI, 609-748) to 729 (95% CI, 634-832) per 100,000 patient-years. The greatest difference in self-harm incidence was found between the substance abuse/dependence case and control groups, where the incidence per 100,000 patient-years was more than 10 times higher in cases than controls (Incidence, 290; 95% CI, 256-325). The incidences of self-harm per 100,000 patients by follow-up year are summarized in Table A1 (appendix pp 8).

In all psychiatric disorders, the risk of self-harm was consistently higher in cases than controls (Figure A1, appendix pp 1-7). Figure 2 shows the cumulative incidence curves illustrating the probability of self-harm since onset per psychiatric disorder. This figure shows that patients with substance abuse/dependence and personality disorders were more likely to suffer from subsequent self-harm than any other. The risks did not fluctuate with the follow-up time for all psychiatric groups.

Figure 3 demonstrates that all psychiatric disorders were significantly associated with increased risk of subsequent self-harm behavior. The associations were all weakened but remained statistically significant after further adjusting for district of residence, and comorbid physical illnesses and psychiatric disorders. Substantial differences were evident between diagnostic groups. The highest self-harm risk was found in the substance abuse/dependence group (aHR, 9.6; 95% CI, 8.4-11.0), followed by patients with personality disorders (3.7; 95% CI, 2.8-4.9) and alcohol abuse/dependence (3.2; 95% CI, 2.9-3.7). There was a considerable decrease in HRs after adjusting for covariates in the personality disorders group. All associations remained significant after the Bonferroni correction (Table A3, appendix pp 16).

The gender stratified adjusted results are shown in Figure 4. For all psychiatric disorder groups, significantly-increased risks of self-harm were detected in both genders, except for males with bipolar disorders. The highest risk was found in substance abuse/dependence group for both genders (female: aHR, 7.7; 95% CI, 6.0-9.8; male: 10.5; 95% CI, 8.9-12.4). The self-harm risks were consistently higher in females across all psychiatric disorder groups, except for

substance abuse/dependence. The largest difference was found in the personality disorders group, while the risk in females (5.3; 95% CI, 3.6-7.8) was more than twice that in males (2.5; 95% CI, 1.7-3.7). After the Bonferroni correction, females with anxiety disorders and males with anxiety disorders and schizophrenia were no longer associated with increased risk of self-harm (Table A3, appendix pp 16). The adjusted HRs (95% CIs) by psychiatric disorder, stratified by age groups, are shown in Figure 5. The highest risk was found in substance abuse/dependence group for all age groups (adolescent: aHR, 9.6; 95% CI, 7.2-12.7; young: 10.2; 95% CI, 8.4-12.3; middle-aged: 11.2; 95% CI, 8.0-15.6; Elderly: 3.2; 95% CI, 1.7-6.1). The adolescent group (10-24 years) had the highest risks of self-harm in the depression (aHR, 4.6; 95% CI, 3.4-6.3), personality disorders (4.8; 95% CI, 2.6-8.8), and schizophrenia (1.8; 95% CI, 1.4-2.4) groups, comparing with other age groups. The young age group (25-44 years) had the highest risk in the bipolar (1.9; 95% CI, 1.4-2.7) and anxiety (1.9; 95% CI, 1.4-2.5) disorders groups. The middle-aged group (45-64 years) had the highest risks in the alcohol (4.2; 95% CI, 3.4-5.2) and substance abuse/dependence groups. The risks were generally lower for the elderly group (65+ years) across all psychiatric disorders. The adjusted HRs for all independent variables in the Cox proportional hazard regression models are documented in Table A2 (appendix pp 9-15). The test results of interaction between the specific psychiatric disorders and gender/age groups are tabulated in Table A4 (appendix pp 17-18). The results show that the differences between gender/age groups are statistically significant. The sensitivity analysis shows that excluding undetermined self-harm (E980-E989) did not have a significant impact on the results. Details are provided in Table A5-7 (appendix pp 19-21).

Discussion

To our best knowledge, this paper presents results from the first attempt at systematically investigating the subsequent risk of self-harm after the first-recorded diagnosis of psychiatric disorder in a Chinese society. The dataset used in this study is based on longitudinal data from comprehensive territory-wide electronic health records over a period of ten years. A particular strength is that risks of self-harm for people with specific psychiatric disorders were estimated using the same dataset and hence are directly comparable. In addition, the availability of comprehensive diagnosis records enabled sufficient controls with respect to gender, age, psychiatric disorders, and physical illnesses. Significant differences of subsequent self-harm incidence were found between all cases and controls groups, where the largest and lowest group was substance abuse/dependence and anxiety disorders, respectively. Substance abuse/dependence group had the highest self-harm risk after adjusting for covariates. Considerable differences in risks of self-harm were found in different gender-age subgroups, across psychiatric disorders. In general, the risk of self-harm was unexpectedly high in patients with substance abuse/dependence and personality disorders, irrespective of gender and for

almost all ages at diagnosis. Females of any age, and younger people had elevated risks of self-harm for most psychiatric disorders. The findings were robust following sensitivity analysis.

Depression, substance and alcohol abuse/dependence, schizophrenia, anxiety, bipolar, and personality disorders all have been shown to be significant factors associated with self-harm. When investigating the links between psychiatric disorders and self-harm or suicide, findings are dominantly generated from retrospective and psychological autopsy studies, where the relative risk is estimated by first identifying a sample of people with suicide behaviour and then retrospectively extracting their information on a principal or multiple psychiatric disorders.¹⁶ An emerging body of research were, instead, interested in estimating the absolute risk of self-harm or suicide after the onset of psychiatric disorders. This type of study identifies patients with psychiatric disorders from a population representative sample and follow them for a sufficiently long observational period. Evidences on relative importance of a specific psychiatric disorder in terms of the absolute risk are hence limited to countries with well-established health registries such as Demark,⁴ Sweden,⁵ England,¹⁷ and the United States.¹⁸ Our study is the first study conducted in Asia to compare the absolute risk of self-harm over a potential ten-year exposure period, associated with specific psychiatric disorders. Studies from both the United States and Denmark identified depression as the strongest factor associated with suicide,^{4,18} while a Swedish study found that schizophrenia and bipolar and unipolar disorder were associated with the highest risks of suicide.⁵ Note that since the main outcomes of all these three studies were suicide instead of self-harm, findings regarding the risks are not directly comparable with this current investigation. To our knowledge, the only comparable results were generated from an English cohort, which reported depression and bipolar disorder as the most predictive disorders for self-harm, followed by anxiety & neurotic disorders, alcohol abuse, schizophrenia, eating disorders and substance abuse. In Hong Kong, although no territory-wide study have investigated the absolute risk of self-harm following a specific psychiatric disorder, a comprehensive psychological autopsy study found that the population attributable risk for suicide was 44% for suicide attempt, 27% for depression, 22% for schizophrenia, and 16% for substance abuse.¹⁹ Many differences can be detected between previous studies and this current study. To illustrate, although substance abuse/dependence has consistently been established as a significant risk factor, its associated risks of suicide and self-harm have been substantially lower than depression and bipolar disorder. Schizophrenia, another major risk factor according to earlier studies, is associated with an unexpectedly lower risk of self-harm compared to substance abuse/dependence and alcohol abuse/dependence. Except for the Danish study which identified personality disorders as the second strongest risk

factor of suicide, this study is the only study identified the highest risks of self-harm in the substance abuse/dependence and personality disorders groups.’

This study highlights the extremely high risk of self-harm associated with substance abuse/dependence that are evident in all gender-age groups, which is in accordance with findings from international literature.^{3,4} Though a number of studies stated that substance abuse/dependence was usually comorbid with other psychiatric disorders,^{4,20} the elevated risk of self-harm is still significantly particularly high in our study after adjusting for these comorbidities. This finding suggests that substance abuse/dependence are significant contributors for self-harm apart from the effect of other psychiatric disorders. There are a few Hong Kong studies found that substance abuse/dependence was significantly associated with suicidal ideation or behavior in adolescents, with odds ratios ranging from 1.35 to 15.55.^{21,22} However, studies focusing on other age groups are rare. It is seen from this study that substance abuse/dependence are robustly associated with substantially higher risks of self-harm, comparing with other selected psychiatric disorders, for people under age 65 years in Hong Kong.

There has been fewer large-scale studies examining the association between personality disorders and self-harm behaviours,⁴ though a meta-analysis based on 94 committed suicide showed that borderline personality disorder is associated with high suicide risk.²³ This study provides new evidence demonstrating that personality disorders are significant risk factors for self-harm, although the risk decreases with age. Previous studies indicated that personality disorders are strongly comorbid with other psychiatric disorders in self-harm cohort.²⁴ This could be a possible explanation for the greatly decrease risk of self-harm in personality disorders group after adjusting for confounders in our study. More specifically, one study found the elevated risk of suicide in those with both personality disorders and other psychiatric disorders (OR: 346; 95 % CI: 31.4-3811) were about nine times higher than in those only with personality disorders (40.0; 7.2-38.3).²⁵ The association between comorbid psychiatric disorders and self-harm is complex and worth more detailed investigation in the future.

Schizophrenia is one of the most severe mental disorder with a life-time risk of suicide up to six percent.⁸ However, the risk of self-harm associated with schizophrenia is surprisingly low, ranging from 1.0 (95% CI, 0.8-1.3) in the elderly group to 1.8 (1.4-2.4) in the adolescent group. This inconsistency with previous findings is likely due to two reasons. First, our study subjects are limited to patients who were already in the health care system and likely with treatments in place. Second, given that the cause of death information is not available, all-cause mortality was treated as censored and may systematically lower the estimates of HRs.

The gender differences in previous studies were not consistent. An England study covering seven psychiatric disorders showed a higher self-harm risk in males for all groups.³ In this Hong Kong setting, we found almost the opposite results to the England study³ that females had greater risk of self-harm than males in all psychiatric disorder groups, except for substance abuse/dependence. This finding is in line with another local study which showed that the lifetime suicidal ideation rate in females (35.3%) was significantly higher than in males (20.2%).²¹ Further studies are required to investigate this finding, and to understand gender-related causes.

One recent review study estimated that the self-harm rate in Hong Kong adolescent ranged from 11.9 % to 32.7%,²⁶ higher than the world average of 10%.²⁷ The present study also shows that the risk of subsequent self-harm keeps prevailing in younger groups for all selected psychiatric disorder groups except for alcohol and substance abuse/dependence. The stigma associated with psychiatric disorder could be one possible reason for the severe situation, which is a sturdy barrier for adolescents' disease detection and help-seeking behaviour.²⁷ Future intervention program for younger group should be focus more on decreasing mental health related stigma and removing the obstacle in access to high quality psychological service.

Depression was the most common psychiatric disorder among the self-harm population and it was estimated that up to 70% self-harm patients had a depression episode.^{2,24} Our study found that some 40% depression cases were older adults, and this figure could be under-estimated due to the stigma and common under-diagnosis in the elderly depression population,^{28,29} indicating that late-life may be a vulnerable period of depression. Preventing depression in later life is conceivably a critical part of suicide prevention.

Limitations

This study has several limitations. First, the study sample employs only inpatient records from CDARS. Data from private hospitals and clinics, general outpatient clinic services and accident & emergency departments are not included. Using inpatient data only could cause biased estimates from two directions. First, given the general situation of undertreatment and under-diagnosis of psychiatric disorders^{20,30} and the possibility that less severe cases are likely to be managed in outpatient clinics, hazard ratios in this study may be over-estimated. Second, people receiving inpatient service have complicated medical needs. Controls selected from the inpatient database are hence likely to be associated with a higher self-harm/suicide risk than the general population, and lead to under-estimated hazard ratios. The representativeness of the

results may also be limited to the study period as patients were only followed until 2010. Other data sources need to be integrated to increase the accuracy of these findings in the future.

In this study, we adopted the broad self-harm category, where deliberate, self-injurious behaviours with a suicidal intent and actions that are not suicidal, unintentionally and intentionally inflicted, were both included. This broad definition of self-harm entails a wide range of behaviours and people who had a diagnosis of self-harm are not necessarily suicidal. Caution is thus urged when comparing our results with previous studies investigating self-harm risk in patients with psychiatric disorders.

The intervention and treatment information of psychiatric disorder patients, which could have significant influence in the results, are not available in our current dataset. One Hong Kong study found schizophrenic adolescents in early intervention group had significant less risk of suicide compared with those only received standard general psychiatric service.⁸ The effectiveness of related treatment and intervention should also be considered in our future research. Given that psychiatric disorders are highly comorbid, increased risk of self-harm is likely to come from the coexisting of several psychiatric disorders rather than the single one. This current investigation treated comorbid psychiatric disorders as control variables without further exploring the interaction effects of different combinations of comorbidity on the risk of self-harm. Future efforts should be made on systematically inspecting the comorbidity network and their subsequent risk of self-harm.

We attempted to study the association between the onset of specific psychiatric disorders and subsequent self-harm behaviours. However, since clinical records before 2000 were not available, it is uncertain whether the first record as shown in this current database is in fact the first diagnosis of a psychiatric disorder. In the case where the onset happened before 2000, the exposure time between the first diagnosis of psychiatric disorder and self-harm record will be shortened and lead to biased results. Another source of bias comes from the unknown cause of death. People who died before any record of self-harm were treated as censored cases and consequently make non-suicide deaths a competing risk.³¹ In addition, data on self-harm are available only via hospital records. As with any self-harm record, there is a risk of under-reporting. For example, those who sort private help, less severe self-harm requiring no acute medical care, self-harm presenting as other issues, passive self-harm.

Finally, self-harm is a complicated behaviour effected by several potential factors (e.g. demographic, social, economic, cultural, psychological, environmental).² However, limited by the data source, we only considered clinical risk factors.

Implications

As recommended by World Health Organization (WHO), identifying the high-risk self-harm population is significant component for self-harm and suicide prevention program.³² In addition to healthcare professionals such as psychiatrist and general practitioners, the varying risk of self-harm according to patients' gender, age, and diagnostic category is relevant to policy makers and clinical guideline committees for identifying the heightened risk groups and providing more efficient and targeted prevention strategies for high-risk populations, even for people with no self-harm history.

Declaration in Interest

None.

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Nil

Author contribution

Y Chai: formulating the research questions, analyzing the data and taking the lead in writing the article

H Luo: formulating the research questions, reviewing the analysis, designing the study and writing the article

GHY Wong, JYM Tang, TC Lam, and ICK Wong: Critically reviewing the analytical frame work, writing the article

PSY Yip: formulating the research questions, reviewing the analysis, designing the study and writing the article

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Table 1. Sample characteristics of the case cohort^a

	Psychiatric disorder						
	Depression	Alcohol abuse/dependence	Personality disorders	Bipolar disorders	Anxiety disorders	Schizophrenia	Substance abuse/dependence
Patients, N	27935	10884	2465	5707	11955	26658	8679
Gender, N (%)							
Female	19109 (68.4%)	2170 (19.9%)	1372 (55.7%)	3367 (59.0%)	8462 (70.8%)	13983 (52.5%)	3307 (38.1%)
Male	8826 (31.6%)	8714 (80.1%)	1093 (44.3%)	2340 (41.0%)	3493 (29.2%)	12675 (47.5%)	5372 (61.9%)
Age at diagnosis, N (%)							
10-24	1754 (6.3%)	1409 (13.0%)	577 (23.4%)	1067 (18.7%)	1470 (12.3%)	3162 (11.8%)	2096 (24.2%)
25-44	7174 (25.7%)	3942 (36.2%)	1161 (47.1%)	2533 (44.4%)	3842 (32.1%)	11542 (43.3%)	4792 (55.2%)
45-64	7970 (28.5%)	3835 (35.2%)	524 (21.3%)	1611 (28.2%)	3348 (28.0%)	8417 (31.6%)	1413 (16.3%)
65+	11037 (39.5%)	1698 (15.6%)	203 (8.2%)	496 (8.7%)	3295 (27.6%)	3537 (13.3%)	378 (4.3%)
Mean (SD)	56.4 (20.6)	45.4 (17.3)	37.8 (16.7)	40.2 (16.1)	49.5 (20.4)	43.9 (16.6)	34.7 (13.9)

^a Since controls are matched by gender and age, sample characteristics of the control groups in terms of gender and age are the same as the corresponding case groups

Table 2. Incidence of self-harm among study cohort in different psychiatric disorder groups

Psychiatric disorder	No. of self-harm patients		Proportion of self-harm during follow-up, %		Incidence per 100,000 patient-years (95% CI)	
	Case	Control	Case ^a	Control ^a	Case	Control
Depression	1420	902	5.1%	1.6%	1396 (1325-1471)	442 (413-471)
Alcohol abuse/dependence	800	414	7.4%	1.9%	1486 (1385-1591)	404 (367-444)
Personality disorders	297	89	12.1%	1.8%	3174 (2827-3549)	449 (362-548)
Bipolar disorders	209	196	3.7%	1.7%	729 (634-832)	358 (310-411)
Anxiety disorders	365	396	3.1%	1.7%	676 (609-748)	393 (356-433)
Schizophrenia	914	989	3.4%	1.9%	686 (643-731)	383 (360-408)
Substance abuse/dependence	1298	270	15.0%	1.6%	3018 (2857-3185)	290 (256-325)

^a Pearson's Chi-squared test was conducted and p values for all psychiatric disorder groups were less than 0.0001

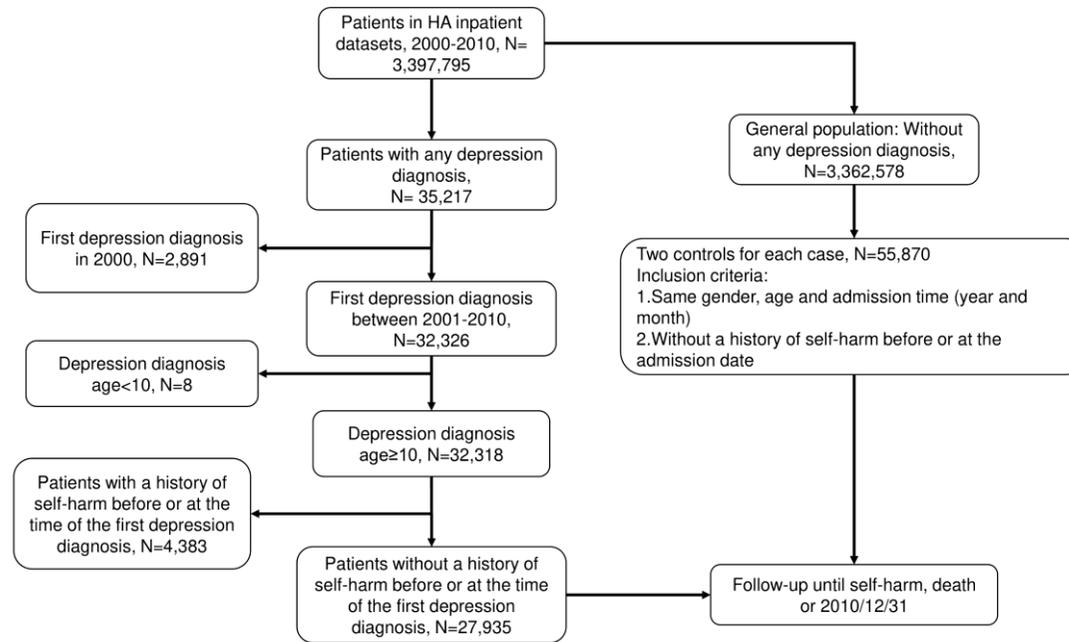


Figure 1(a). Flowchart of the case and control identification procedure for the depression group

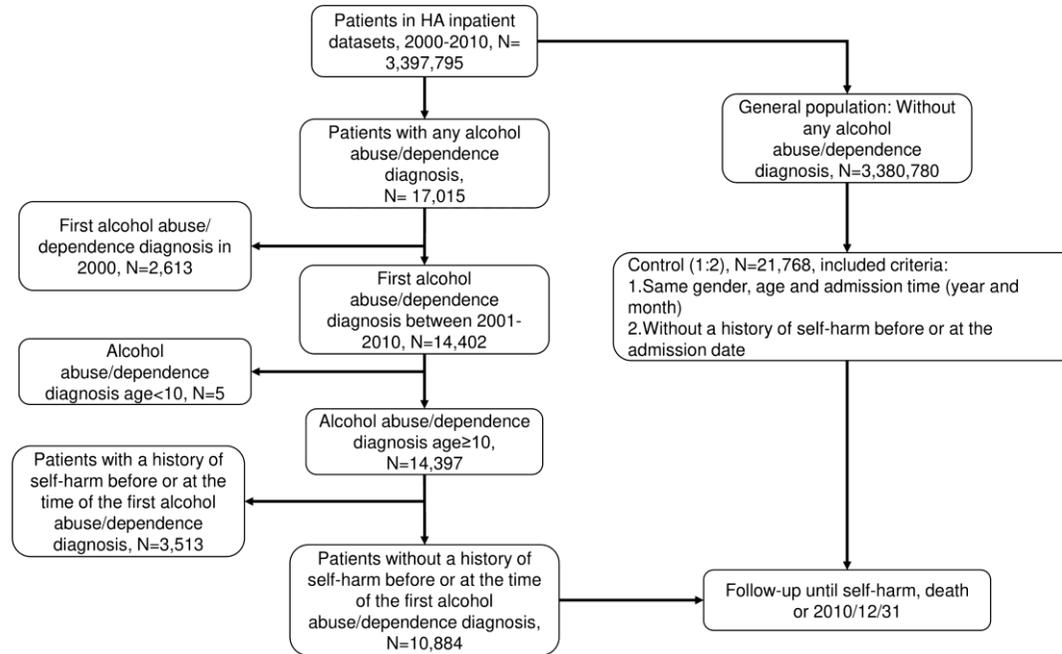


Figure 1(b). Flowchart of the case and control identification procedure for the alcohol abuse/dependence group

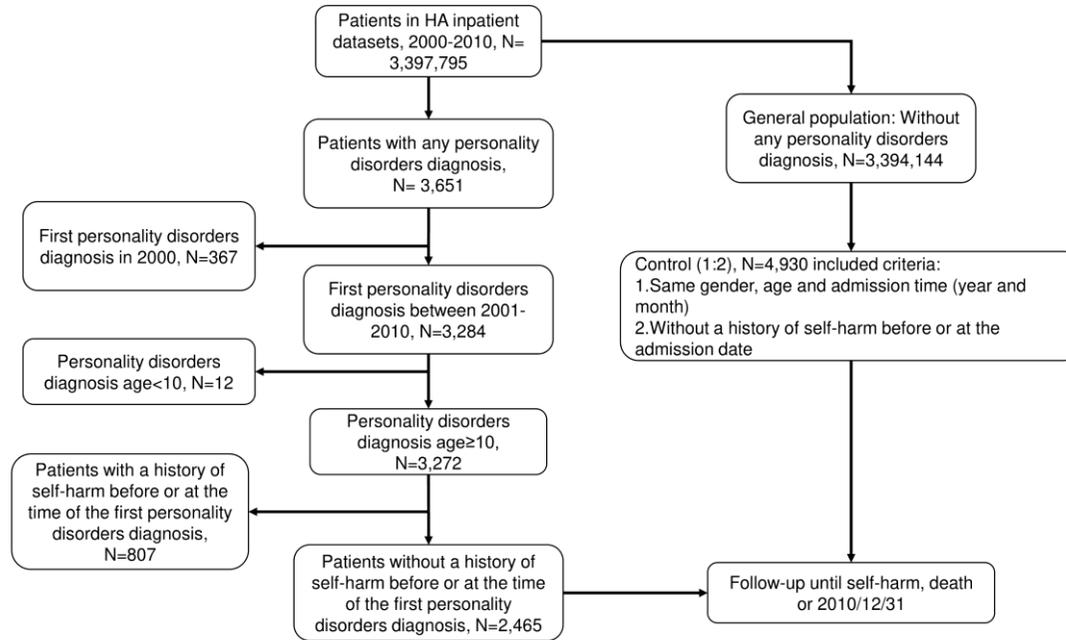


Figure 1(c). Flowchart of the case and control identification procedure for the personality disorders group

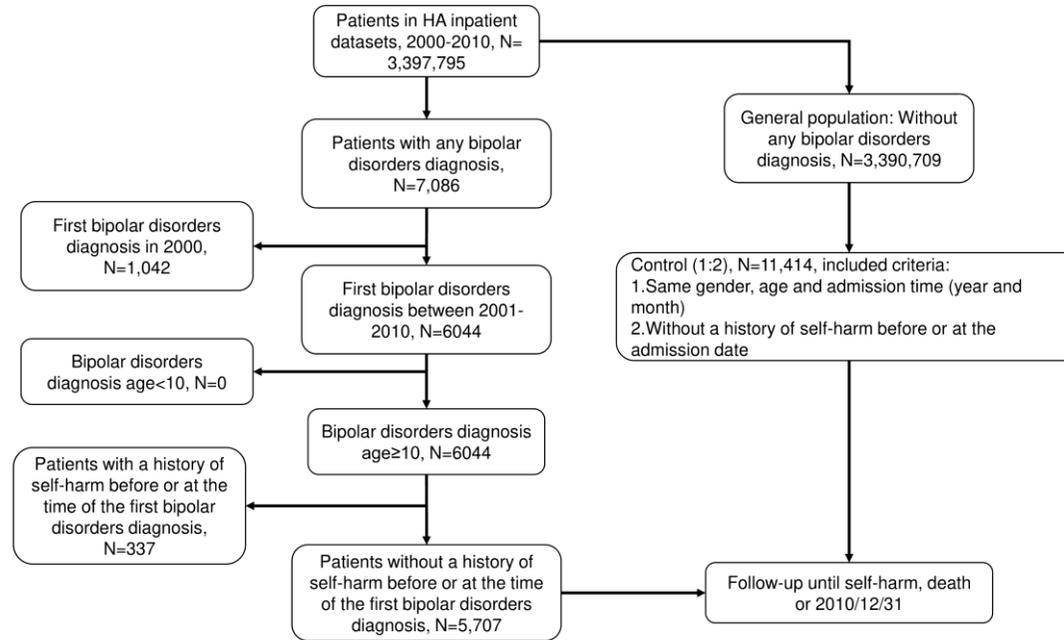


Figure 1(d). Flowchart of the case and control identification procedure for the bipolar disorders group

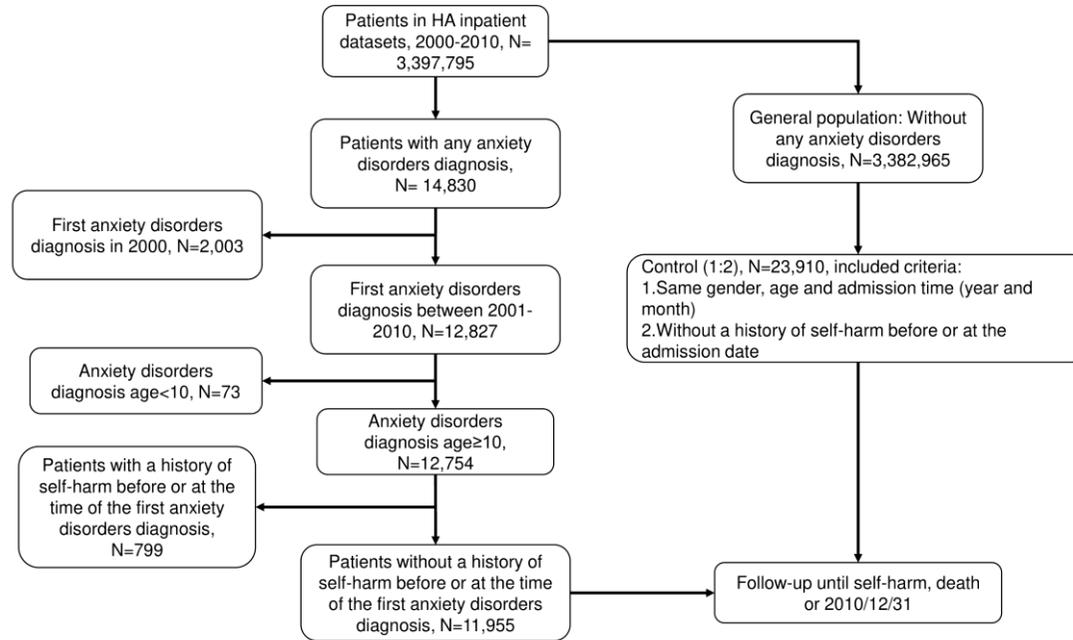


Figure 1(e). Flowchart of the case and control identification procedure for the anxiety disorders group

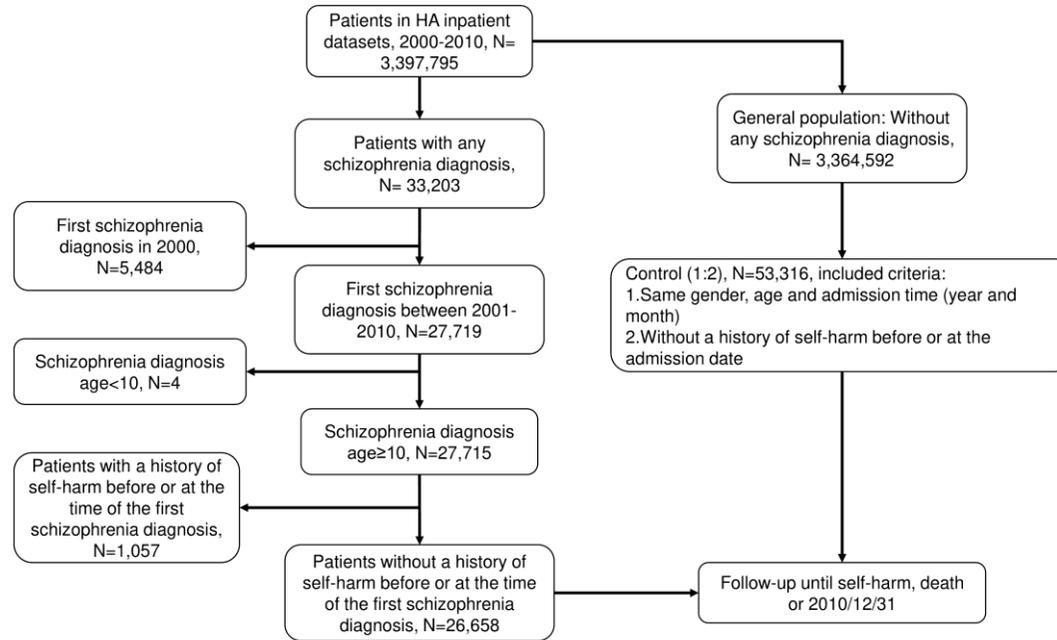


Figure 1(f). Flowchart of the case and control identification procedure for the schizophrenia group

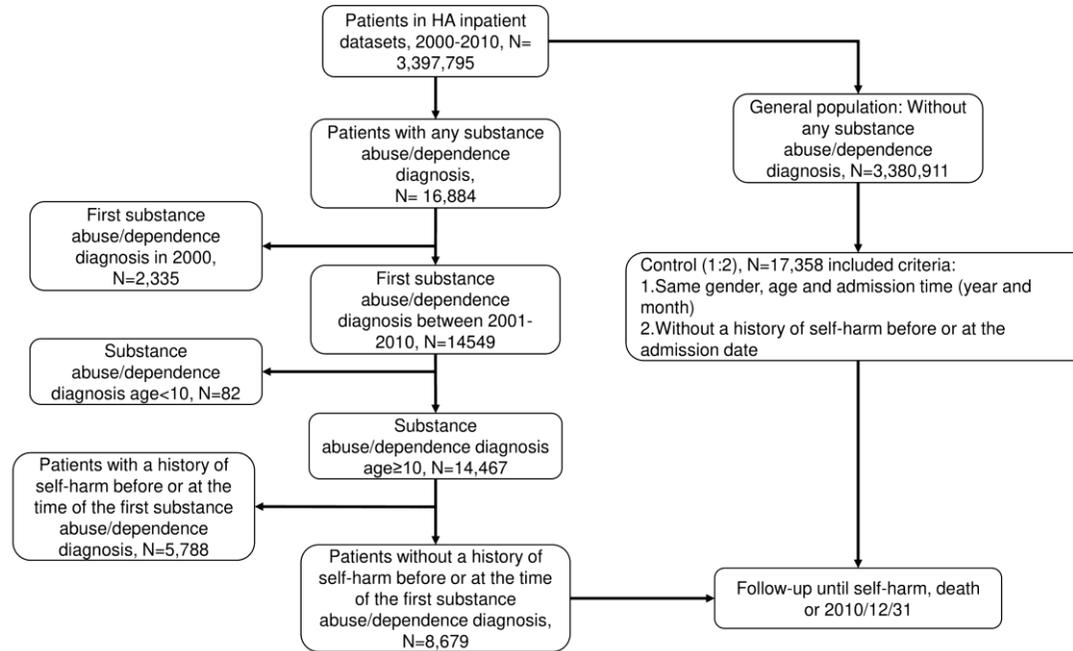
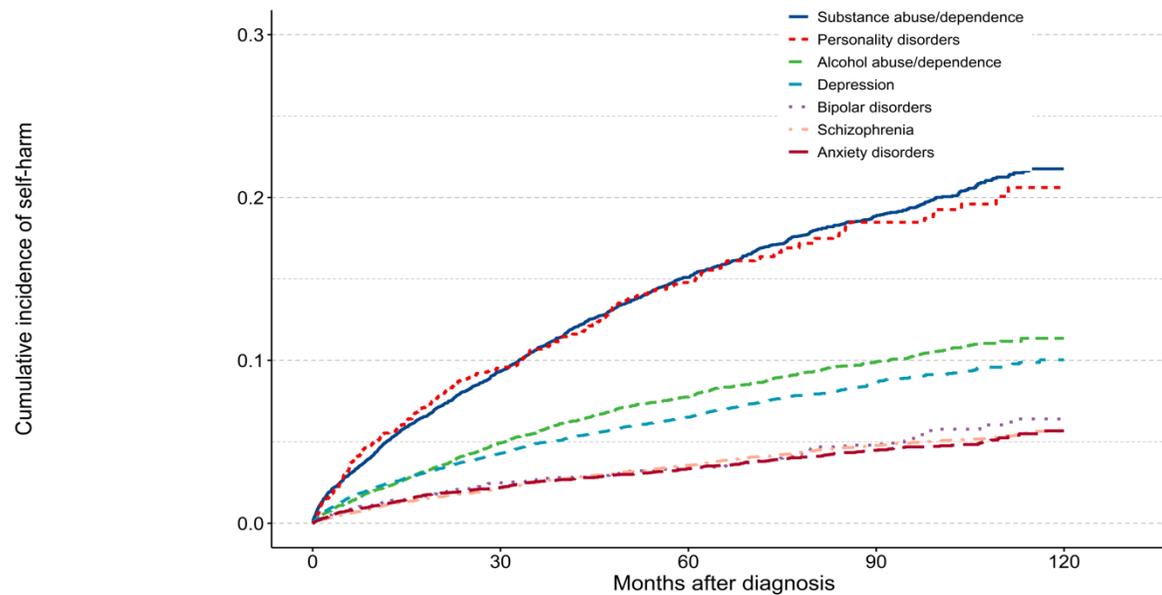


Figure 1(g). Flowchart of the case and control identification procedure for the substance abuse/dependence group



	Number at risk				
	0	30	60	90	120
Substance abuse/dependence	8679	6272	4234	2381	0
Personality disorders	2465	1402	799	420	0
Alcohol abuse/dependence	10884	7491	5292	3315	0
Depression	27935	14977	9116	4212	0
Bipolar disorders	5707	4161	2925	1538	0
Schizophrenia	26658	19119	13385	7490	0
Anxiety disorders	11955	7225	5272	3306	0
	Cumulative number of censoring				
	0	30	60	90	120
Substance abuse/dependence	0	1663	3355	5057	7381
Personality disorders	0	864	1402	1754	2168
Alcohol abuse/dependence	0	2930	4934	6806	10084
Depression	0	12012	17588	22338	26515
Bipolar disorders	0	1420	2622	3976	5498
Schizophrenia	0	7040	12533	18291	25744
Anxiety disorders	0	4512	6391	8306	11590

Figure 2. Cumulative incidence curves of self-harm by psychiatric disorder in people admitted to hospital during 2001-2010 in Hong Kong

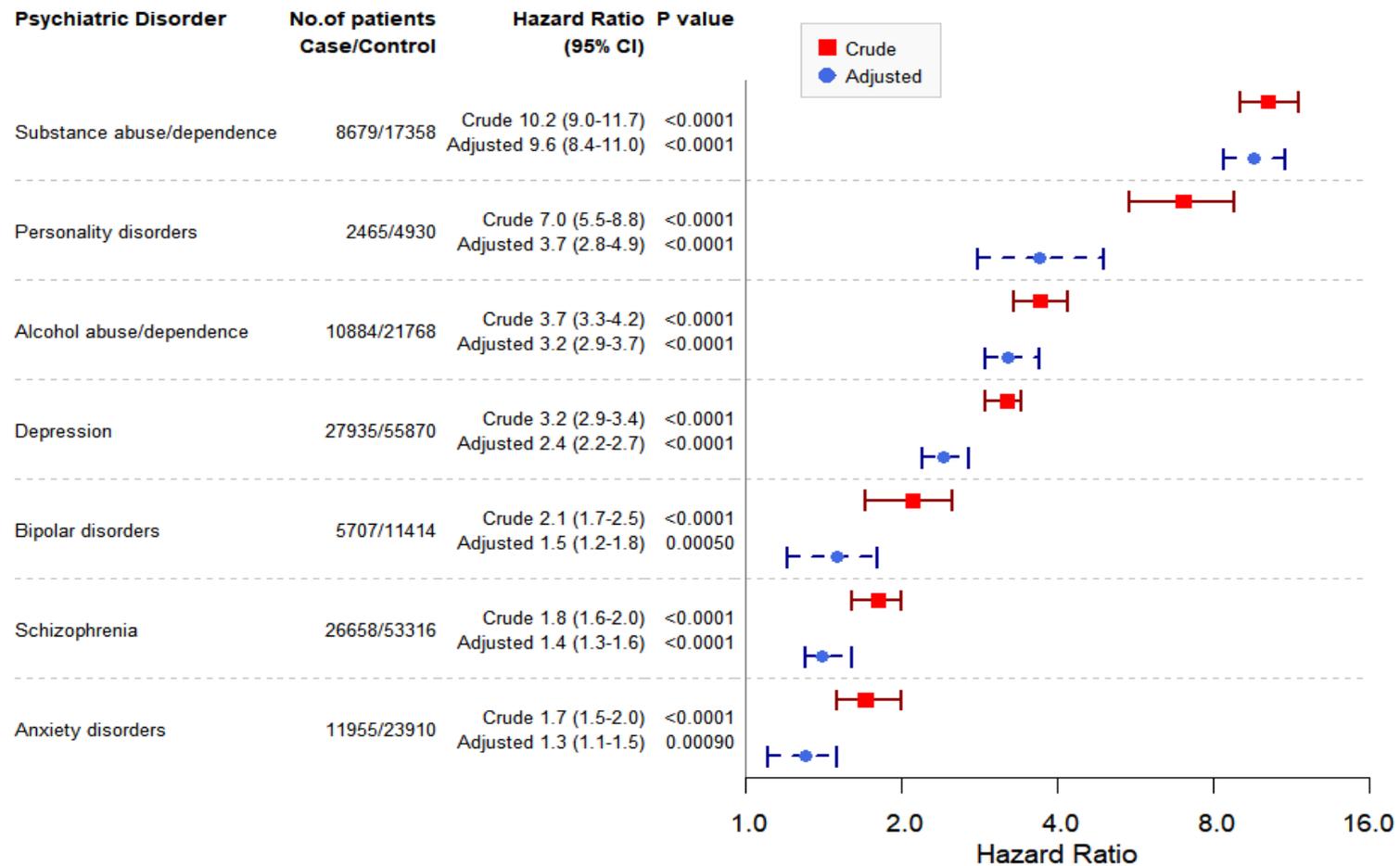


Figure 3. Crude and adjusted hazard ratios¹ of self-harm by psychiatric disorder

¹ Crude hazard ratios were adjusted for gender, age, and admission time through matching. Adjusted hazard ratios were further adjusted for twenty districts of residence (Kwai Tsing, Tsuen Wan, Tuen Mun, Yuen Long, North, Tai Po, Sha Tin, Sai Kung, Islands, Yau Tsim Mong, Sham Shui Po, Kowloon City, Wong Tai Sin, Kwun Tong, Central and Western, Wan Chai, Eastern, Southern, Outside Hong Kong, and Others), six physical illnesses (diabetes, asthma, migraine, epilepsy, HIV, and cancer), and the presence of other six psychiatric disorders.

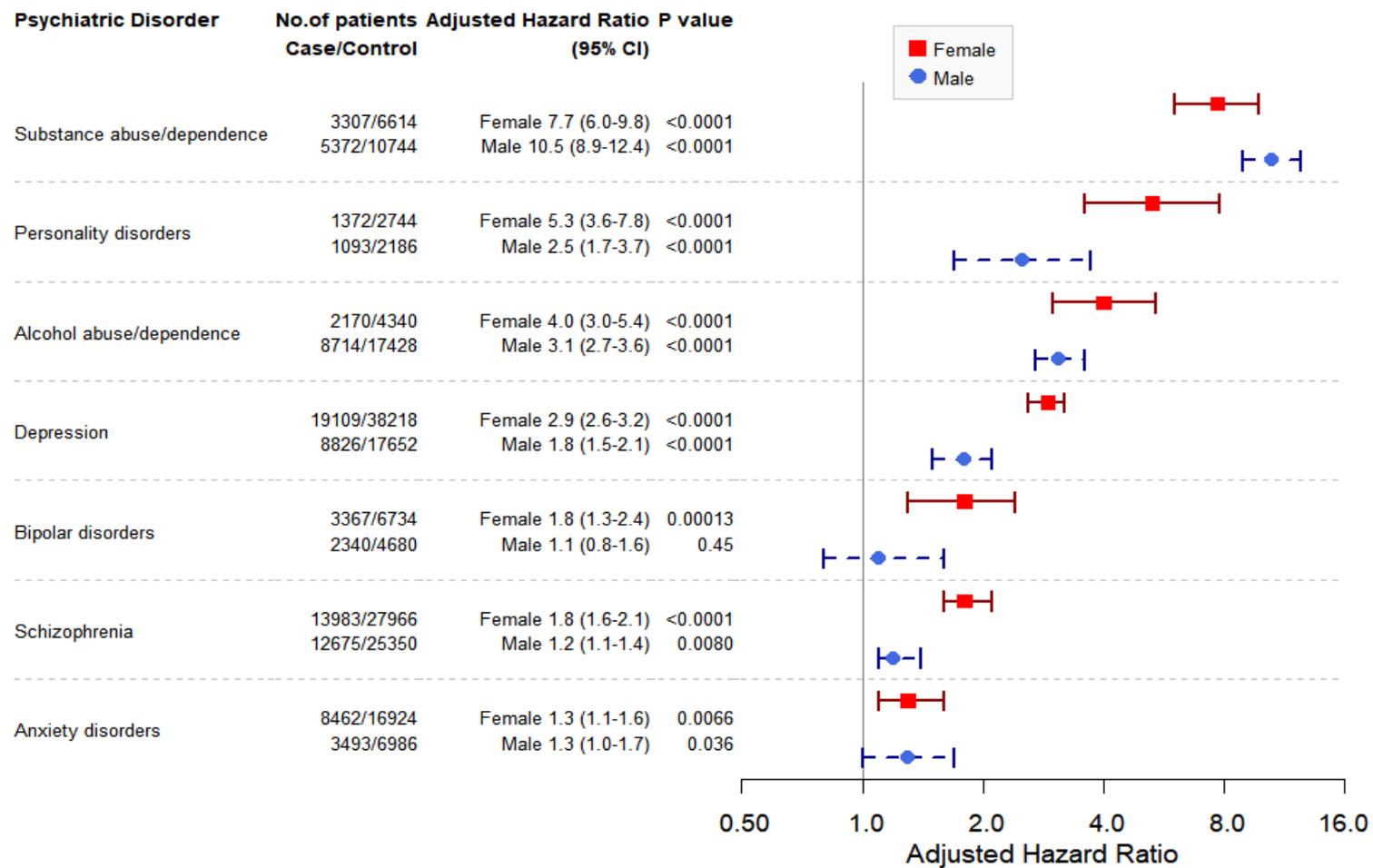


Figure 4. Adjusted hazard ratios¹ of self-harm by psychiatric disorder, stratified by gender

¹ Adjusted hazard ratios were adjusted for age and admission time through matching, and further adjusted for twenty districts of residence (Kwai Tsing, Tsuen Wan, Tuen Mun, Yuen Long, North, Tai Po, Sha Tin, Sai Kung, Islands, Yau Tsim Mong, Sham Shui Po, Kowloon City, Wong Tai Sin, Kwun Tong, Central and Western, Wan Chai, Eastern, Southern, Outside Hong Kong, and Others), six physical illnesses (diabetes, asthma, migraine, epilepsy, HIV, and cancer), and the presence of other six psychiatric disorders.

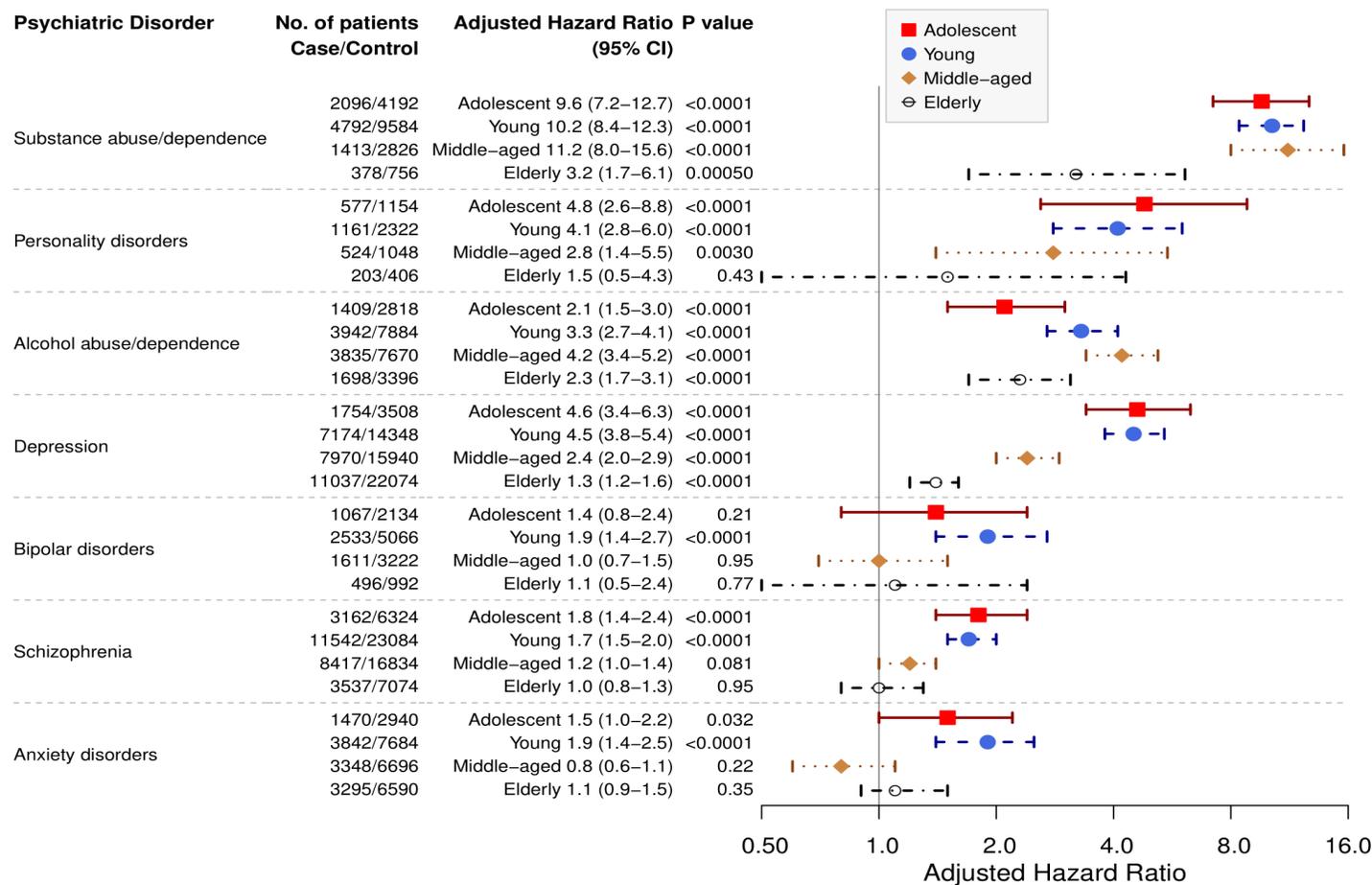


Figure 5. Adjusted hazard ratios¹ of self-harm by psychiatric disorder, stratified by age groups

¹ Adjusted hazard ratios were adjusted for gender and admission time through matching, and further adjusted for twenty districts of residence (Kwai Tsing, Tsuen Wan, Tuen Mun, Yuen Long, North, Tai Po, Sha Tin, Sai Kung, Islands, Yau Tsim Mong, Sham Shui Po, Kowloon City, Wong Tai Sin, Kwun Tong, Central and Western, Wan Chai, Eastern, Southern, Outside Hong Kong, and Others), six physical illnesses (diabetes, asthma, migraine, epilepsy, HIV, and cancer), and the presence of other six psychiatric disorders.