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急診兒科精神病患就診之趨勢與臨床特徵:
台灣某區域醫院七年之回溯性分析

Trends and Clinical Features of Pediatric Psychiatric Visits to the Emergency Department: a 7-Year Retrospective Analysis in a Regional Hospital in Taiwan

卓靜怡

CHING-YI CHO

指導教授：張弘潔 博士

Advisor: HUNG-CHIEH CHANG, Ph.D.

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口試委員會審定書

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本論文係卓靜怡君（P10848003）在國立臺灣大學健康政策與管理研究所完成之碩士學位論文，於民國 112 年 05 月 24 日承下列考試委員審查通過及口試及格，特此證明

口試委員：

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致謝

送出申請文件、面試、拿到台大學生證、踏入公衛大樓上第一堂課……每個畫面還歷歷在目，轉眼已是準備交出論文的畢業時節。

入學時疫情尚未趨緩，第一年與同學們幾乎是在口罩掩面之下、實體與線上輾轉之間，度過每個週末、拼搏無數份報告，而逐漸熟識，建立了革命情感。

屢行當初給自己的承諾來唸了健管所，我想是人生至此，最正確的決定之一 。得以跳脫日復一日生活與工作的恆常、透過同學與師長看見各種可能、也終將數年前因臨床觀察而埋藏心中的困惑，轉化爲數字、圖表、文字，付梓為本篇論文。以上都是兩年前收到錄取通知時想像不到、超乎預期的。

能有這些蛻變，我想感謝指導教授弘潔老師一路以來的支持鼓勵、指點引領、熱誠感召，啟發我用更客觀多元的角度評判分析；感謝 EMHA110 同學的陪伴與肯定，重返校園而能結識這麼一群善良熱血的朋友，何其有幸；最感謝無論豔陽風雨，總是給我溫暖依靠和堅定後盾的家人-爸爸、媽媽、小比、烏梅，因為你們，我有勇氣走到現在，也敞開胸懷心存感激，擁抱接下來的所有。

或許，一切真的都是最好的安排。

卓靜怡 僅誌于
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中文摘要

研究背景:近年國際研究均發現兒童罹患精神疾病比例有增加之勢，台灣於 2017 年首次針對兒童精神疾病的研究調查顯示，近三分之一兒童終其一生有心理健康疾患，近六個月自殺意念盛行率達 3.1%；因精神疾患至急診就醫之兒科病患數目亦逐年上升。精神疾患對於生理尚在發育，心理人格正處形塑階段之兒少產生重大且長期的影響，對社會之衝擊亦不容小覷。家庭能否給予支持、學校有無適切的輔導、在醫療體系中是否持續且妥善被治療，都是病患康復程度、保有正常社交工作與生活能力的關鍵。除了急性處置，兒科精神病患在急診是否得到適切的專科照會、轉介、後續追蹤等，目前仍缺乏研究。

研究目的:本研究針對兒科病人因精神疾患至急診就診之流行病學，其在急診室接受之處置、等待時間、離院動向、再返診頻率做分析探討，以了解近年兒科急診精神病患就診趨勢、疾病診斷與臨床因子分布，及其與急診兒科其他病患的差異，並檢視相關醫療資源和人力之運用。研究成果可提供醫療機構、政策制定單位作為客觀參考依據。

研究方法:本研究分析自 2015 年 1 月 1 日至 2021 年 12 月 31 日七年間，於臺大醫院新竹分院兒科急診就診之零至十八歲，且符合精神疾患診斷之個案，其臨床表徵(年齡、性別、疾病診斷)、是否有自傷傷人行為(性別差異、所用的自傷方式是否不同)、是否接受精神科醫師及社工會診、在急診停留的時間、離院動向、一年內返診頻率，並與主訴非精神疾患之兒科急診病患做比較。

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研究結果:2015 至 2021 年間，至台大醫院新竹分院兒科急診就診之案例共 105976 人次，其中 925 人次(0.87%)有精神疾患診斷。歷年兒科急診就診人次有下降趨勢，但因精神疾患就診人數佔比卻增加十倍之多，尤其新冠疫情期間更為顯著。所有兒科精神病患中青少年(13-18 歲)佔 71.78% ，女性患者居多。疾病診斷以憂鬱症、躁鬱症、自殺為前三名，其累積成長率皆超過 100%。不同年齡及性別的精神疾病診斷有顯著分布差異。而所有病患中僅 28.9%患者接受精神科醫師會診，18.6%有社工介入。相較於非精神疾病診斷的病人，精神病患在急診留滯時間顯著較長，一年內返診頻率也較高。兒童精神病患的離院動態，住院比例約增加兩倍，離院及安排門診追蹤之比例則相對穩定。

結論及建議：急診是兒童精神病患及其家庭相當重要的醫療資源和社會支持介入節點，也是後續能否得到適當治療處置的關鍵。研究結果顯示，罹患精神疾患並有治療需求的兒童和青少年有逐年增加之勢，但目前急診的環境設備和人力配置還無法給予相應的回饋與照護。此議題尚須醫療機構及政策制定單位多方檢討、合作，針對精神科專業人員配置、高風險病患篩檢系統建立、急診室環境和處置流程改善等面向努力，才能提升兒童精神病患的整體醫療與生活品質。

關鍵字:兒童、兒科、青少年、精神疾患、急診、自殺、人力配置

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英文摘要

Background and objectives

Steep rise of mental disorders among children had become a major child public health concern that reflected the urgent but unmet demand of psychiatric health care. Pediatric emergency departments (PED) are usually the first checkpoint of entry into health system for the newly diagnosed patients or disease crisis. Timely recognition and properly management are crucial for stabilizing clinical condition, arranging future treatment outside of PED, and optimizing the prognosis. To improve pediatric PED settings for children seeking psychiatric services in Taiwan, a more accurate and contemporary description of current epidemiology and characteristics should be demonstrated. Our objectives are to explore (1) trend and demographic characteristics of PED visits of children with mental disorders; (2) distribution of psychiatric diagnoses during study period; (3) medical need and utilization of mental health PED visits.

Methods

This was a secondary data analysis of clinical data retracted from National Taiwan University Hospital Hisn-Chu Branch from January 2015 to December 2021. Every visitor aged 0-18 years old having mental disorder diagnosis were recruited. Analyses were conducted to present the trend of PED utilization and the association between different demographic and clinical factors.

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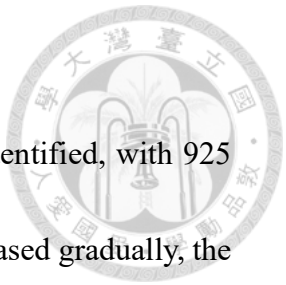

Results

Over the 7-year study period, a total of 105976 PED visits were identified, with 925 (0.87%) had mental health diagnosis. Despite the annual visits decreased gradually, the proportion of psychiatric requested reached a tenfold increase. The surge was heavily driven in 2020, when COVID-19 started raging. Youths 13-18 years of age accounted for 71.78% of the visits, and female preponderance was found. Depressive disorder, anxiety disorder, and suicide attempt remained the leading diagnosis and their cumulative growth increased by more than 100%. The diagnoses differed across gender and age with significance. Only 28.9% psychiatric visits received evaluation by psychiatrists, and 18.6% of them were contacted by social workers. Compared to patients with other chief complaints, mentally ill children had longer length of stay at PED ($p<0.05$) and more frequent return. Their admission rate almost doubled during study period while the discharge rate remained relative stable.

Conclusions

PED is an important community resource for helping children and family get through psychiatric crisis and bridging them into appropriate psychiatric treatment, particularly with the relative shortage of outpatient and other supportive setting. The multidisciplinary cooperation focusing on psychiatric manpower relocation, risk screening system buildup, process and environment refinement at PED must be

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engaged in order to provide comprehensive, equitable, and timely access to pediatric mental health care.

Key words: children, pediatric department, adolescent, mental disorders, suicide, emergency department, manpower allocation

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第一章 緒論及文獻回顧

(Introduction and Literature Review)

Mental disorders in children had been a high-profile issue for decades since the physical illnesses not only impair the individual development but also bring great impacts on family or even socioeconomic infrastructure. Fully recognizing the importance of Child and adolescent mental health (CAMH), World Health Organization (WHO) proposed that every country around the world should have a national plan for child mental health since 1977.[1]

Numerous countries conducted surveys and released the worrying concern- globally, approximately one out of every four to five children now experience mental health problems and satisfy life time criteria for a Diagnostic and Statistical Manual of Mental Disorder (DSM), one in seven 10-19 year old adolescents suffer from a psychiatric illness, comprising 13% of the worldwide burden of disease in this age group, yet these remain largely undiagnosed and untreated.[2–4] An abundance of studies has shown that most adulthood mental disorders stems from childhood and adolescence.[5,6] Failing to properly manage childhood psychiatric circumstances impairs both physical and mental health and limiting opportunities to lead fulfilling lives as adults. This affirms the importance of thoroughly interpretating the scale and risk factors of mental disorders in youth.[4] However, mental health care and supportive system for children are

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complicated and expensive, the time-consuming clinical feedback and suboptimal reimbursement limit the incentives to expand the services.

The inadequate or inappropriate management of the diseases due to either relative lacking of supportive system or personal reason, makes it highly possibly that the pediatric emergency departments (PED) become the initial contact of medical help for children with mental illnesses, serve as the critical safety net.[7,8] Statistics among western countries reported that despite the relative stable patient number of PED, visits for mental health disorders rose 60% and for deliberate self-harm increased 329% in the past decades.[9–11] Depressive and anxiety symptoms together with suicidal ideation increased significantly among all chief complaints.[12,13]

Several surveys disclosed that the mental health of youth has been negatively impacted by theme COVID-19 global pandemic.[14] While the number of PED visits dramatically reduced during the pandemic period, the proportion of PED visits for mental health conditions surged.[15–17] In addition, patients visiting for PED since the onset of COVID-19 outbreak have been more likely to require hospitalization and longer admissions.[14]

In Taiwan, a nation-wide epidemiological study conducted between 2015 to 2017 indicated that lifetime prevalence rates for overall mental disorders among elementary school children were 31.6%. The most prevalent mental disorders were anxiety disorders (12.0%), followed by attention-deficit hyperactivity disorder (ADHD) and

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sleep disorders.[18] Suicide was also a major public health issue and ranked second leading cause of death, accounting for 19% of all death among adolescents aged 12-17 years.[19] What makes the matter worse, due to the overcrowding and relative tight manpower in Taiwan's psychiatric health care as well as PED, children with mental disorder have limited chances to receive comprehensive psychiatric intervention, which inclusive of physician interview, social worker evaluation, and the corresponding management.[20–23] However, explicit data for current condition of PED visits of children with mental disorders in Taiwan are nonexistent. The epidemiological description from previous research may not be applied to Taiwan because of ethnic and cultural discrepancies. Furthermore, COVID-19 pandemic did tremendously impact the medical-seeking behaviors of Taiwanese and the disease distribution among children in Taiwan.[24–26]

Since childhood and adolescence is a crucial period for social and emotional development; whether youth population with mental disorder are being properly treated is a critical determinant for their further well-being, making it urgent and important for health providers and policy makers to have adequate and latest knowledge about the assessment and management of the frequently encountered illness, and current reality of pediatric psychiatric emergency resources utilization.

This study aims to understand 1) the trend and demographic characteristics of PED

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visits seeking for mental health care; 2) the distribution of mental disorders during the study period; 3) medical demand and utilization, which presented as psychiatric consultation, PED stay length, PED repeat visits, time of arrival at PED, observed among these patients. The most updated epidemiological data would highlight key issues, provide reference and directions for future pediatric mental health-related policies development and medical resource allocation.

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第二章 研究方法(Method)

2.1 研究設計 (Study design)

A retrospective study, recruiting clinical data from all patients aged between 0-18 years, presenting to PED, at National Taiwan University Hospital Hsin-Chu Branch, from 1 January 2015 to 31 December 2021 was conducted. We reviewed patients' demographic and clinical information such as age, gender, time of arrival, chief complaint, treatment and consultant received, length of stay, and discharge status. Patient with the diagnosis of mental disorders were further identified by aligning with the Healthcare Cost and Utilization Project Clinical Classification Software (CCS) groupings for mental health disorders.[27] CCS is a tool produced at the agency for Healthcare Research and Quality (AHRQ) for categorizing patient diagnoses and procedures into a manageable number of clinically meaningful categories according to International classification of diseases, Ninth Revision (ICD-9) and Tenth revision (ICD 10). The CCS categories and corresponding ICD-9 and ICD-10 codes are provided in Supplemental Table.

The clinical characteristics of patients with mental disorder diagnoses were analysis and compared with those without mental disorder diagnoses. When analyzing diagnoses of mental disorders, we further divided the patients into two categories – children (0-12 years old) and adolescents (13-18 years old), because of the different mental disorder prevalence and onset among children and adolescents.[6,18,28,29]

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2.2 研究對象 (Study source)

National Taiwan University Hospital Hisn-Chu Branch is a regional teaching hospital which focuses on critical and emergent care. It has a capacity of around 2000 beds, provides 24-hour emergent medical care. The PED is a “walk in” unit. Any visitor aged between 0-18 years is checked by a pediatrician first. If the patients had pervious diagnosed psychiatric history or presented with any psychiatric related symptoms/signs, doctors prescribe emergent treatment and consult psychiatric specialists or social workers for further evaluation and management if needed. After the assessment, either admission for advanced treatment or discharge with medication/ outpatient follow up would be ordered.

All the patients presenting to PED of National Taiwan University Hospital Hsin-Chu Branch, from 1 January 2015 to 31 December 2021 were recruited for the research.

2.3 資料分析 (Data analysis)

All the analysis were performed with statistical software SAS. Version 9.4. Conventional descriptive statistics were applied and reported by percentages for qualitative data, and by mean and standard deviation for quantitative data. Categorical variables were compared and determined whether data are significantly different using

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chi-squared test and Fischer's exact test. Continuous variables were analyzed with ANOVA. A *P*-value less than 0.05 was considered statistically significant. We applied *t* tests to determine statistically significant difference among group means.

2.4 研究倫理(Research ethics)

The study was approved by the Research Ethics Committee of National Taiwan University Hospital Hsin-Chu Branch, Taiwan (approval number:111-081-E), before study implementation.

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第三章 研究結果 (Results)

Over the 7-year study period, we identified 105976 PED visits at National Taiwan University Hospital Hsin-Chu Branch. The total annual number of PED visits continuously decreased (19415 visits in 2015 and 8516 visits in 2021 respectively) over time. Among these, 925 (0.87%) were primary mental health visits. The proportion of psychiatric requests almost reached a tenfold increase. (from 0.25% to 2.28% between 2015 and 2021) (Figure 1) The different aspects of these visits were described as the following.

3.1 人口學特徵(Demographic characteristics)

Table 1 illustrated demographic characteristics of patients admitted to PED. Compared with all PED visits, those with psychiatric diagnosis were associated with older age and female gender. The mean age of PED visits for all reasons fell at 7.37±5.89 years old, and 13.16±5.76 years old for patients with mental disorders. The group aged 13-18 years old were much more likely to visit PED for psychiatric purposes compare with the group aged 0-12 years old (P<0.0001). Patients aged 13-18 years old accounted for 71.78% (664 visits of 925) of the visits for mental health conditions across all years, while children 0-12 contributed to the rest of the visits. Rate increase in psychiatric PED visiting was observed notably among adolescents (71.43% in 2015 and 82.99% in

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2021 among all mental health visits).

For all PED visits, there was no gender difference. Yet, there was a female preponderance for mental health visits (*P*=0.0302), with girls accounting for 59.45% (550 visits of 925).

3.2 疾病診斷分佈(Diagnosis distribution)

The psychiatric diagnosis between 2015 to 2021 was demonstrated in Table 2. The rate of increase in psychiatric PED visits differed by diagnosis. Since CCS category was produced by redistributing the original ICD-9 and ICD-10 codes, over-coding (one original code may be distributed to two or more CCS code) occurred. That was the reason why the accumulation of each percentage of disease diagnosis exceeded 100%. Suicidal ideation and behavior (42.7%, 395 visits of 925), mood disorder (23.5%, 217 visits of 925), accompanied with anxiety disorder (21.7%, 201 of 925), as the primary psychiatric diagnoses, remained the leading causes during the recent 7 years. Suicide and intentional self-inflicted injury represented almost one third of all mental health visits and grew to 61.9% by 2021. Percentage of patients under the diagnosis of mood disorder, which inclusive of depressive disorder, bipolar, dysthymic disorder, etc., among total annual psychiatric visits significantly rose from 18.37% to 31.96% within 7 years. (*P*=0.0007). Visits for anxiety disorders in 2015 was 34.69%, dropped to

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19.27% in 2016, and then rose to 28.35 % of all psychiatric visits over time (P=0.0263). Figure 2 further displayed cumulative growth relative to 2015 of psychiatric diagnoses. The three leading mental health conditions- suicidal attempt, mood disorder, and anxiety increased dramatically by more than 100%. By the end of year 2021, cumulative growth of suicide attempt was 395%, for mood disorder it was 217%, and 201% for anxiety disorder.

Table 3 reported that the diagnosis distribution for pediatric psychiatric ED visits by gender. For girls, the most frequent diagnosis was suicide and intentional self-inflicted injury (45.09%), followed by mood disorder (34.91%) and anxiety disorders (22.91%). For boys, suicide, similar with girls, remained for the top diagnosis (39.2%). Anxiety and "disorders usually diagnosed infancy, childhood, or adolescence" ranked the second (20%) and the third (19.73%). The latter category comprised autism, Asperger syndrome, Tics and Tourette's disorder, Rett's syndrome, unspecified emotional disturbance, etc. The significant discrepancy of psychiatric diagnoses between genders were noted on mood disorder, "attention-deficit conduct and disruptive behavior disorders", autism, Tics and Tourette's disorder, schizophrenia. (P<0.0001) Among them, mood disorder occurred more frequently in girls while others more likely seen in boys.

Table 4 presented the diagnosis distribution of mental disorders by age group. Suicidal

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behavior was the major diagnosis for both 0-12 and 13-18 age group. Adolescents aged 13-18 years visited PED mainly due to suicidal behavior (40.21% of all psychiatric visit), mood disorder (32.23%), and anxiety disorders (23.64%). For children aged 0-12 years, suicidal ideation or attempt accounted for nearly half (49.04%) of all psychiatric PED visits. Other causes that triggered their need for PED help were anxiety disorder (16.86%), adjustment disorder (15.71%), and disorders like autism and Tourette's syndrome (14.94%.). Compared to younger children, adolescent tend to visited PED due to mood disorder (32.23% vs. 1.15%), schizophrenia and other psychotic disorders (10.24% vs. 0.77%) (P<0.0001)

3.3自殺意念與行為 (Suicidal ideation and behavior)

In 2015, the incidence of suicide was 3.09 per 10000 PED visits (6 among 19415 total annual PED visits); in 2021 it increased significantly to 126.82 (108 among 8516 total annual PED visits). Figure 3 revealed the trend made by children with suicide and self-inflicted injuries among all visits with mental disorders. In 2015, it accounted to 12.24% and rose to 55.67%, reached a significant ninefold increase in 2021. (P <0.0001)

Table 5 and figure 4 showed the methods of suicide by genders. Poison or drug intoxication was the most common mechanism of injury in both genders (22.95% for girls and 36.05 % for boys). The source of poison were prescription medications such

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as benzodiazepines, antipsychotics, and other over-the counter medications including acetaminophen, non-steroid anti-inflammatory drugs. Compared to visits made by males, a significantly higher proportion of females visited with cutting wound (*P=0.0008*). Relatively, male tend to use chemical burn and carbon monoxide for suicide (*P< 0.0001*). The former mechanism included acid, alkaline, or caustic chemicals ingestion such as pesticide or cleaning agents. Every patient who had suicidal ideation or attempt at ED would be reported to the public suicidal prevention center via certain operating system. However, some patients had been reported to the system but there was no specific suicidal method could be identified. These patients were categorized into "others". And some other patients pursued suicided by several mechanisms and got more than one diagnosis code. All the record was summated.

3.4 精神科醫師與社工會診

(Psychiatrist and social worker consultation)

As PPED visits for mental disorders increased during the study period, the need for psychiatric consultation grew in demand. Figure 5 showed the trend of psychiatrist consultation for pediatric psychiatric visits between 2015 and 2021. During the study period the percentage of patients who were able to be interviewed by psychiatric specialists almost doubled. In 2021, 28.9% ED patients with mental disorder received

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evaluation by psychiatric specialists, compared with 14.29% in 2015.

Figure 6 demonstrated the trend of social worker consultation from 2015 to 2021. Initially social worder interviewed 8.16% of pediatric patients with metal disorder in ED; in 2021 18.56% of them were contacted by social workers for further management. Both the trend of consultation from psychiatrists and social workers were rising, however, only fewer than one out of three to four patients could be checked by the psychiatric professionals.

3.5 急診滯留時間與返診頻率(PED Stay length and return)

Figure 7 described the length of stay for all PED patients. The length of stay for patients with mental disorders significantly exceeded that of others, with the mean time 3.46±5.35 hours (min-max: 0.12-65.33 hours); and it was 2.20±3.98 hours (min-max: 0.08-253.32) for patients without psychiatric diagnosis. Patients with psychiatric needs experienced almost one and half times as much length of stay waiting for final deposition.

Figure 8 illustrated PED return frequency. Pediatric psychiatric patients were more likely to return to PED in a one-year period. The analysis reported average revisits 2.76±2.09 times for them, ranged from 2 to 21 times; whereas for those without psychiatric complaints, the average revisits time was 2.37±0.74. However only in 2015

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the significant discrepancy of repeat visits between two groups was noted.

3.6 離院動態(Discharge status)

Table 6 presented the discharge status of psychiatric PED visits. Of 925 patients, 202 (21.8%) were admitted to inpatient psychiatric facilities directly. The rate of admission almost doubled and reached significancy within the 7-year period. In 2015 admitted patients contributed to 16.3% of total annual number of psychiatric PED visits and in 2021 it raised to 29.4%.

The trend of patients being discharged with outpatient clinic follow up remained relative stable, contributed to 66.49% to 77.55% of all visits during study years. Other patients were either against advised discharged (AAD) or transferred to other medical facilities because of clinical or personal needs. Figure 9 converted discharge status into histogram, showing the steadily rising trend of patients being admitted to psychiatric ward.

3.7 就醫時段(Time of PED arrival)

Figure 10 compared the time of PED arrival by patient with and without mental disorders. Children with psychiatric request frequently arrived PED during daily working hours, in other words, 9 AM to 5 PM, while patients with complaints other

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than mental illness tend to seek for PED help in the evening. For both groups, approximately 10-20% patients visited PED between midnight to early morning.

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第四章 討論(Discussion)

This study demonstrates an increase in psychiatric PED requests while total PED visits declined between 2015 and 2021. I discuss the overall trend in section 4.1. Section 4.2 focus on the change of epidemiology during COVID-19 pandemic. The following sections describe detailed analysis of patients' demographic characteristics (4.3), clinical features of their stay in PED which inclusive of disease distribution (4.3), suicidal issues (4.4). Psychiatric manpower allocation is discussed in section 4.5 through disclosing the rate of consultation with psychiatrists and social workers. Section 4.6 reveal medical utilization of these group of patients by showing their discharge status, PED stay length, repeat visits, and arrival time.

4.1 兒童精神疾患與急診就診趨勢

(The trend of pediatric mental disorder and PED utilization)

The constriction of inpatient, outpatient services and insufficient socio-educational professionals for children's psychiatric care, accompanied with a heightened alertness of the potentially serious and extensive consequences of untreated psychiatric crisis, had led to a dramatic increase in youth presenting to PED for psychiatric care. The increasing frequency of visits to the pediatric psychiatric PED signaled a need for a better understanding of current condition, clinical characteristics, and factors

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contributing to more frequent utilization. Chun et al. (2015) highlighted key features of appropriate emergency evaluation and management of children in psychiatric crisis, comprising through and structured risk assessment, engagement of family members or key caregivers, application of de-escalation strategies to ensure safety in PED, and connection to appropriate medical services outside PED [30]. Also, collaboration between emergency medicine and psychiatrists is essential because the evaluation and management of aggressive and/or violent behavior requires skilled and trained specialists. Unfortunately, most children and adolescents in acute attack of psychiatric illness presenting in PED do not receive the ideal care. Because of insufficient funding and organized training, PED have not kept pace with the escalating demand for pediatric mental health service. The increasing trend of self-inflicted injuries and suicidal behavior was also noted.[18,31]

Most pediatric patients in psychiatric crisis presenting at ED in Taiwan were seen and treated in general pediatric or even other emergency clinicians who lack psychiatric training. At ED, they were deposited in environments overwhelmed with crowd and noise, often with lengthy waiting times and little available private space, which was disastrous and often led to restrains or seclusions for the agitated, paranoid, traumatized, or autistic youth. The unfriendly environment, shortage of expertise, and insufficient evaluation and treatment resulted in a vicious cycle. The negative impacts may extend

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to the aspects of families, schools, societies and even the development of the whole country.

PED was a critical checkpoint to terminate the devastating condition. In order to clarify and exam the up-to-date epidemiology, we analyzed the clinical data collected from January 1, 2015 to December 31, 2021. This was the first study focused on ED visiting among children suffered from psychiatric illnesses in Taiwan, aiming to describing current PED environment for children and families struggling in mental illness and strengthening the safety net for those in crisis.

According to previous studies[13,32,33], PED visits were either relative stable or increasing in trend. However, in our study we found a gradual decrease in annual number even before COVID-19 pandemic. This could be caused by continuously drop of birth rate, increased number of medical institutions, and change of healthcare utilization behavior. In Taiwan, birth rate was 8.23 births per 1000 total population in 2015 and 6.69 in 2021.[34] (birth rate for whole world was 19.08 births in 2015 and 17.87 in 2021 per 1000 total population.[35]) Even in Hsinchu, the region ranked top one or second townships for the highest crude birth rate in the past decade, the statistics subsided from 10.3 births per 1000 total population to 7.6 during the study period. Besides, the number of hospitals and clinics increased, which enhance the accessibility of health care. Take Hsinchu county as an example, from 2018 to 2021, number of clinics grew from 389 to

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410 and hospitals from 10 to 11, a growth rate of 10.27% was also noted for physicians.[36] When children got sick, they could be treated via nearby clinics rather than visiting hospitals or ED.

Despite the reduction of PED visits, our data disclosed visits among children with mental health disorders had increased for more than tenfold (0.25% in 2015 and 2.28% in 2021) over 7 years. (Figure 1) The results paralleled with the observation in the U.S. and Europe.[13,37–39] The continuously increase number of PED psychiatric diagnoses may reflected increased prevalence and exacerbated severity of the diseases, change in diagnostic criteria or clinical practice, gradually raised awareness of the mental disorders by the parents and school teachers or even youths themselves, or inadequate outpatient access and shortage resources. Probably it is the combination of the above factors that contributed to the elevated need for well-equipped PED, both the facilities and manpower, to provide an instant and appropriate management.

4.2 COVID-19 疫情對兒科急診之影響

(The impact of COVID-19 pandemic to pediatric ED)

It should be noted that the decrease in general PED visits and increase in psychiatric needs were heavily driven in 2020, in which the largest increase in visits was observed. It was the time when COVID-19 started raging all over the world. During COVID-19

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pandemic, multiple studies conducted in western countries indicated massive drops of approximately 60% in pediatric emergency healthcare utilization.[40,41] In Taiwan, epidemic control like social distancing, school shuts down, mask wearing, hand hygiene, not only slow down COVID-19 spreading but also prevent the circulation of other virus such as enterovirus, influenza, adenovirus, and other respiratory or gastrointestinal pathogens, hence further inhibited related disease burden. Reports from official and certain medical centers disclosed a reduction of PED visiting by nearly 40%.[25,26] In our target institution it was a 24% reduction. (Figure 1, total annual PED visits were 13546 in 2019 and 10297 in 2020)

But for psychiatric patients, numerous reports suggested that COVID-19 pandemic had negative effects on children's mental health and record the increase of overall proportion of children's ED visits for mental health-related concerns.[14,16,17,24] Our analysis demonstrated a similar trend, with a surge from 1.10% in 2019 to 2.28% in 2021. (Figure 1) Since many children received psychiatric treatment or consultant through clinical and community institutions, school also played a decisive role. The exacerbation of clinical condition may be explained by the pandemic-associated stress, unintended consequences of mitigation of healthcare measures, and school shutdown, which hindered or modified patients access to trusted mental health providers, peer connections, and could resulted in increased reliance on PED for their routine

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prescription or crisis.

4.3 兒科急診精神病患之疾病分佈

(Distribution of psychiatric illness among PED subgroups)

Compared with patients visiting PED for any complaints, adolescents and girls with psychiatric requests had higher rate of PED visits than children younger than 13 years old and boy. (Table 1) Among all pediatric psychiatric patients, the most common presenting complaint was suicide and intentional self-inflicted injury, followed by depressive disorders and anxiety disorders. The result was in line with the studies conducted in western countries over the decades. [12] We further presented the cumulative growth of the diagnosis relative to year 2015 (Figure 2) , in which the top three diagnosis skyrocketed with more than 200% growth could be clearly seen.

As illustrated by Table 3 and 4, gender discrepancies in the main psychiatric diagnosis were identified. Schizophrenia or other psychotic disorder, ADHD, autism, Asperger syndrome, Tics, Tourette's disorder, and Rett's syndrome were more frequently seen among boys, while girls were more likely to seek help for depressive disorder and anxiety, as well as suicidal ideation or behavior. Such findings were consisted with preexisting literatures.[10–12] The reality reflected the incidence of the disease in nature documented in several researches. [28,42] Aside from gender, significant differences across

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age among specific psychiatric disorders. As expected, adolescents were more likely to have mood disorders, schizophrenia and other psychotic disorders. However, our study surprisingly recorded significantly higher percentage of suicidal behavior in younger children, which may be the impact of the peers, social media, or the shift of ways youths express their emotion and request. The reality indicated the urgent mental health need like earlier identification and intervention for this vulnerable population at PED.

4.4 兒科急診自殺分析

(Suicidal issues in PED)

This study showed a dramatic increase in suicidal behavior among mentally-ill children was noted in the analysis, which is consistent with previous studies addressing Taiwanese adolescents with self-inflicted injuries visiting PED.[31] According to Chang et al. (2021)[31], intentional poisoning with prescription and over-the counter medications ranked the leading self-harm methods. Among PED visits due to self-inflicted injuries made by children, 88% of them were diagnosed with mental illness; with depressive disorders being the most common (57%). The finding in Figure 3 disclosed that the number of patients with suicidal attempt or ideation per 10000 PED visits rose from 3.09 in 2015 to 126.82 in 2021. There was a nearly 4.5 folds increase of such patients among children visiting PED with psychiatric needs.

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When taking a closer look into suicidal mechanisms, drug overdose was the most common method for self-harm. The most frequent used medications were acetaminophen and Benzodiazepam. NSAID, TCA, and other over-the counter drugs were also listed. Girls had significant higher tendency to apply knife for self-injury, which was differed from previous report, which record that this suicidal mechanism happened more frequently among males.[31,43] According to clinical observation it was not unusual to see girls under this diagnosis actually performed repeatedly non-lethal cutting over the forearms instead of assaulting themselves by "knife" or stabbing. Cognitive differences in diagnostic classification may led to this result. In addition, compared with females, previous reports recorded that male tend to use more vigorous and lethal methods such as jumping from heights or rushing into traffic due to stronger impulsivity. [43–46] However, vigorous behavior was rarely seen in this study. Instead, we found boys had higher intention in applying chemical burn and carbon monoxide intoxication. The mismatch may be explained by the limitation of our analysis, in which we only reviewed patients admitted to PED, whereas male youths getting hurt with more brutal self-harm behavior were registered directly to the surgical ED for urgent management. This is the limitation of our study and need further detailed investigation. Also, when taking a closer look at self-harm behavior, elementary school-aged children as young as 5 were found to have suicidal behavior. Mental health specialists used to

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believe that young children were not capable of suicide because it couldn't be as hopeless as it was often seen to be required, or they didn't have a sense of time or an understanding of the permanence of death. However, it happens, most likely due to experience of relationship problems with family members or friends.[47] To clarify whether the suicidal diagnoses for young children in our research were appropriate or regarded as classification error, further detailed history investigation should be done.

4.5 兒科急診精神科專業人力配置

(Psychiatric manpower allocation in PED)

Children suffered from mental disorders is the most fragile and vulnerable population in dire need of thorough evaluation and appropriate arrangement, especially when facing disease flare up in PED. The ideal procedure, however, when inspecting the professional psychiatric manpower, is far from being achieved. We found only one out of four pediatric patients with mental disorder received psychiatrist interview and treatment during their stay at PED. And less than 20% patients could be consulted and evaluated by social workers. In a statewide survey in California, only 10% of ED programs had child psychiatrists for consultation; less then 35% had general psychiatrists available, and less than 50% programs had a social worker (most of them were in charge of work other than consultation) to assist in evaluation or long-term

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follow up.[48] In Taiwan there was no documented data or analysis for pediatric psychiatric service at ED as mentioned above. Generally speaking, only medical center and teaching hospitals have psychiatrists on duty for emergent consultation all day long. Patients under 18 years old with mental disorders would be registered to PED (or general ED if there is no pediatrician on duty), and then physician in charge has the right to decide if further psychiatric evaluation is needed. Once the consultation requirement is prescribed, patients should stay at ED until psychiatrist is available. The waiting time lasts from few minutes to more than one day, depending on the availability of the doctors and social workers. For hospitals without resident expert taking in charge of night shifts and for patients who do not want to wait, patients would be discharged or transferred after receiving emergent management. And there is no specific tracking mechanism to make sure they do attend the scheduled outpatient clinic or other mental health care institution for further management. Hsinchu is a region that is relative abundant in medical resources in Taiwan, only two hospitals provide all day PED services. (National Taiwan University Hospital Hsin-Chu Branch is one of them, and there are five pediatricians taking charge of round the clock shifts.) In other words, the children would be checked up by pediatrician directly while arriving ED. Yet, children live in other counties, especially in rural areas, might not be able to find a nearby hospital with ED that offers pediatric service. Based on the statistics from "Annual

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report of medical care institution & hospital utilization, 2021" released by ministry of health and welfare, there were 435 psychiatrists served in the hospitals and clinics in Hsinchu.[49] Nineteen of them (4.3%) were qualified for children and adolescent subspecialty. And there were only 21 social workers who are in charge of contacting with psychiatric patients referred from ED and outpatient clinics in the hospitals located in Hsinchu area. However, these staffs are responsible for other business ordered from other divisions simultaneously. The above description discloses the truth that children with psychiatric request visiting PED could be barely evaluated by the pediatrician properly and immediately, not to mention the contact with other associated psychiatric professionals or resources. Most patients are treated with sedative therapy to relive critical symptoms. Once the clinical condition is stabilized, they then are deposited at PED until psychiatrists come for visits, or discharged without close tracking.

Since the etiologies for children and adolescents with mental problems are usually complicated, comprehensive investigation manipulated from different aspects are needed in order to individualize the therapy. To complete the long-term treatment plan, even the caregivers and school teachers should participate and being interviewed. However, a lack of manpower coverage made a distinct gap between ideal scenario and reality. And this harm overall outcomes by not only keeping patient from adequate treatment and resulted in deterioration of clinical condition, but also cause long stay at

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PED which contributes to inefficient utilization of medical resources.

4.6 精神病患兒科急診之醫療利用

(Medical utilization by psychiatric patients at PED)

Length of stay at ED varies greatly by disposition, driven mainly by ED boarding time. By far this was the first study that disclosed the average waiting time for patients visiting PED. Consistent with previous literatures [50–52], mental health patients in this data had lengthy PED visits compared to those with chief complaint other than psychiatric illness, mainly because of scarce of psychiatric professionals. (Figure 5,6,7) Also, young children with psychiatric complaints, especially those who first visited PED or presented with psychiatric symptoms/signs, need more comprehensive interview and evaluation. In addition, the caregiver should accept the investigation as well in order to clarify the clinical condition and decide the final deposition. Furthermore, if the patients committed suicide with either drug or other self-harm behavior, immediate treatment must be done first to stabilize the vital signs. The psychiatrists could only perform thorough evaluation after the patient regained his or her consciousness regained and general vital condition is stable. The recovery period may took hours to days and that extended the length of stay. Although the etiology of prolong PED stay length is likely multifactorial and need more precise investigation,

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the results represented the worsening access to essential mental health services across the care continuum, in other words, in the PED, inpatient, outpatient settings, or even family and educational systems. Prolonged boarding times in PED often lead to patient and provider dissatisfaction and exacerbation of clinical performance.

Unstable clinical condition as well as socioeconomic factors, age, and disease categories may be associated high odds of PED psychiatric visits.[53,54] In line with previous studies, our study revealed relative high PED return within one year since their first PED visits of patients with mental disorders compared with non-psychiatric patients. The phenomenon may be caused by limited outpatient access and inadequate treatment, especially in certain cultural or socioeconomic groups.[55] A study conducted in Australia found that 25% of pediatric PED visits had psychiatric chief complaints, and this was most prevalent among those with suicidal attempt or behavior. And the greatest risk of re-presentation was within 30-60 days. [56] In any events, chronic use of PED service may be an alertness of insufficient management at other levels of care. Whether children with mental disorders visiting PED in Taiwan had similar distribution and characteristics need more deep dive survey. And the result could be applied to the design of risk screening and early intervention in the future.

To strengthen the knowledge of features of children visited PED due to mental health reasons, we also examined their discharge status and the arrival time. According to

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research performed in the U.S., of youth presenting to PED with psychiatric requests, 66% are discharged, but only approximately a third of them are being properly referral to any professional psychiatric care.[51,57] A narrative review conducted in Australia record that the admission rate of psychiatric patients was between 14-40% where the rate for all PED attendees was 20.8%.[58] Also, retrospective studies from Germany showed approximately 47.1% of pediatric psychiatric patients presenting at PED were admitted to an inpatient unit; and a 200-400% increase in emergency admissions for child and adolescent psychiatry was found. [59] In Taiwan there was no such record addressing the final deposition of pediatric psychiatric patients. Rather than being discharged from PED, our analysis disclosed an increased likelihood of psychiatric ward admission, with almost doubled hospitalization rate during the study period. The relative high admission rate may signaled the elevated disease burden and deteriorating clinical condition. Except for the disease-related epidemiologic change, the inpatient capacity for psychiatric patient had a 9.1% increase (in 2020 there were 32788 psychiatric beds, compared to 30063 in 2015.), which might further explained why admission rate continuously elevated.

Finally, we examined time of arrival at PED, expecting to provide information for optimizing psychiatric staff and other related emergency settings. Since PED was often regarded as the initial or an alternative point of care for patients acquiring immediate

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and after-hours mental health care, we found that psychiatric patients tend to visit PED during work hours (09:00 AM to 04:59 PM) compared to patients with other chief complaints. Most pediatric patients waited till parents or caregiver, who had job at working hours, get off work to bring them to PED. They could also go to general outpatient clinic for help instead of visiting PED. However, those who suffered from psychiatric crisis or performed suicidal behavior need immediate management. Rather than wait until after- hours, they visited PED with the companion with school teachers, friends, or people other than parents during daytime. This phenomenon might also indicated that these patients were under more critical circumstances that required emergent attentions compared with those without psychiatric complaint.

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第五章 結論與建議(Conclusions and suggestions)

Emergency department visits for children with mental health disorders had risen around the world and in Taiwan, this study analyzes the trend, clinical characteristics, and the distribution of psychiatric disorders among children seeking for emergent mental health care. Counting cases is the first step toward measuring the social burden caused by the disease and the effectiveness of current preventive setting. Especially in a world of scarce resources, figuring out the number of affected, the impact on the individual, and the cost to the community is important for more efficiently apply the supplies. In section 5.1 the research implications are listed; and in section 5.2, this study makes suggestions for future policies and systems revision. Finally, the limitations of this study are illustrated in section 5.3.

5.1 研究及臨床意義

(Research and Clinical implications)

The findings of this study provide the following academic and policy implications.

For academic evidence, this study was the first research identifying children mental health related PED visits in Taiwan, which demonstrated a rising trend and highlighted the complex interplay of characteristics involved in PED setting as well as patients' clinical condition. We had confirmed the escalating need for mental health service and

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the changes in the types of psychiatric disorders of children and adolescents over the last 7 years. The trend was largely driven by adolescent, female gender, and COVID-19 pandemic. Patients requiring psychiatric help had longer PED stay and more frequent returns. More patient tended to be admitted to psychiatric ward than being discharged during the study period. The research also addressed the shortage of professional mental health providers and disclosed PED facilities that were less prepared to provide comprehensive a higher-level pediatric emergency care.

For policy development, the rise in PED psychiatric visiting among these children is a sentinel indicator of health system mal-functioning, resulting in a persistent dearth of child psychiatrists and community supports. The exacerbation of psychiatric PED needs was multifactorial, it represented the shift in the epidemiology of mental illness, a change in identification by healthcare providers or reporting by the family or teacher, the transformation of referral patterns or service-seeking behavior, and last but not the least, a burgeoning but unmet clinical need for children suffered from mental disorders. And it uncovered the scarce of professional human resources as well as capacity at PED to treat pediatric patients with mental health concerns. All of the facts mentioned above brought children with mental illness into vicious cycles.

Although the ultimate goal is to appropriately and timely link children with health care

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source outside of PED especially for those with relatively poor socioeconomic status, poor compliance, and repeat visits, the psychiatric PED acts as a bridge or a transition zone between acute crisis and long-term mental health care. It is an important community resource for helping children and family through psychiatric crisis, particularly with the relative shortage of outpatient and other supportive setting. Timely and proper responses to the mental health emergencies should be addressed; and the effort should be focused on reducing PED boarding by manpower allocation and risk screening. The government must allocate resources and deployment of evidence-based interventions for building an intact public health surveillance infrastructure that tracks resilience and mental well- being in addition to prevalence of mental health conditions and effective access to the most vulnerable populations.

5.2建議(Suggestion)

With the number of mental health presentations dramatically increasing, carefully designed and integrated strategies are required to pro-actively tackle this growing epidemic. A multidisciplinary approach to efficiently manage the demand without compromising on the quality of care delivered to pediatric mental health patients is needed. From the public health viewpoint, community and health care system should work together to strengthen navigation pathways all the way out of PED to provide

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comprehensive mental health care, since parents, teachers, pediatricians, psychiatric professionals all serve as “gatekeepers” to treatment. Through identification of clinical and health system variables that predict PED visits, implantation for targeted measures for the persistent mental health needs, children and adolescent with mental disorder would be benefit. The successful interventions in a solid health care system may break the cycle and minimize harms to our future pillars of society.

The following are suggestions for future study and policy making. 1) Larger scale research including more patient number, different level of medical facilities located in different areas are needed in order to reflect national demographics and trend of pediatric psychiatric request. Furthermore, applying more specific measures of clinical severity and comorbid psychopathology would help more precisely understand the socio-demographic and clinical factors that contribute to the evolution observed, and demonstrate demand from psychiatric PED care for children in Taiwan. 2) Perform more detailed exam to figure out etiologies of longer length of stay at PED, for example, wait for a bed, pend for the consultation, evaluation time, individual insurance status, etc. Once the association is recognized, the policy could be set specifically against the sticking point. 3) Since PED serves as the national safety net for individuals suffered from mental health disorders, it is critical to monitor the trend of their PED visits because it signals fluctuation of population health. Future analyses of the universal/

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standard use of PED-based psychiatric and suicide risk screening, triage, risk assessment, and referral are another important area of study, given that children and adolescent who present to PED with somatic or other medical concerns may manifest latent or hidden. Early recognition and intervention are beneficial for the target population. 4) The possible solution to ensure pediatric mentally-ill patients receive optimal care is to find better ways to connect them to mental health and social services. The gap caused by either long distance or scarce manpower could be solved by applying remote videoconference technology to facilitate assessments in the PED setting by psychiatrists located in other medical facilities.

5.3 研究限制(Limitations)

This study should be interpreted in the context of its methodological limitations, including being limited to a single regional PED within a metropolitan area, retrospective analysis, and lack of information about the outpatient, inpatient, and medication use history. For psychiatric diagnosis, sometimes the first-line PED physicians made the diagnosis based on instant episode or straightforward impression. However, lacking in professional psychiatric training or knowledge may mislead the judgement. Even more, patients may had more than one mental health disorders but the medical chart only record the primary diagnosis. The diagnostic bias resulted in

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interference for ranking of mental illness. Additionally, there might be an underestimation in the analysis of repeating PED visits. It was possible that patients visited the PED in other hospitals while next crisis happens. Implementation of screening efforts across multiple sites or self-reporting system, and application of Taiwan's National Health Insurance Research Database (NHIRD) are indicated for further understanding the impact of disease burden, PED management, long-term and comprehensive care for patients.

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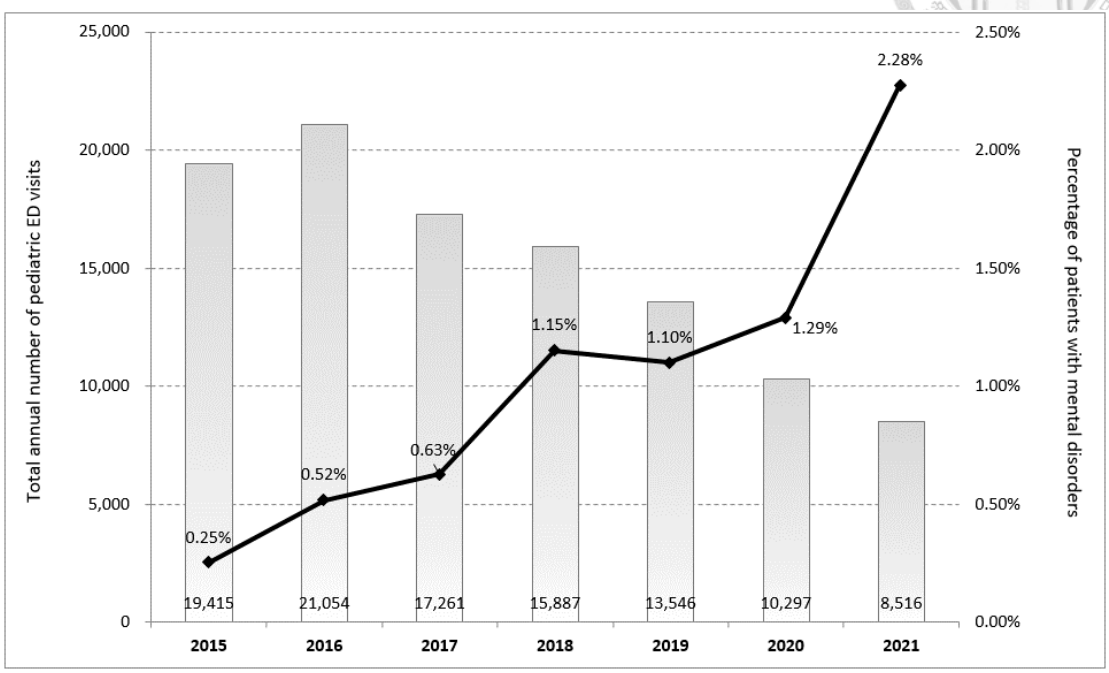
附錄(Appendix)

Figure 1. Trends of PED visits



PED, pediatric emergency department; Trends of pediatric ED visits (bar) and those with mental disorders (solid line)

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Table 1. Demographic characteristics of patients admitted to PED

Characteristics	Total	Year														P value※
		2015		2016		2017		2018		2019		2020		2021		
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Annual number of ED visits	105,976	19,415	(18.32)	21,054	(19.87)	17,261	(16.29)	15,887	(14.99)	13,546	(12.78)	10,297	(9.72)	8,516	(8.04)	-
Age (mean±SD)ϕ	7.37±5.89	7.15±5.86		7.13±5.84		7.09±5.85		7.19±5.81		7.58±5.79		7.90±6.06		8.38±6.14		<0.0001***
																<0.0001***
0-12 y/o	79,907	14,828	(76.37)	16,161	(76.76)	13,277	(76.92)	12,246	(77.08)	10,185	(75.19)	7,391	(71.78)	5,819	(68.33)	
13-18 y/o	26,069	4,587	(23.63)	4,893	(23.24)	3,984	(23.08)	3,641	(22.92)	3,361	(24.81)	2,906	(28.22)	2,697	(31.67)	
Gender																0.7568
Male	60,149	11,068	(57.01)	11,973	(56.87)	9,827	(56.93)	8,983	(56.54)	7,697	(56.82)	5,836	(56.68)	4,765	(55.95)	
Female	45,827	8,347	(42.99)	9,081	(43.13)	7,434	(43.07)	6,904	(43.46)	5,849	(43.18)	4,461	(43.32)	3,751	(44.05)	
Annual number of ED visits with mental disorders	925	49	(0.25)	109	(0.52)	108	(0.63)	183	(1.15)	149	(1.10)	133	(1.29)	194	(2.28)	<0.0001***
Age (mean±SD) ϕ	13.16±5.76	13.63±6.23		11.60±6.36		11.82±6.72		13.02±6.13		13.19±5.50		14.23±4.86		14.17±4.72		0.0003***
																<0.0001***
0-12 y/o	261	14	(28.57)	46	(42.20)	44	(40.74)	58	(31.69)	37	(24.83)	29	(21.80)	33	(17.01)	
13-18 y/o	664	35	(71.43)	63	(57.80)	64	(59.26)	125	(68.31)	112	(75.17)	104	(78.20)	161	(82.99)	
Gender																0.0302*
Male	375	18	(36.73)	50	(45.87)	50	(46.30)	70	(38.25)	74	(49.66)	49	(36.84)	64	(32.99)	
Female	550	31	(63.27)	59	(54.13)	58	(53.70)	113	(61.75)	75	(50.34)	84	(63.16)	130	(67.01)	

PED, pediatric emergency department; y/o, years old; ***, P value <0.001; **, P value <0.01; *, P value <0.05; ※Pearson's chi-squared test; ϕANOVA

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Table 2. Main psychiatric diagnosis of children admitted to PED

CCS	Total visits (n=925)	Year														P value※
		2015 (n=49)		2016 (n=109)		2017 (n=108)		2018 (n=183)		2019 (n=149)		2020 (n=133)		2021 (n=194)		
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
662: suicide and intentional self-inflicted injury	395	1	(2.04)	46	(42.2)	42	(38.89)	73	(39.89)	48	(32.21)	65	(48.87)	120	(61.86)	<0.0001***
657: mood disorders	217	9	(18.37)	8	(7.34)	16	(14.81)	50	(27.32)	35	(23.49)	37	(27.82)	62	(31.96)	0.0007***
651: anxiety disorders	201	17	(34.69)	21	(19.27)	23	(21.3)	22	(12.02)	28	(18.79)	35	(26.32)	55	(28.35)	0.0263*
655: disorders usually diagnosed in infancy, childhood, or adolescence	109	1	(2.04)	19	(17.43)	13	(12.04)	21	(11.48)	33	(22.15)	13	(9.77)	9	(4.64)	<0.0001***
650: adjustment disorders	83	4	(8.16)	11	(10.09)	20	(18.52)	16	(8.74)	13	(8.72)	10	(7.52)	9	(4.64)	0.0016**
659: schizophrenia and other psychotic disorders	70	9	(18.37)	18	(16.51)	8	(7.41)	11	(6.01)	8	(5.37)	8	(6.02)	8	(4.12)	<0.0001***
654: developmental disorders	24	4	(8.16)	2	(1.83)	1	(0.93)	6	(3.28)	3	(2.01)	3	(2.26)	5	(2.58)	0.2729§
670: miscellaneous mental health disorders	21	3	(6.12)	1	(0.92)	4	(3.7)	3	(1.64)	2	(1.34)	5	(3.76)	3	(1.55)	0.2237§
652: ADHD	16	0	(0)	0	(0)	0	(0)	1	(0.55)	5	(3.36)	3	(2.26)	7	(3.61)	0.1086§
653: delirium dementia, amnestic and other cognitive disorders	14	2	(4.08)	2	(1.83)	2	(1.85)	2	(1.09)	2	(1.34)	0	(0)	4	(2.06)	0.3817§
661: substance-related disorders	9	6	(12.24)	0	(0)	2	(1.85)	1	(0.55)	0	(0)	0	(0)	0	(0)	<0.0001§***
656: impulse control disorders	5	0	(0)	0	(0)	0	(0)	2	(1.09)	0	(0)	1	(0.75)	2	(1.03)	0.8457§
658: personality disorders	4	0	(0)	1	(0.92)	0	(0)	1	(0.55)	1	(0.67)	0	(0)	1	(0.52)	0.8824§
660: alcohol-related disorders	2	2	(4.08)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0.0024§*
663: screening, history of mental health and substance abuse	2	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	2	(1.03)	0.7629§

PED, pediatric emergency department; CCS, Clinical Classification Software; ADHD, attention-deficit conduct and disruptive behavior disorders; ※Pearson's chi-squared *test;* §Fisher's exact test; ***, P value <0.001; **, P value <0.01; *, P value <0.05

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Figure 2. Cumulative % growth for PED visit by children with mental disorders

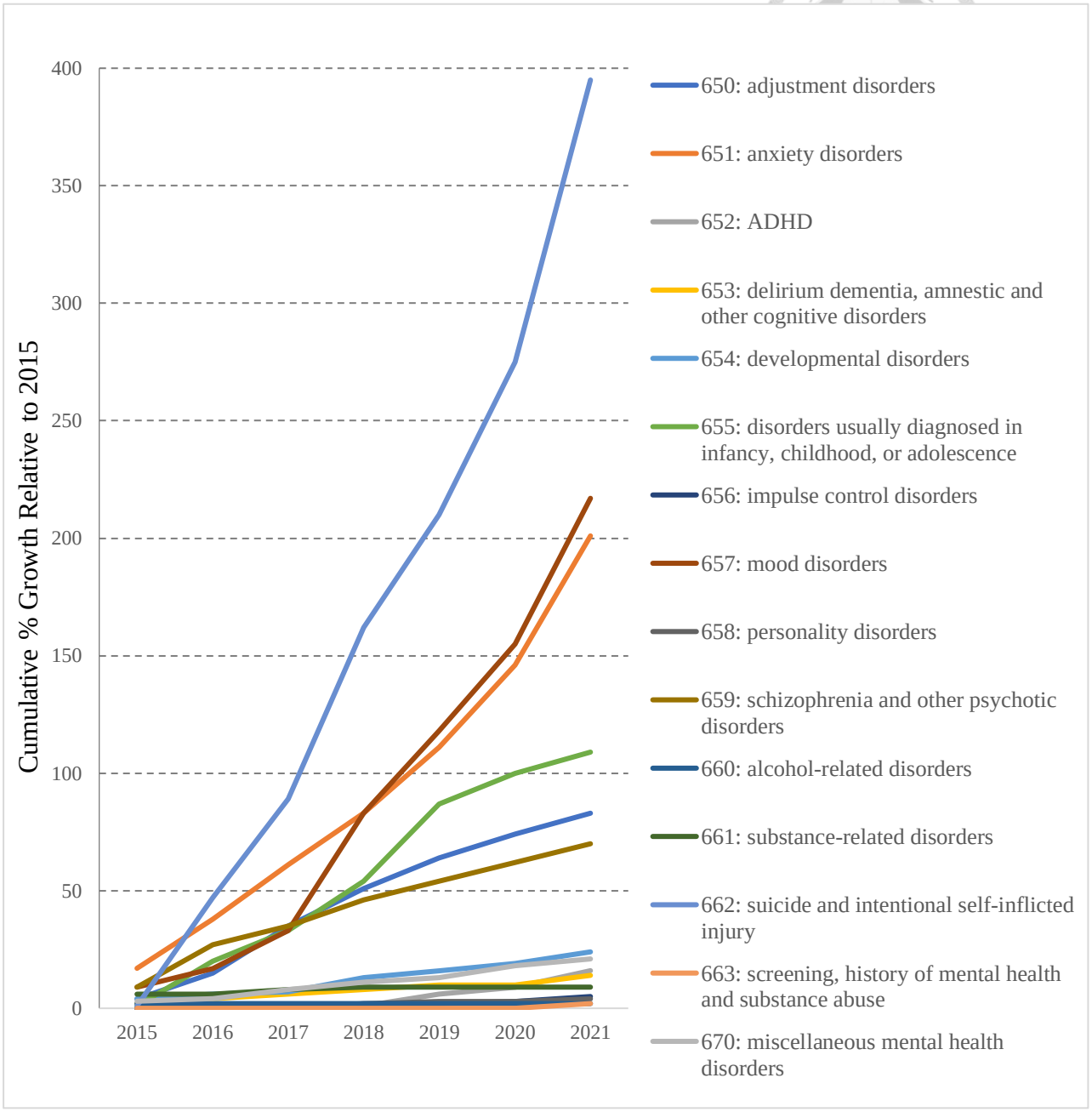

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Table 3 Gender analysis of main reason for PED visiting with mental disorders

CCS (frequency)	Total visits (n=925)	Gender				P value※
		Female (n=550)		Male (n=375)		
		n	(%)	n	(%)	
662: suicide and intentional self-inflicted injury	395	248	(45.09)	147	(39.20)	0.8689
657: mood disorders	217	192	(34.91)	25	(6.67)	<0.0001***
651: anxiety disorders	201	126	(22.91)	75	(20.00)	0.9412
655: disorders usually diagnosed in infancy, childhood, or adolescence	109	35	(6.36)	74	(19.73)	<0.0001***
650: adjustment disorders	83	49	(8.91)	34	(9.07)	0.5043
659: schizophrenia and other psychotic disorders	70	33	(6.00)	37	(9.87)	0.0064**
654: developmental disorders	24	14	(2.55)	10	(2.67)	0.6733
670: miscellaneous mental health disorders	21	16	(2.91)	5	(1.33)	0.1897
652: ADHD	16	0	(0.00)	16	(4.27)	<0.0001***
653: delirium dementia, amnestic and other cognitive disorders	14	4	(0.73)	10	(2.67)	0.0084**
661: substance-related disorders	9	5	(0.91)	4	(1.07)	0.7352§
656: impulse control disorders	5	2	(0.36)	3	(0.80)	0.3701§
658: personality disorders	4	4	(0.73)	0	(0.00)	0.3034§
660: alcohol-related disorders	2	2	(0.36)	0	(0.00)	0.5306
663: screening, history of mental health and substance abuse	2	2	(0.36)	0	(0.00)	0.5306§

PED, pediatric emergency department; CCS, Clinical Classification Software; ADHD, attention-deficit conduct and disruptive behavior disorders; ※Pearson's chi-squared test; §Fisher's exact test; ***, P value <0.001; **, P value <0.01; *, P value <0.05

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Table 4. Age analysis off diagnosis for PED visiting with mental disorders

CCS (frequency)	Total (n=925)	Age				P value※
		0~12 (n=261)		13~18 (n=664)		
		n	%	n	%	
662: suicide and intentional self-inflicted injury	395	128	(49.04)	267	(40.21)	<0.0001***
657: mood disorders	217	3	(1.15)	214	(32.23)	<0.0001***
651: anxiety disorders	201	44	(16.86)	157	(23.64)	0.4116
655: disorders usually diagnosed in infancy, childhood, or adolescence	109	39	(14.94)	70	(10.54)	0.0029**
650: adjustment disorders	83	41	(15.71)	42	(6.33)	<0.0001***
659: schizophrenia and other psychotic disorders	70	2	(0.77)	68	(10.24)	<0.0001***
654: developmental disorders	24	11	(4.21)	13	(1.96)	0.0121*
670: miscellaneous mental health disorders	21	2	(0.77)	19	(2.86)	0.1141
652: ADHD	16	6	(2.30)	10	(1.51)	*0.2381*§
653: delirium dementia, amnestic and other cognitive disorders	14	3	(1.15)	11	(1.66)	*>0.9999*§
661: substance-related disorders	9	3	(1.15)	6	(0.90)	0.4577
656: impulse control disorders	5	1	(0.38)	4	(0.60)	*>0.9999*§
658: personality disorders	4	0	(0.00)	4	(0.60)	0.5777
660: alcohol-related disorders	2	0	(0.00)	2	(0.30)	*>0.9999*§
663: screening, history of mental health and substance abuse	2	0	(0.00)	2	(0.30)	*>0.9999*§

PED,pediatric emergency department; CCS, Clinical Classification Software; ADHD, attention-deficit conduct and disruptive behavior disorders

※Pearson's chi-squared test; §Fisher's exact test; ***, P value <0.001; **, P value <0.01; *, P value <0.05

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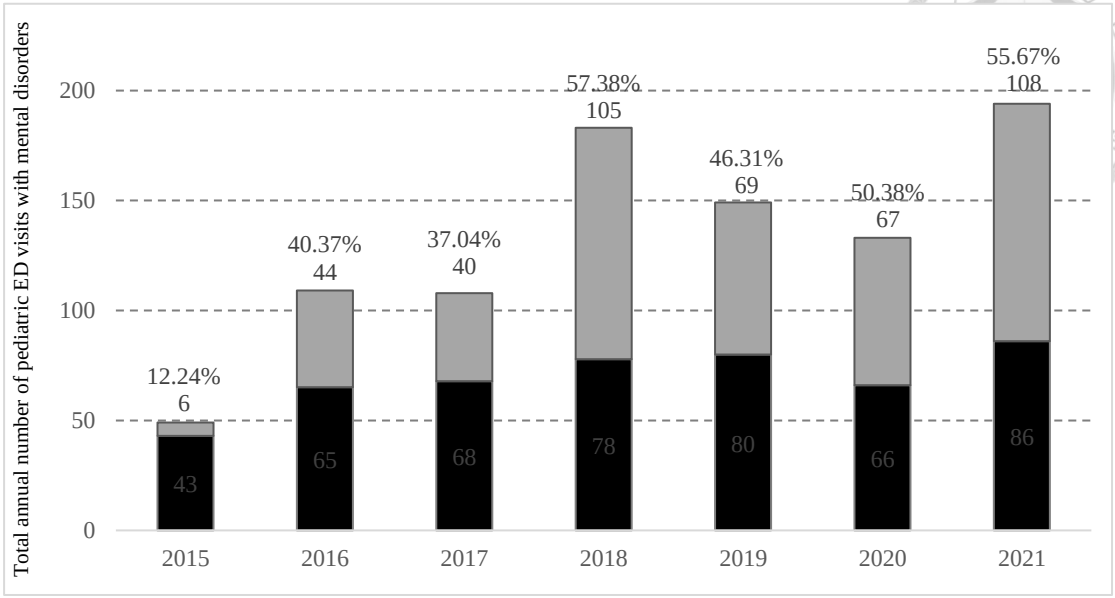
Figure 3. The trend of PED visits with suicide attempt



PED, pediatric emergency department; Black bar, patient number with mental disorder without suicidal attempt; Gray bar, patients with mental disorder with suicidal attempt

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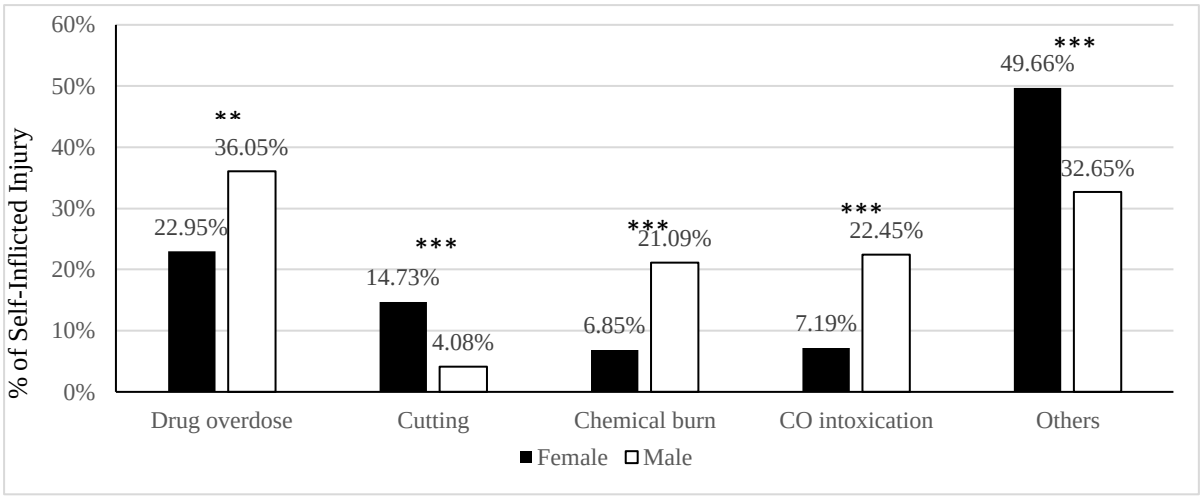
Table 5. Gender comparison of suicidal methods

Suicide	Total	Female (n=292)		Male (n=147)		P value※
		n	(%)	n	(%)	
Drug overdose	120	67	(22.95)	53	(36.05)	0.0036**
Cutting	49	43	(14.73)	6	(4.08)	0.0008***
Chemical burn	51	20	(6.85)	31	(21.09)	<0.0001***
CO intoxication	54	21	(7.19)	33	(22.45)	<0.0001***
Others	193	145	(49.66)	48	(32.65)	0.0007***

※Pearson's chi-squared test; ***, P value <0.001; **, P value <0.01; *, P value <0.05

Figure 4. Suicidal methods between genders



***, P value <0.001; **, P value <0.01; *, P value <0.05

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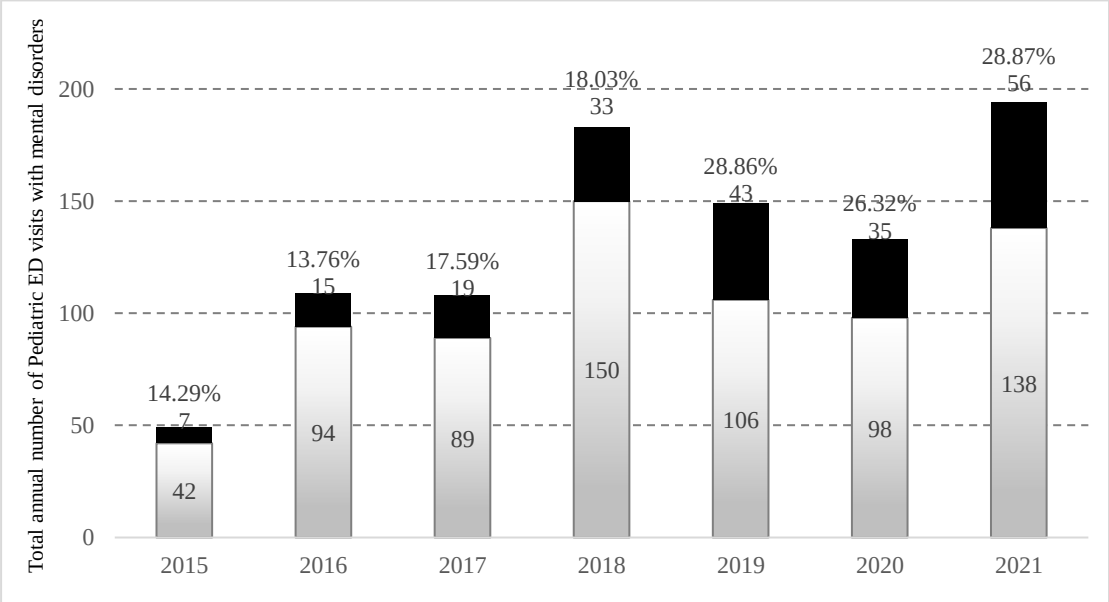
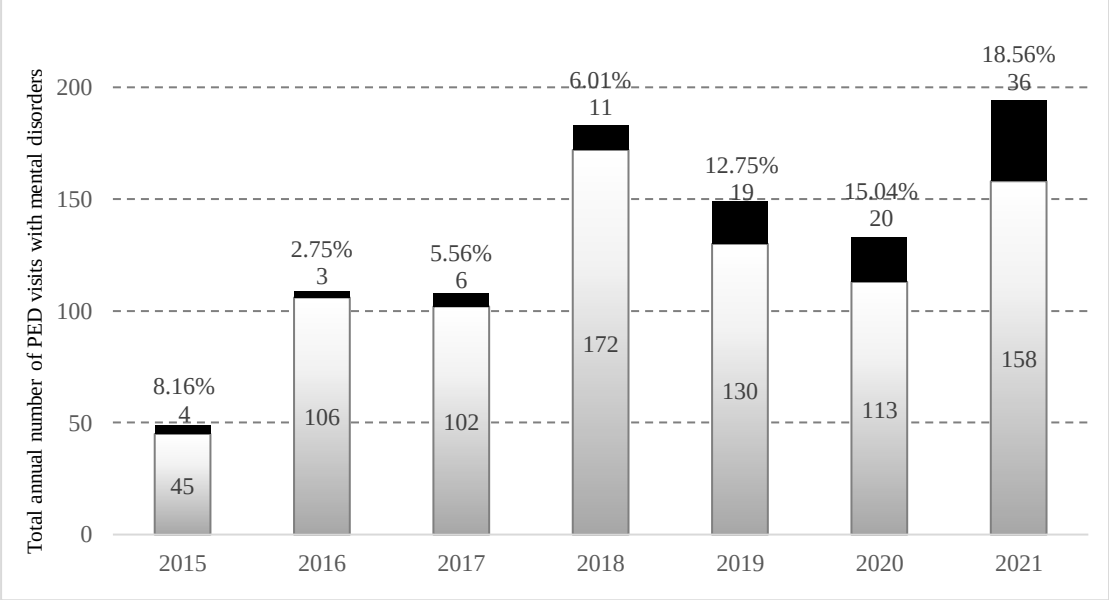
Figure 5. Trends of psychiatrist consultation for psychiatric PED visits



PED, pediatric emergency department; Black bar, patients who received psychiatrist consultation; Gray bar, patients who did not receive psychiatrist consultation

Figure 6. Trends of social worker consultation for psychiatric PED visits



PED, pediatric emergency department; Black bar, patients who received social worker consultation; Gray bar, patients who did not receive social worker consultation

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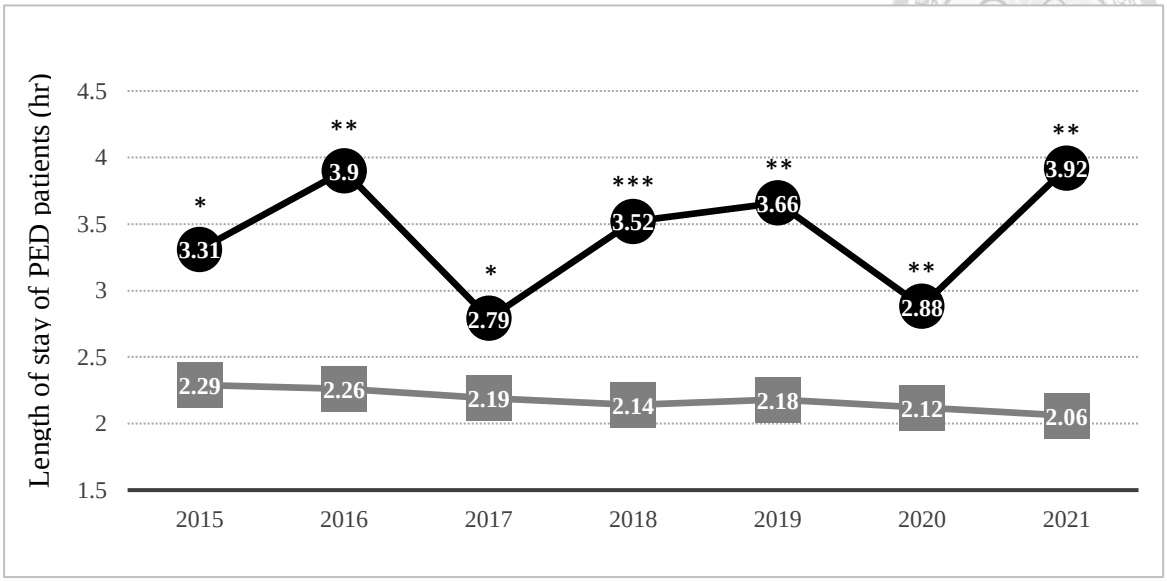
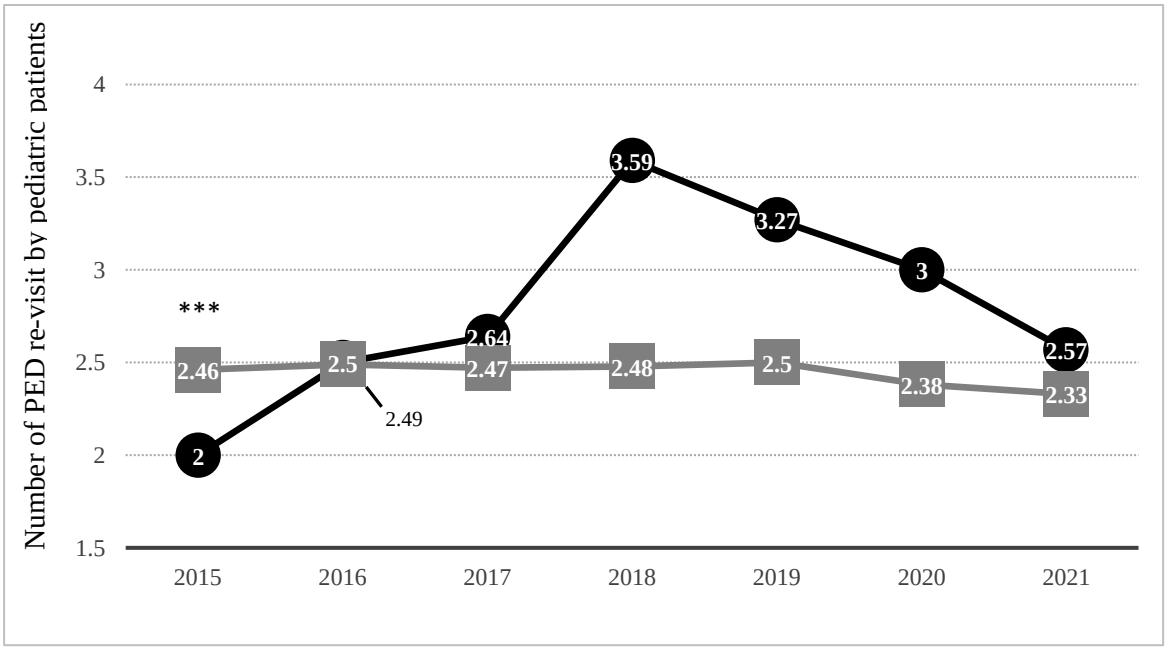
Figure 7. Length of stay at PED



PED, pediatric emergency department ; Circle, patients with mental disorders; Square, patients without mental disorders

***, P value <0.001; **, P value <0.01; *, P value <0.05

Figure 8. PED repeated visits



PED, pediatric emergency department; Circle, patients with mental disorders; Square, patients without mental disorders

***, P value <0.001; **, P value <0.01; *, P value <0.05

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Table 6. Discharge status of patient visiting PED with mental disorders

Discharge status	Total number	YEAR														P value※
		2015 (n=49)		2016 (n=109)		2017 (n=108)		2018 (n=183)		2019 (n=149)		2020 (n=133)		2021 (n=194)		
		n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Discharged, OPD follow up	668	38	(77.55)	93	(85.32)	78	(72.22)	130	(71.04)	102	(68.46)	98	(73.68)	129	(66.49)	0.7300§
Admission to ward	202	8	(16.33)	9	(8.26)	25	(23.15)	34	(18.58)	39	(26.17)	30	(22.56)	57	(29.38)	0.0244**
AAD	26	2	(4.08)	0	(0.00)	3	(2.78)	5	(2.73)	6	(4.03)	5	(3.76)	5	(2.58)	0.0012**
Transfer	24	1	(2.04)	6	(5.50)	2	(1.85)	12	(6.56)	2	(1.34)	0	(0.00)	1	(0.52)	0.4081§
Others	5	0	(0.00)	1	(0.92)	0	(0.00)	2	(1.09)	0	(0.00)	0	(0.00)	2	(1.03)	0.0006§***

PED, pediatric emergency department; OPD, outpatient department; AAD, against advised discharged; Others, operation or loss follow up;

※Pearson's chi-squared test; §Fisher's exact test; ***, P value <0.001; **, P value <0.01; *, P value <0.05

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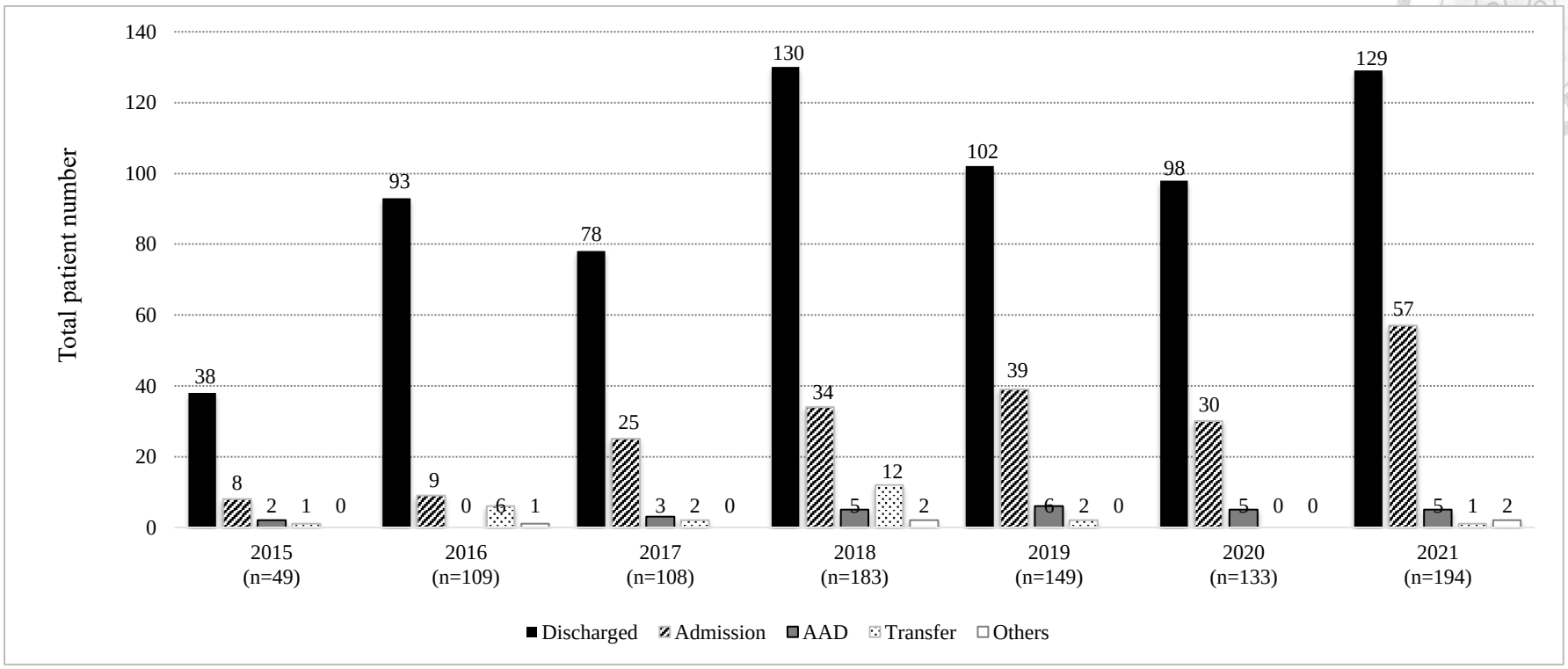
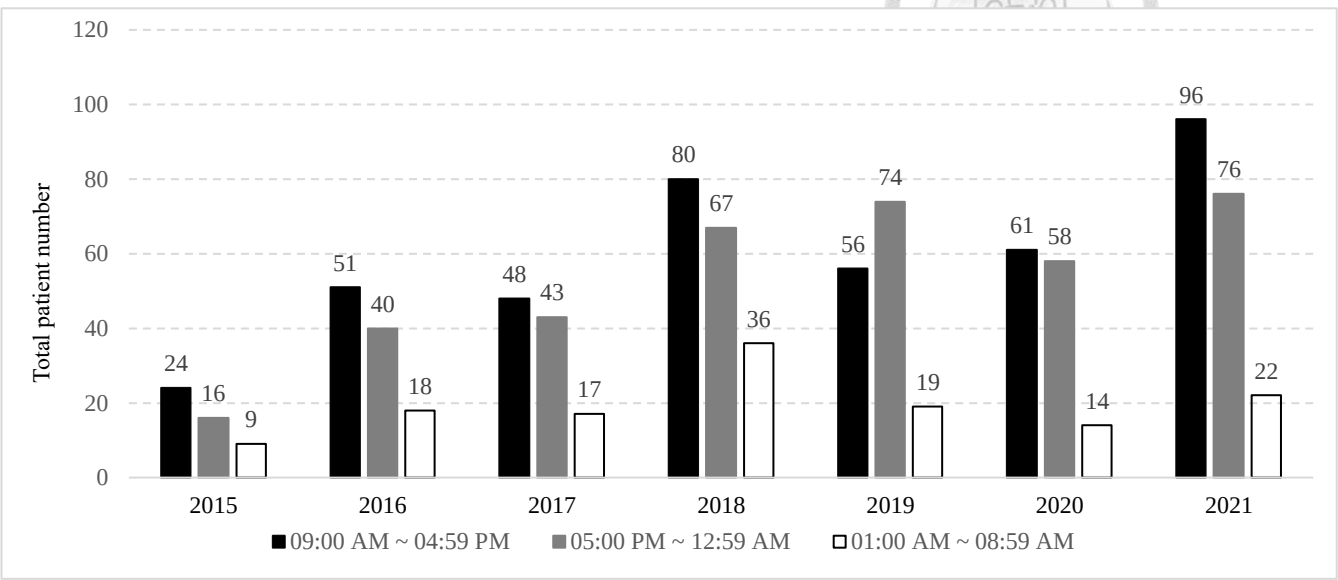
Figure 9. Discharge status of patient visiting PED with mental disorders

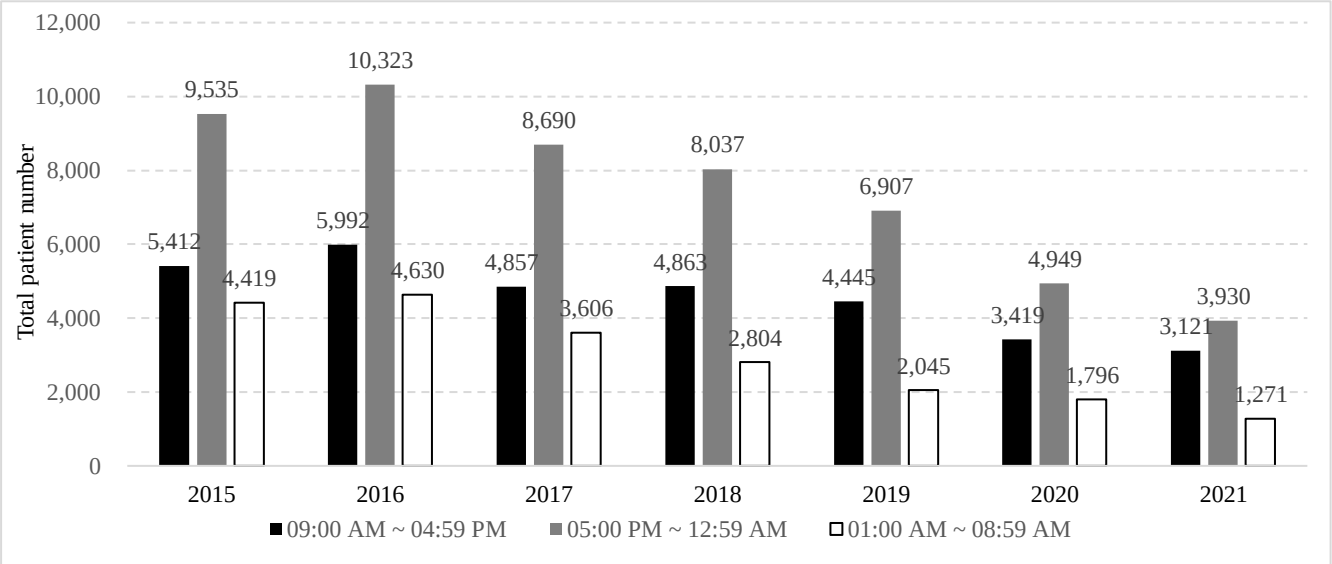


doi:10.6342/NTU202301070

Figure 10. Time of PED arrival by patients with/without mental disorders



PED arrival time by patients with mental disorders



PED arrival time by patients without mental disorders

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Supplementary table

Clinical Classification Software (CCS) Category

		CCS categories	ICD-9	ICD-10
(1) Any mental disorder		650: adjustment disorders	309.0-309.9	F43.20-F43.9
		651: anxiety disorders	293.84, 300.00-300.9, 308.0-308.9, 309.81, 313.0-313.83	F06.4, F40.00-F40.11, F402.10-F402.98, F40.8-F40.9, F41.0-F41.9, F42-F42.9, F43.0-F43.12, F48.8-F48.9, R45.2-R45.84
		652: attention-deficit conduct and disruptive behavior disorders	312.00-312.9, 313.81, 314.00-314.9	F90.0-F90.9, F91.0-F91.9, R46.0-R46.89
		656: impulse control disorders NEC	312.30-312.39	F63.0-F63.9, R458.50
		657: mood disorders	293.83, 296.00-296.99, 300.4, 311	F06.30-F06.34, F30.10-F30.9, F31.0-F31.9, F32.0-F32.9, F33.0-F33.9, F34.0-F34.9, R45.86
		659: schizophrenia and other psychotic disorders	293.81-293.82, 295.00-295.95, 297.0-297.9, 298.0-298.9	F06.0-F06.2, F20.0-F20.9, F21-F29
	Miscellaneous mental health disorders	653: delirium dementia and amnestic and other cognitive disorders	290.0-290.9, 293.0-293.1, 294.0-294.9, 310.0-310.9, 331.0-331.82, 797	F01.50-F01.51, F02.80-F02.81, F03.90-F03.91, F04, F05, F07.0-F07.9, F09, F48.2, G30.0-G30.9, G31.01-G31.83, R41.81, R54
		654: developmental disorders	307.0-307.9, 315.00-315.9, 317, 318.0-318.2, 319, V40.0-V40.1	F70-F79, F80.0-F80.9, F81.0-F81.9, F82-F89, F98.5, R41.83, R48.0
		655: disorders usually diagnosed in infancy, childhood, or adolescence	299.00-299.91, 307.20-307.7, 309.21, 313.23-313.9	F64.2, F84.0-F84.9, F93.0-F93.9, F94.0-F94.9, F95.0-F95.9, F98.0-F98.9

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		670: miscellaneous mental health disorders	293.89-293.9, 300.11-300.82, 302.1-302.9, 306.0-306.9, 307.1-307.89, 310.1, 316, 648.40-648.44, V40.2-V40.9, V67.3	F06.1-F06.8, F44.0-F44.9, F45.0-F45.9, F48.1, F50.00-F50.9, F51.01-F51.9, F52.0-F52.9, F53-F59, F64.0-F64.9, F65.0-F65.9, F66, F68.10-F68.8, F99, O90.6, R37, R45.89, Z87.890, Z91.83
		658: personality disorders	301-301.9	F60.0-F60.9, F69
(2) Substance use disorder		660: alcohol-related disorders	291.0-291.9, 303.00-303.93, 305.00-305.03, 357.5, 425.5, 535.3-535.31, 571.0-571.3, 760.71, 980.0	F101.0-F101.9, F102.0-F102.59, F10.26-F10.27, F102.80-F102.9, F109.20-F109.9, G62.1, I42.6, K292.0-K292.1, K70.0-K70.9, O99.310-O99.315, P04.3, Q86.0
		661: substance-related disorders	292.0-292.9, 304.00-304.93, 305.20-305.93, 648.30-648.34, 655.50-655.53, 760.72-760.75, 779.5, 965.00-965.09, V65.42	F111.0-F111.9, F112.0-F112.9, F119.0-F119.9, F121.0-F121.9, F122.0-F122.9, F129.0-F129.9, F131.0-F131.9, F132.0-F132.9, F139.0-F139.9, F141.0-F142.1, F142.20-F142.9, F149.0-F149.9, F151.0-F151.9, F152.0-F152.9, F159.0-F159.9, F161.0-F161.9, F162.0-F162.9, F169.0-F169.9, F172.00-F172.99, F181.0-F181.9, F182.0-F182.9, F189.0-F189.9, F191.0-F191.9, F192.0-F192.9, F199.0-F199.9, F55.0-F55.8, O35.5XX0-O35.5XX9, O99.320-O99.325, P04.41-P04.49, P96.1-P96.2, T40.0X1A-T40.996S
		663: screening and history of mental health and substance abuse	305.1-305.13, 333.92, 790.3, V11.0-V11.9, V15.4-V15.82, V62.85, V66.3, V70.1-V70.2, V71.01-V71.09, V79.0-V79.9	R78.0-R78.6, Z04.6, Z13.4, Z72.810-Z72.811, Z86.51-Z86.59, Z87.891, Z91.410-Z91.49
(3) Deliberate self-harm		662: suicide and intentional self-inflicted injury	E950.0-E959, V62.84	R45.851, T14.91-T14.91XS, T36.0X2A-T50.Z92S, T51.0X2A-T65.92XS, T71.112A-T71.232S, X71.0XXA-X83.8XXS, Z91.5

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