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ORIGINAL RESEARCH

Severe mental illness and non-specific abdominal pain in the emergency department: a multi-institutional database study

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Abstract

Abdominal pain frequently leads to emergency department (ED) visits, with non-specific abdominal pain (NSAP) being a common diagnosis. Patients with severe mental illness (SMI) face higher risks due to atypical disease presentations and elevated comorbidity rates. Studies show that patients with both SMI and NSAP have increased ED revisit rates and delayed diagnoses. This study examines ED management, unscheduled ED revisit rates, and short-term adverse outcomes in patients with both SMI and NSAP using data from the Chang Gung Research Database from 01 January 2007, to 31 December 2017. Diagnoses were confirmed through the International Classification of Diseases (ICD) codes and medical records, with a 1:3 matching ratio for the non-SMI group using a Greedy algorithm. The outcomes assessed were ED management, 72-hour unscheduled ED revisits, and 7-day adverse events. From seven hospitals, 233,671 patients were initially included over 11 years; 98,722 were excluded, leaving 134,949 for analysis. The SMI group showed higher comorbidity rates, more frequent 72-hour unscheduled ED revisits, and greater use of analgesics but were less likely to receive laboratory tests or CT scans. Non-SMI patients were more likely to be admitted to the hospital and receive invasive procedures within 7 days after index discharge. There were no significant differences in intensive care unit (ICU) admissions, abdominal surgery, or in-hospital mortality between the groups. This study indicates that while patients with SMI and NSAP have higher 72-hour ED revisit rates, they do not experience higher short-term adverse outcomes. Although NSAP is generally safe for all patients, the higher unscheduled revisit rate highlights the need for tailored healthcare interventions to reduce health disparities in this vulnerable group. Future efforts should focus on strategies to improve healthcare for individuals with SMI and NSAP.

Keywords

Severe mental illness; Non-specific abdominal pain; Emergency department; Unscheduled emergency department revisit

1. Introduction

Abdominal pain is one of the most common reasons for patients to visit the emergency department (ED), accounting for 10–16% of all ED visits [1, 2]. Despite advancements in diagnostic modalities, non-specific abdominal pain (NSAP) remains a major discharge diagnosis, accounting for 23.8%–50.3% of ED patients with a chief complaint of acute abdominal pain, and this has not changed over recent decades [3, 4]. Although a definitive diagnosis has not yet been made, NSAP is generally considered safe and self-limiting. Approximately 88% of patients experience symptom improvement or become symptom-free within two weeks of presentation [5]. However, some patients with NSAP may have life-threatening etiologies that require hospitalization, and in some cases, invasive or surgical intervention. Factors that make a timely diagnosis difficult may be the natural history of the disease, misdiagnosis by health providers, or atypical presentations in certain populations [6].

Patients with severe mental illness (SMI) are considered vulnerable due to several factors that include higher rates of comorbidities, poorer socioeconomic support, and atypical disease presentation of their illness [7–9]. Patients with major depressive disorder had higher ED revisit rates when diagnosed with NSAP [10]. Case reports have also documented delayed diagnosis and adverse outcomes in patients with SMI and NSAP who presented to the ED [11–13]. However, the association of SMI with NSAP, ED management and short-term adverse outcomes remains unknown.

The aim of this study was to evaluate ED management,

72-hour unscheduled ED revisit rate, and short-term adverse outcomes of patients with SMI who presented to the ED with a discharge diagnosis of NSAP.

2. Methods

2.1 Data source

This is a retrospective and multicenter database study. We extracted data from the Chang Gung Research Database (CGRD), the largest collection of electronic medical records (EMR) from multiple institutions in Taiwan. The CGRD contains EMR data from the Chang Gung Memorial Hospitals (CGMH), which includes two medical centers, two regional hospitals, and three district hospitals located across northern to southern Taiwan. The CGMH has a bed capacity of >10,000 and admits more than one million patients annually. In 2015, CGMH received >500,000 ED visits, and the hospital received approximately 12% of the annual National Health Insurance budget in Taiwan [14]. The CGRD is structured to include clinical, epidemiological, laboratory, nursing and disease categories as well as cancer registry data for inpatients, outpatients, and emergency patients. Data on the patients' current and previous health conditions were collected. The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes before 2016 and the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-10-CM) codes have been used since then [15, 16].

2.2 Study population

Participants were selected from the CGRD data between 01 January 2007 and 31 December 2017. NSAP was confirmed based on the major diagnostic ICD codes in the ED discharge medical records. Patients with ICD-9-CM codes 789 and ICD-10-CM codes R10 for their major diagnoses were enrolled. SMI was defined as a diagnosis of schizophrenia, bipolar disorder, or major depressive disorder. The diagnosis of SMI was made by a psychiatrist at least once before the diagnosis of NSAP in the ED. Patients who were under 18 years of age, transferred from other health facilities, died in the ED, admitted to the hospital, discharged against medical advice, escaped from the ED, had trauma, had more than four visits to the ED with NSAP in the past year, or had incomplete medical records were excluded from the study. The relevant ICD codes for NSAP and SMI are listed in Table 1.

2.3 Study outcomes and covariates

Patients with CGRD who were discharged from the ED with a major NSAP diagnosis were identified. Outcomes were 72-hour unscheduled ED revisit and short-term adverse outcomes, including ward admission, ICU admission, abdominal operation, abdominal invasive procedure and in-hospital mortality within seven days after ED discharge. We defined per ED visit with the discharge diagnosis of NSAP as an index visit. Abdominally invasive procedures include CT or ultrasound-guided drainage of the abdominal or pelvic cavity. Data on abdominal operations, invasive procedures and ED expenditures were extracted from the national health insurance declaration data. In-hospital mortality was defined as mortality due to any etiology during hospitalization. Covariates included demographic data and comorbidities. The Charlson Comorbidity Index (CCI) and ED management were evaluated. The CCI is calculated based on the sum of weighted diagnoses, including several comorbidities. We determined the CCI score of patients based on the presence of two or more outpatient department visits with the same diagnosis within 1 year. CCI scores were categorized into three grades: mild, with CCI scores of 1–2; moderate, with CCI scores of 3–4; and severe, with CCI scores ≥5 [17, 18]. Index ED management includes analgesic prescription (opioid and non-opioid), laboratory tests, abdominal ultrasound, abdominal or pelvic CT, and endoscopic studies. ED stay duration and expenditure were also extracted from the EMR.

2.4 Statistical analysis

Continuous variables are presented as mean (SD), and categorical variables are presented as count (%). Due to the large difference in patient numbers between the two groups, we employed a matched case-control study design. Specifically, the non-SMI patient group was matched at a ratio of 1:3 using a Greedy algorithm [19]. Age (±5 years), gender and CCI category were included as variables in the matching process. Continuous variables were compared between the two independent groups using Student's *t*-test, while categorical variables were compared using the chi-square test. Statistical analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC, USA). Statistical significance was set at $p < 0.05$. This study was conducted in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [20].

3. Results

A total of 233,671 patients from seven hospitals were recruited over an 11-year period. Among them, 98,722 were excluded based on the criteria, leaving 134,949 patients for the analysis. The recruitment flowchart is shown in Fig. 1. The mean age of the participants was 47.68 ± 18.70 (years), and 58.95% were females. In the SMI group, 68.41%, 10.77% and 20.82% of patients had depression, schizophrenia, bipolar disorder, respectively. When the patient demographics and medical histories of SMI and non-SMI groups were compared, we found that patients in the SMI group were older (52.13 *vs.* 47.51 years, $p < 0.001$) and had a higher percentage of females (66.62 *vs.* 58.65%, $p < 0.001$). Comorbidities including cardiovascular disease (28.47 *vs.* 12.45%, $p < 0.001$), cerebrovascular disease (37.53 *vs.* 13.88%, $p < 0.001$), pulmonary disease (50.56 *vs.* 31.04%, $p < 0.001$), liver disease (52.32 *vs.* 29.24%, $p < 0.001$), diabetes mellitus (36.01 *vs.* 18.36%, $p < 0.001$), renal disease (30.87 *vs.* 19.93%, $p < 0.001$), and malignancy (23.01 *vs.* 15.65%, $p < 0.001$) had a higher prevalence in the SMI group than in the non-SMI group; therefore, the SMI group had a higher percentage of patients with moderate-to-severe CCI ($p < 0.001$). After matching with age, gender and CCI, comorbidities including cardiovascular

TABLE 1. ICD codes for inclusion criteria.

	ICD-9-CM code	ICD-10-CM code
NSAP[a]		
	Leading by 789	Leading by R10
SMI[b]		
Depression	296.20–26; 296.30–36; 296.82; 298.0	F32.0–5; F32.9; F33.0–4; F33.9; F32.8
Schizophrenia	295; 297; 298.3–4; 298.9	F20.0–3; F20.5; F20.8–9; F25.0–1; F25.8–9; F22–24; F28–29
Bipolar disorder	296.00–16; 296.40–81; 296.89–99; 298.1	F30.1–4; F30.8–9; F31.0–9; F28

[a]*NSAP, non-specific abdominal pain.* [b]*SMI, severe mental illness. ICD, The International Classification of Diseases; CM, Clinical Modification.*

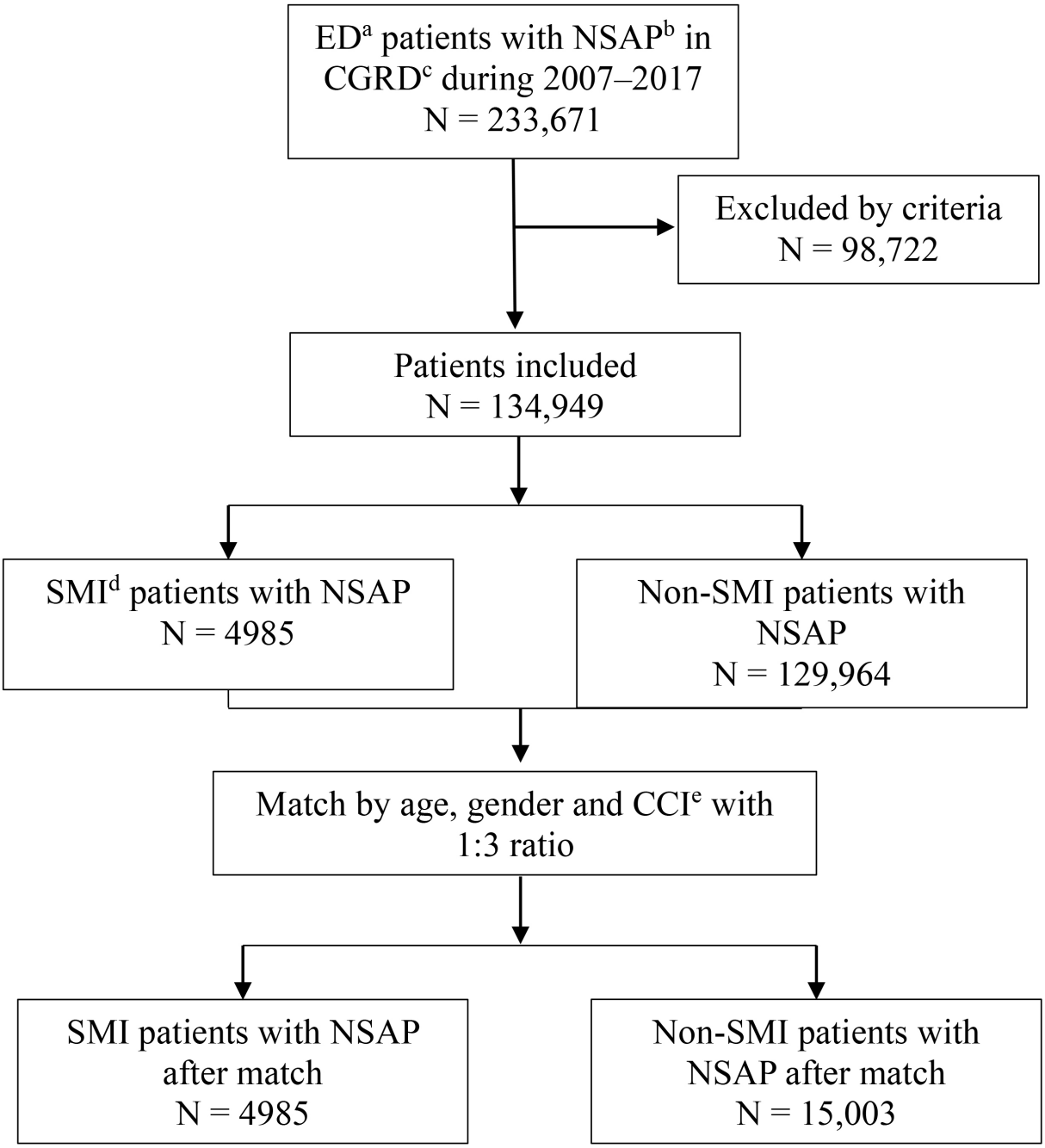

FIGURE 1. Flow chart of participants in the study. [a]ED, emergency department. [b]NSAP, non-specific abdominal pain. [c]CGRD, Chang Gung Research Database. [d]SMI, severe mental illness. [e]CCI, Charlson Comorbidity Index.

disease (28.47 *vs.* 20.95%, $p < 0.001$), cerebrovascular disease (37.53 *vs.* 22.00%, $p < 0.001$), pulmonary disease (50.56 *vs.* 35.90%, $p < 0.001$), liver disease (52.32 *vs.* 40.67%, $p < 0.001$), and diabetes mellitus (36.01 v*s.* 29.78%, $p < 0.001$) still showed a higher prevalence in the SMI group, while malignancy showed a higher prevalence in the non-SMI group (23.01 *vs.* 30.79%, $p < 0.001$). The results are summarized in Table 2.

Further analysis of the matched groups revealed that patients in the SMI group had a higher rate of receiving analgesics (66.78 *vs.* 61.39%, $p < 0.001$) than those in the non-SMI group, but were less likely to undergo laboratory test (68.67 *vs.* 70.90%, $p = 0.003$) and CT scans (9.95 *vs.* 11.38%, $p = 0.006$), resulting in lower ED expenditures (3408.66 *vs.* 3364.44 Taiwan dollar, $p = 0.005$). A higher rate of 72-hour unscheduled ED revisit rate (6.34 *vs.* 4.33%, $p < 0.001$) was observed in the SMI group than in the non-SMI group. A higher rate of ward admission (0.70 *vs.* 1.09%, $p = 0.020$) and abdominal invasive procedures (0.08 *vs.* 0.55%, $p < 0.001$) within seven days after the index ED discharge was found in the non-SMI group. No significant differences in ICU admission, abdominal operation, or in-hospital mortality were observed within seven days after the index ED discharge between the two groups. The results are summarized in Table 3.

4. Discussion

This is the first study to investigate ED management, 72-hour unscheduled ED revisit rate, and short-term adverse outcomes in patients with SMI who visited the ED with a discharge diagnosis of NSAP. The findings revealed a higher 72-hour unscheduled ED revisit rate in the SMI group, but no poorer short-term outcomes, such as ward admission, ICU admission, surgery or invasive procedures within seven days, or in-hospital mortality in this population. Higher rates of ward admission and surgery or invasive procedures within seven days after index ED discharge were found in the non-SMI group.

Digestive system diseases are the most common diagnostic category leading to unscheduled ED revisits, which may be attributed to various differential diagnoses and diverse clinical presentations [21, 22]. Meltzer *et al.* [10] reported that major depressive disorder is associated with an increased risk of ED revisits in patients with NSAP. Our results are consistent with those of previous studies and provide further evidence that not only patients with major depressive disorder but also those with SMI who present to the ED with NSAP are at increased risk of subsequent 72-hour unscheduled ED revisits. This relationship may be explained by disease and healthcare system factors. Functional gastrointestinal disorders (FGID) are characterized by gastrointestinal symptoms without a demonstrable etiology and have been shown to be highly associated with SMI and ED use [23–26]. However, the diagnosis of FGID is primarily based on criteria that require a stepwise exclusion, making it difficult to diagnose in an ED setting [27]. In addition, the ED plays a crucial role in the healthcare system, especially for the underserved vulnerable population who may have limited access to other healthcare services, such as outpatient departments. In particular, patients with SMI are less likely to have access to established healthcare services and have a higher rate of ED utilization [28, 29]. The higher prevalence of FGID and increased ED utilization among patients with SMI may be important factors contributing to the higher 72-hour unscheduled ED revisit rate in this group.

Although patients with NSAP and SMI have a higher 72-hour unscheduled ED revisit rate, no apparent short-term adverse outcomes, including ward admission, ICU admission, surgery or invasive procedures within seven days, and in-hospital mortality were noted. Patients received fewer laboratory and CT studies during the index ED visit, resulting in a lower total ED expenditure. Despite this, no apparent adverse short-term outcomes were associated with the reduced testing and lower costs. NSAP is generally considered a benign diagnosis in the ED, and a 2020 study found that only 0.7% of revisiting patients with a previous discharge diagnosis of NSAP required hospitalization, and only 0.06% needed immediate surgery [30]. Comparing with previous study, our study revealed higher hospitalization rates of 1.1% and 0.37%, respectively, in patients who underwent abdominal surgery. The differences in rates may be attributed to different healthcare and insurance systems as well as the different definitions used in the studies [31]. For instance, our current study defined any abdominal operation within the acute phase, whereas Saaristo *et al.* [30] defined abdominal surgery only in urgent conditions (*e.g.*, acute mesenteric ischemia and bowel perforation). However, despite these differences, our study concurs with previous studies demonstrating that NSAP is a safe diagnosis in current clinical practice in the ED, both in the overall population and in patients with SMI, given its low short-term adverse outcomes.

Although a higher rate of 72-hour unscheduled ED revisits did not contribute to higher short-term adverse outcomes in patients with SMI and NSAP, this may reflect inadequate ED management. The 72-hour unscheduled ED revisit rate is considered a healthcare quality indicator, as unscheduled ED revisits are associated with ED crowding, higher healthcare expenditure, and poorer medical experiences [32, 33]. Previous studies have also revealed that mental illness is a risk factor for unscheduled ED revisits and have attributed this to unclear discharge instructions, inefficient discharge systems, and inadequate post-ED follow-ups [34–37]. To address this issue, various strategies such as multidisciplinary approaches, integrated discharge systems, and post-ED care programs have been found to be effective in reducing unscheduled ED revisits [38, 39]. Reducing unscheduled ED revisits may have a particularly profound effect on vulnerable patient populations with frequent ED visits, and further improve healthcare equity [40, 41].

5. Limitations

This study has some limitations. First, although the CGRD is one of the largest databases in Taiwan, it is not sufficiently comprehensive to include all patients with SMI diagnoses from other health facilities. Data related to 72-hour unscheduled ED revisits, hospitalizations, operations or invasive procedures, and mortality may be missed if they occur at other healthcare institutions. Second, no consensus is available on the defini-

TABLE 2. Patient characteristics for overall, non-matched, and matched groups.

Variable	Overall (N = 134,949)	Non-matched			Matched by age, gender and CCI (1:3)		
		SMI[a] (N = 4985)	Non-SMI (N = 129,964)	*p* value	SMI (N = 4985)	Non-SMI (N = 15,003)	*p* value
Age (yr)	47.68 ± 18.70	52.13 ± 17.11	47.51 ± 18.74	<0.001*	52.13 ± 17.11	52.10 ± 17.11	0.928
Female	79,551 (58.95)	3321 (66.62)	76,230 (58.65)	<0.001*	3321 (66.62)	9991 (66.59)	0.986
Categories of SMI							
Depression	3410 (2.52)	3410 (68.41)	-	-	3410 (68.41)	-	-
Schizophrenia	537 (0.40)	537 (10.77)	-	-	537 (10.77)	-	-
Bipolar disorder	1038 (0.77)	1038 (20.82)	-	-	1038 (20.82)	-	-
Comorbidities							
Cardiovascular disease	17,603 (13.04)	1419 (28.47)	16,184 (12.45)	<0.001*	1419 (28.47)	3143 (20.95)	<0.001*
Cerebrovascular disease	19,910 (14.75)	1871 (37.53)	18,039 (13.88)	<0.001*	1871 (37.53)	3301 (22.00)	<0.001*
Pulmonary disease	29,716 (32.02)	2339 (50.56)	27,377 (31.04)	<0.001*	2339 (50.56)	4520 (35.90)	<0.001*
Liver disease	40,603 (30.09)	2608 (52.32)	37,995 (29.24)	<0.001*	2608 (52.32)	6102 (40.67)	<0.001*
Diabetes mellitus	25,655 (19.01)	1795 (36.01)	23,860 (18.36)	<0.001*	1795 (36.01)	4468 (29.78)	<0.001*
Renal disease	19,001 (20.47)	1428 (30.87)	17,573 (19.93)	<0.001*	1428 (30.87)	3689 (29.30)	0.048
Malignancy	21,492 (15.93)	1147 (23.01)	20,345 (15.65)	<0.001*	1147 (23.01)	4620 (30.79)	<0.001*
AIDS[b]	43 (0.05)	4 (0.09)	39 (0.04)	0.165	4 (0.09)	6 (0.05)	0.269
CCI[c] 1–2	80,644 (59.76)	1570 (31.49)	79,074 (60.84)	<0.001*	1570 (31.49)	4746 (31.63)	0.869
CCI 3–4	16,940 (12.55)	992 (19.90)	15,948 (12.27)	<0.001*	992 (19.90)	2982 (19.88)	0.987
CCI ≥5	37,365 (27.69)	2423 (48.61)	34,942 (26.89)	<0.001*	2423 (48.61)	7275 (48.49)	0.901

Count data are expressed as number (percentage) and continuous values are expressed as mean ± SD.
[a]SMI, severe mental illness. [b]AIDS, acquired immunodeficiency syndrome. [c]CCI, Charlson Comorbidity Index.
**p < 0.05.*

tion of NSAP, which may vary depending on the healthcare system. Therefore, caution should be exercised when generalizing the results of this study before performing further external validation. Third, although we defined NSAP using a major diagnostic ICD code, patients with a definite diagnosis but without an appropriate ICD code may still have been enrolled, and misclassification bias was unavoidable. Fourth, the medication profile is a crucial component in reflecting the condition of patient with SMI. Unfortunately, because of the database limitations, we could not access this information. Fifth, because of the restricted database duration, the long-term outcomes of patients could not be well established in this study. Further prospective studies that focus on well-defined populations with longer follow-up periods can provide valuable insights into this specific population and help improve healthcare equity among vulnerable groups.

6. Conclusions

Our study demonstrated a higher 72-hour unscheduled ED revisit rate but not poorer short-term outcomes in patients with SMI and a previous ED discharge diagnosis of NSAP. Since poor short-term outcomes are rare, NSAP is considered safe in current clinical practice in the ED for both the general population and patients with SMI. However, a higher rate of unscheduled ED revisits indicates suboptimal healthcare, highlighting the need for further investigations and interventions to eliminate health disparities among this vulnerable group.

TABLE 3. ED management, 72-hour unscheduled ED revisit, and short-term adverse outcomes for matched groups.

Variable	Overall (N = 19,988)	SMI[a] patient with NSAP[b] (N = 4985)	Non-SMI patient with NSAP (N = 15,003)	*p* value
Age (year)	52.11 (17.11)	52.13 (17.11)	52.10 (17.11)	0.928
Female	13,312 (66.60)	3321 (66.62)	9991 (66.59)	0.986
Index ED[c] management				
Analgesics	12,540 (62.74)	3329 (66.78)	9211 (61.39)	<0.001*
Non-opioid analgesics	8727 (43.66)	2804 (56.25)	8457 (56.37)	0.895
Opioid analgesics	11,261 (56.34)	2181 (43.75)	6546 (43.63)	0.895
Laboratory test	14,060 (70.34)	3423 (68.67)	10,637 (70.90)	0.003*
Abdominal ultrasound	670 (3.35)	152 (3.05)	518 (3.45)	0.185
CT[d] scan	2204 (11.03)	496 (9.95)	1708 (11.38)	0.006*
Endoscopy	46 (0.23)	11 (0.22)	35 (0.23)	1.000
ED stay time (min)	309.50 (1026.29)	311.04 (783.52)	308.99 (1095.13)	0.885
Index ED expenditures (TWD[e])	3317.71 (3378.51)	3177.31 (3408.66)	3375.92 (3364.44)	0.005*
72-hour unscheduled ED revisit	965 (4.83)	316 (6.34)	649 (4.33)	<0.001*
7-day adverse outcomes				
Ward admission	199 (1.00)	35 (0.70)	164 (1.09)	0.020*
ICU[f] admission	21 (0.11)	2 (0.04)	19 (0.13)	0.167
Abdominal operation	73 (0.37)	14 (0.28)	59 (0.39)	0.315
Abdominal invasive procedure	86 (0.43)	4 (0.08)	82 (0.55)	<0.001*
In hospital mortality	6 (0.03)	1 (0.02)	5 (0.03)	0.821

Count data are expressed as number (percentage) and continuous values are expressed as mean ± SD.
[a]SMI, severe mental illness. [b]NSAP, non-specific abdominal pain. [c]ED, emergency department. [d]CT, computed tomography. [e]TWD, Taiwan dollar. [f]ICU, intensive care unit.
**p < 0.05.*

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and analyzed in the current study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

WCC and SKH—Conceptualization, Writing. KHW and CHL—Data Curation. SYG and CHL—Formal analysis, Methodology. YYH and SKH—Investigation. CJN and CWL—Resources. CJN—Supervision.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Chang Gung Medical Foundation Institutional Review Board (IRB: 202001785B0C601), which waived the need to obtain informed consent from the study participants. All methods were performed in accordance with relevant regulations.

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CONFLICT OF INTEREST

The corresponding author confirms on behalf of all authors that there has been no involvement that might raise the question of bias in the work reported or in the conclusions, implications, or opinions stated.

REFERENCES

[1] Cervellin G, Mora R, Ticinesi A, Meschi T, Comelli I, Catena F, *et al*. Epidemiology and outcomes of acute abdominal pain in a large urban emergency department: retrospective analysis of 5340 cases. Annals of Translational Medicine. 2016; 4: 362.

[2] Arvig MD, Mogensen CB, Skjøt-Arkil H, Johansen IS, Rosenvinge FS, Lassen AT. Chief complaints, underlying diagnoses, and mortality in adult, non-trauma emergency department visits: a population-based, multicenter cohort study. The Western Journal of Emergency Medicine. 2022; 23: 855–863.

[3] Fagerström A, Paajanen P, Saarelainen H, Ahonen-Siirtola M, Ukkonen M, Miettinen P, *et al*. Non-specific abdominal pain remains as the most common reason for acute abdomen: 26-year retrospective audit in one emergency unit. Scandinavian Journal of Gastroenterology. 2017; 52: 1072–1077.

[4] Yau FF, Yang Y, Cheng CY, Li CJ, Wang SH, Chiu IM. Risk factors for early return visits to the emergency department in patients presenting with nonspecific abdominal pain and the use of computed tomography scan. Healthcare. 2021; 9: 1470.

[5] Lukens TW, Emerman C, Effron D. The natural history and clinical findings in undifferentiated abdominal pain. Annals of Emergency Medicine. 1993; 22: 690–696.

[6] Karcioglu O. Nonspecific abdominal pain: do I have to allocate a specific diagnosis for every patient? Signa Vitae. 2022; 18: 1–4.

[7] Zabeen S, Lawn S, Venning A, Fairweather K. Why do people with severe mental illness have poor cardiovascular health? The need for implementing a recovery-based self-management approach. International Journal of Environmental Research and Public Health. 2021;18: 12556.

[8] Luciano M, Pompili M, Sartorius N, Fiorillo A. Editorial: mortality of people with severe mental illness: causes and ways of its reduction. Frontiers in Psychiatry. 2022; 13: 1009772.

[9] Oliveira J. E Silva L, Prakken SD, Meltzer AC, Broder JS, Gerberi DJ, Upadhye S, *et al*. Depression and anxiety screening in emergency department patients with recurrent abdominal pain: an evidence synthesis for a clinical practice guideline. Academic Emergency Medicine. 2022; 29: 615–629.

[10] Meltzer AC, Bregman B, Blanchard J. Depression is associated with repeat emergency department visits in patients with non-specific abdominal pain. Western Journal of Emergency Medicine. 2014; 15: 325–328.

[11] Retamero C, Paglia C. When patients do not hurt: silent acute abdomen in a patient with schizophrenia. General Hospital Psychiatry. 2012; 34: 210.e9–210.e11.

[12] Kallur A, Yoo E, Bien-Aime F, Ammar H. Diagnostic overshadowing and pain insensitivity in a schizophrenic patient with perforated duodenal ulcer. Cureus. 2022; 14: e21800.

[13] Katz E, Kluger Y, Rabinovici R, Stein D, Gimmon Z. Acute surgical abdominal disease in chronic schizophrenic patients: a unique clinical problem. Israel Medical Association Journal. 1990; 26: 275–277.

[14] Tsai M, Lin M, Lee C, Yang Y, Chen W, Chang G, *et al*. Chang gung research database: a multi-institutional database consisting of original medical records. Biomedical Journal. 2017; 40: 263–269.

[15] Shao S, Chan Y, Kao Yang Y, Lin S, Hung M, Chien R, *et al*. The Chang gung research database—a multi-institutional electronic medical records database for real-world epidemiological studies in Taiwan. Pharmacoepidemiology and Drug Safety. 2019; 28: 593–600.

[16] Huang Y, Chen Y, Chang S, Kuo C, Chen M. Discharge status validation of the Chang gung research database in Taiwan. Biomedical Journal. 2022; 45: 907–913.

[17] Huang Y, Gou R, Diao Y, Yin Q, Fan W, Liang Y, *et al*. Charlson comorbidity index helps predict the risk of mortality for patients with type 2 diabetic nephropathy. Journal of Zhejiang University Science B. 2014; 15: 58–66.

[18] Charlson ME, Carrozzino D, Guidi J, Patierno C. Charlson comorbidity index: a critical review of clinimetric properties. Psychotherapy and Psychosomatics. 2022; 91: 8–35.

[19] Jungnickel D. The greedy algorithm. Graphs, Networks and Algorithms. 1999; 5: 129–153.

[20] Skrivankova VW, Richmond RC, Woolf BAR, Yarmolinsky J, Davies NM, Swanson SA, *et al*. Strengthening the reporting of observational studies in epidemiology using mendelian randomization. JAMA. 2021; 326: 1614.

[21] Al-Mashat H, Lindskou TA, Møller JM, Ludwig M, Christensen EF, Søvsø MB. Assessed and discharged—diagnosis, mortality and revisits in short-term emergency department contacts. BMC Health Services Research. 2022; 22: 816.

[22] Hutchinson CL, Curtis K, McCloughen A, Qian S, Yu P, Fethney J. Identifying return visits to the emergency department: a multi-centre study. Australasian Emergency Care. 2021; 24: 34–42.

[23] Fikree A, Byrne P. Management of functional gastrointestinal disorders. Clinical Medicine. 2021; 21: 44–52.

[24] Wu JC. Psychological co-morbidity in functional gastrointestinal disorders: epidemiology, mechanisms and management. Journal of Neurogastroenterology and Motility. 2012; 18: 13–18.

[25] North CS. Relationship of functional gastrointestinal disorders and psychiatric disorders: implications for treatment. World Journal of Gastroenterology. 2007; 13: 2020.

[26] Ålander T, Svärdsudd K, Johansson S, Agréus L. Psychological illness is commonly associated with functional gastrointestinal disorders and is important to consider during patient consultation: a population-based study. BMC Medicine. 2005; 3: 8.

[27] Drossman DA, Hasler WL. Rome IV—functional GI disorders: disorders of gut-brain interaction. Gastroenterology. 2016; 150: 1257–1261.

[28] Niedzwiecki MJ, Sharma PJ, Kanzaria HK, McConville S, Hsia RY. Factors associated with emergency department use by patients with and without mental health diagnoses. JAMA Network Open. 2018; 1: e183528.

[29] Fang A, Hersh M, Birgisson N, Saynina O, Wang NE. "Could we have predicted this?" the association of a future mental health need in young people with a non-specific complaint and frequent emergency department visits. Journal of the American College of Emergency Physicians Open. 2021; 2: e12556.

[30] Saaristo L, Ukkonen MT, Laukkarinen JM, Pauniaho SK. The rate of short-term revisits after diagnosis of non-specific abdominal pain is similar for surgeons and emergency physicians-results from a single tertiary hospital emergency department. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2020; 28: 63.

[31] Shou-Hsia C. The effect of universal health insurance on health care utilization in Taiwan. JAMA. 1997; 278: 89.

[32] Sabbatini AK, Kocher KE, Basu A, Hsia RY. In-hospital outcomes and costs among patients hospitalized during a return visit to the emergency department. JAMA. 2016; 315: 663.

[33] Tsai CL, Ling DA, Lu TC, Lin JC, Huang CH, Fang CC. Inpatient outcomes following a return visit to the emergency department: a nationwide cohort study. The Western Journal of Emergency Medicine. 2021; 22: 1124–1130.

[34] Guo DY, Chen KH, Chen IC, Lu KY, Lin YC, Hsiao KY. The association between emergency department revisit and elderly patients. Journal of Acute Medicine. 2020; 10: 20–26.

[35] Hsu CC, Chu CJ, Lin CH, Huang CH, Ng CJ, Lin GY, *et al*. A machine learning model for predicting unscheduled 72 h return visits to the emergency department by patients with abdominal pain. Diagnostics. 2021; 12: 82.

[36] Hung S, Kou H, Wu K, Chen S, Li C, Lee C, *et al*. Does medical disparity exist while treating severe mental illness patients with acute appendicitis in emergency departments? A real-world database study. BMC Psychiatry. 2022; 22: 488.

[37] Wang LH, Lee HL, Lin CC, Lan CJ, Huang PT, Han CY. Factors associated with return visits by elders within 72 hours of discharge from the emergency department. Healthcare. 2023; 11: 1726.

[38] Fruhan S, Bills CB. Association of a callback program with emergency

department revisit rates among patients seeking emergency care. JAMA Network Open. 2022; 5: e2213154.

[39] Moss JE, Houghton LM, Flower CL, Moss DL, Nielsen DA, Taylor DM. A multidisciplinary care coordination team improves emergency department discharge planning practice. Medical Journal of Australia. 2002; 177: 427–439.

[40] Biese K, Lash TA, Kennedy M. Emergency department care transition programs—value-based care interventions that need system-level support. JAMA Network Open. 2022; 5: e2213160.

[41] Gettel CJ, Hastings SN, Biese KJ, Goldberg EM. Emergency department-to-community transitions of care: best practices for the older adult population. Clinics in Geriatric Medicine. 2023; 39: 659–672.

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