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Research paper

Access to means of lethal overdose among psychiatric patients with co-morbid physical health problems: Analysis of national suicide case series data from the United Kingdom

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ABSTRACT

Background: Many physical health problems are associated with elevated suicide risk whilst also providing access to means of overdose. We aimed to investigate whether psychiatric patients with physical co-morbidities who die by suicide were more likely than those without co-morbidities to self-poison with non-psychotropic medications.

Methods: We analysed data on 14,648 psychiatric patients who died by suicide in England & Wales during 2004–2015, as recorded by the National Confidential Inquiry into Suicide and Safety in Mental Health. Using logistic regression models adjusted for age, gender, ethnicity, and primary drug dependence/misuse we compared patients diagnosed with physical co-morbidities versus those without to assess whether a greater proportion of the former had died by overdose, and medication prescribed to treat such disorders (e.g. opioids, insulin).

Results: 24% ($n = 3525$) were recorded as having physical co-morbidity. A greater proportion of these individuals died by self-poisoning than those without physical co-morbidity (37% vs. 20%, $p < .001$; adjusted OR 2.47; 95% CI 2.26–2.70), and they were more likely to have used medications for a physical health disorder in overdose (50% vs. 34%; adjusted OR 2.10; 95% CI 1.80–2.46), particularly opioids (30% vs. 22%; $p < .001$), paracetamol/opioid compounds (11% vs. 7%, $p < .001$) and insulin (4% vs. 1%, $p < .001$).

Limitations: Use of survey data may have resulted in under-reporting of physical health problems and/or overdose medications.

Conclusions: Overdose, rather than hanging, is the leading cause of suicide among psychiatric patients with physical co-morbidities, particularly using non-psychotropic medications. There is potential for means restriction in preventing suicide among these patients.

1. Background

Restricting access to lethal means is the suicide prevention intervention with the best evidence for effectiveness (Zalsman et al., 2016). Means restriction has most public health impact in relation to common, high-lethality suicide methods. After hanging, poisoning is the second commonest method of suicide in England, Scotland and Wales; accounting for 18% of male and 36% of female suicides in 2016 (Office for National Statistics, 2016a). Restricting means of overdose entails impeding access to the medication load available to at-risk persons to a level that, even if taken in one dose, will not pose serious harm (Hawton et al., 2013). Usually this involves adjusting the frequency (and therefore volume) of medication prescribed or available over-the-counter. The value of this approach is exemplified in the

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significant reduction in fatal paracetamol overdoses associated with UK legislation restricting pack size of over-the-counter analgesics (Barber and Miller, 2014). Where methods are not easily substituted by others, means restriction does not necessarily prompt means substitution (Sarchiapone et al., 2011). Indeed, the UK withdrawal of co-proxamol was associated with a significant reduction in deaths involving co-proxamol poisoning but no corresponding increase in deaths involving analgesics (Hawton et al., 2009). Physical disorders such as cancer (Henson et al., 2019; Ahmedani et al., 2017), osteoporotic fracture (Chang et al., 2018; Webb et al., 2012), back pain (Ahmedani et al., 2017), diabetes (Ahmedani et al., 2017; Webb et al., 2014), and heart disease (Ahmedani et al., 2017; Wu et al., 2018) are associated with an increased risk of suicide, and may provide affected individuals access to potentially lethal doses of prescribed medication Gorton et al., 2016). In a Swedish sample, 9% of patients diagnosed with diabetes who died from fatal poisoning had taken overdoses of diabetic drugs (Webb et al., 2014). For people with pain conditions, particularly chronic pain (Petrosky et al., 2018), opioids are a key target for means restriction, especially as the association of non-cancer pain and suicide risk is independent of psychiatric illness (Ilgen et al., 2013). In 2016 opioids accounted for 54% of all fatal drug poisonings (suicides and accidental overdoses) in England & Wales (ONS, 2016b). The most common opioid responsible was heroin and/or morphine (ONS, 2016b), although available data do not indicate what proportion involved 'street' opioids or those prescribed for chronic pain. With approximately 6000 people dying by suicide in the UK annually (ONS, 2016c), there is great interest among both clinicians and policymakers in the potential to restrict the volume of potentially lethal medication available to patients with physical illnesses. However, an improved understanding is needed regarding the role of access to these medications in pathways to suicide.

Our research question was whether a greater proportion of psychiatric patients also diagnosed with physical illnesses who die by suicide poison themselves compared to individuals without physical co-morbidities, and whether they are more likely to self-poison using medication prescribed to treat their physical health problems. We thereby aimed to explore the potential for means restriction interventions in a sub-group of psychiatric patients with co-morbid physical illnesses. Using national suicide case series data on psychiatric patients who died by suicide in England & Wales during 2004–2015, we aimed to describe the sociodemographic and clinical characteristics of psychiatric patients with a diagnosis of a co-morbid physical illness. We tested the hypotheses that:

- a greater proportion of deceased patients diagnosed with co-morbid physical illness fatally poisoned themselves than such patients without co-morbidity
- a greater proportion of deceased patients diagnosed with physical illness who fatally poisoned themselves overdosed on medication used for physical health problems versus such patients who died by intentional self-poisoning without co-morbidity
- among deceased patients with co-morbid physical illness who fatally poisoned themselves with medications prescribed to treat these conditions, a higher proportion had been prescribed the medication taken in overdose versus those without physical health disorders
- among deceased patients diagnosed with cancer, diabetes, and pain conditions the proportion who fatally self-poisoned using physical health medications was greater than among such patients diagnosed with other physical illnesses. These conditions have been linked with elevated suicide risk (Henson et al., 2019; Ahmedani et al., 2017; Webb et al., 2012), whilst also providing access to medications that are highly toxic in overdose (Gorton et al., 2016).

2. Methods

2.1. Study dataset

Questionnaire data were collected as part of the National Confidential Inquiry into Suicide and Safety in Mental Health (Appleby et al., 1999). This database provides a national case series of patients under the care of mental health services who have died by suicide across the UK (i.e. England, Scotland, Wales and Northern Ireland). A detailed description of the National Confidential Inquiry's methodology is available elsewhere (Windfuhr et al., 2008). In brief, firstly, data on all deaths in England & Wales receiving a verdict of suicide or unnatural death of undetermined intent ('open' verdict) at coroner's inquest were received from the Office for National Statistics (ONS). Suicide research conducted in the UK conventionally includes open verdicts to avoid underestimating the number of suicide deaths (Linsley et al., 2001). Second, administrative contacts at NHS Trusts or Health Boards in the deceased person's district of residence identified whether contact had been made with secondary mental health services in the 12 months prior to death. Third, for those individuals with psychiatric contact, detailed data were collected via a questionnaire sent to the clinicians who had been responsible for that psychiatric patient's care. The questionnaire captured information on suicide method, demographic details, clinical characteristics, including any major physical illness at the time of death, aspects of care and treatment received.

2.2. Ethical approvals

The National Confidential Inquiry has research ethics approval from North West - GM South REC (reference: ERP/96/136) and Section 251 Approval under the NHS Act 2006 (reference: PIAG 4-08(d)/2003), allowing collection of patient identifiable data for medical research.

2.3. Measures

We defined physical health conditions on the basis of responses to the questionnaire item: "*Did the patient have a major physical illness at the time of death? (include conditions even if well controlled by treatment)*". Free text responses to a further specifier permitted categorisation of conditions into those corresponding to International Classification of Diseases (ICD-10, 1992) categories (diseases of the musculoskeletal system, circulatory system, nervous system, digestive system, and endocrine disease). We used clinician-derived search terms to identify conditions with heterogeneous descriptors. For our sub-analyses we defined a specific diabetes category and overlapping categories for pain conditions and cancer.

We categorised the substances used in self-poisoning on the basis of fixed-choice responses to the questionnaire item: "*If self-poisoning, specify substance (if more than one substance, select most likely cause of death)",* to develop a categorical measure of whether or not these drugs are prescribed to treat physical illnesses. This was coded by a psychiatrist (AP), including free text responses to the "*Other drug (please specify)*" category. Categories within the physical illness treatment group were: opioids (morphine, codeine and methadone), paracetamol/opioid compounds, other analgesics, insulin, cardiac medications, and other specified drugs for physical conditions (Box 1).

We categorised the source of substances used in self-poisoning cases using fixed-choice responses to the relevant questionnaire item (prescribed for the patient; prescribed for someone else; not prescribed). For data collected from 2012, where opioids were reported in self-poisoning cases, further detail was available on whether these were prescribed for the patient for treatment of pain or for the treatment of drug misuse, prescribed for someone else, obtained illicitly, or obtained over-the-counter. We analysed drugs used for physical health conditions in cases of self-poisoning, irrespective of whether they had been prescribed for

Box 1
Categories of medications that we regarded as those that could be prescribed to treat a physical health disorder

- opioids
  - morphine
  - codeine
  - methadone
- paracetamol/opioid compounds
- insulin
- cardiac medications
- other analgesics
- other specified drugs for physical conditions
  - aminophylline or theophylline - asthma or COPD
  - colchicine – gout
  - gliclazide – diabetes
  - metformin – diabetes[a]
  - other oral hypoglycaemic agents (sulfonylureas, acarbose, pioglitazone, gliptins) – diabetes
  - pregabalin –chronic pain, epilepsy, fibromyalgia[a]
  - primidone, gabapentin – for epilepsy
  - topiramate – epilepsy
  - taxine alkaloids - cancer chemotherapy

[a] denotes excluded in sensitivity analysis due to dual indication for treatment of psychiatric disorder or the side effects of psychotropic medications.

the patient or for someone else, or obtained illicitly.

2.4. Statistical analysis

Chi-square tests (with a 2-sided p-value threshold of < 0.05) were used to compare proportional distributions of sociodemographic and clinical characteristics between psychiatric patients with versus without diagnosed physical illness. We fitted logistic regression models to estimate the strength of these associations, with and without adjustment for age, gender, ethnicity, and presence of a primary drug dependence/misuse disorder (which may itself be associated with chronic pain conditions). Odds ratios (ORs) and their 95% confidence intervals (CIs) were presented. Pairwise deletion was applied to address missing data; ie. if an item of information was unknown, the case was removed from the analyses of that variable. All analyses were conducted using Stata version 15.0 (StataCorp, 2017).

2.5. Sensitivity analyses

We conducted sensitivity analyses to assess robustness of findings when using a more stringent definition of medications that may have been prescribed to treat physical health conditions. This excluded drugs that can be used to treat psychiatric conditions (e.g. gabapentin and pregabalin for anxiety) or to address the side effects of psychotropics (e.g. metformin for antipsychotic-induced weight gain). We also repeated our analysis for data from 2012–2015 excluding opioids not prescribed for pain, medications prescribed for someone else, and non-prescribed medications (including over-the-counter paracetamol/opioid compounds). In a *post hoc* sensitivity analysis we tested whether our findings were accounted for by the older age of those with co-morbid physical illness, and their greater prevalence of affective disorder.

3. Results

3.1. Descriptive statistics and prevalence of physical illnesses

Between 1st January 2004 and 31st December 2015 inclusive, the National Confidential Inquiry was notified of 57,863 suicides in England & Wales (43,539 cases with a suicide verdict; 14,324 with an open verdict). Of these, 15,934 (28%) people had been in contact with secondary mental health services in the 12 months before they died. Questionnaires were returned on 15,662 patients, a response rate of 98%. We excluded 6% (1014 cases) with missing data for presence/absence of physical co-morbidities, leaving a final dataset for analysis of 14,648 patients. Of these, 3525 (24%) had a recorded diagnosis of one or more co-morbid physical illness, most commonly diseases of the musculoskeletal (884, 25%); circulatory (822, 23%); endocrine (646, 18%); nervous (608, 17%); and digestive systems (580, 16%). Overall, 66% had a condition from a single major category of physical illness, 25% from two major categories, and 9% from three or more. Overlying these diagnostic categories, 16% (546 patients) had a pain condition and 9% had a cancer diagnosis.

Table 1
Sociodemographic, behavioural and clinical characteristics of patients who died by suicide with co-morbid physical illness (England & Wales, 2004–2015).

Feature	Patients with co-morbid physical illness (N = 3525)		Patients without co-morbid physical illness (N = 11,123)		
	N	%	N	%	*p*
Sociodemographic:					
Male gender	2262	64.2	7437	66.9	=0.003
Black & minority ethnic group	201	5.8	903	8.3	<0.001
Unmarried	2293	66.9	7882	72.3	<0.001
Living alone	1697	49.5	5007	46.3	=0.001
Unemployed	1237	36.4	4981	46.3	<0.001
Homeless	57	1.7	290	2.7	=0.001
Behavioural:					
History of self-harm	2319	67.5	7447	68.2	=0.420
History of violence	649	19.1	2415	22.4	<0.001
History of alcohol misuse	1444	42.0	5002	46.0	<0.001
History of drug misuse	918	26.8	3799	35.1	<0.001
Clinical:					
Primary diagnosis:					
Schizophrenia & other delusional disorders	391	11.2	2137	19.4	<0.001
Affective disorder	1719	49.4	4827	43.9	<0.001
Alcohol dependence/misuse	281	8.1	809	7.4	=0.156
Drug dependence/misuse	140	4.0	474	4.3	=0.472
Personality disorder	291	8.4	1050	9.5	=0.037
Any secondary diagnosis	1819	52.3	5614	51.0	=0.186
In-patient	259	7.4	1047	9.4	<0.001
Post-discharge patient	520	16.0	1937	19.3	<0.001
Under crisis resolution/home treatment	449	13.5	1654	15.9	=0.001
Missed last contact	700	21.7	2499	25.2	<0.001
Non-adherent to medication	349	11.0	1413	13.7	<0.001
Duration of history (<12 months)	676	20.5	2314	21.9	=0.083
Last contact <1 week before death	1648	47.2	5663	51.3	<0.001
Symptoms of mental illness at last contact	2284	68.1	6704	63.1	<0.001

3.2. Patient characteristics of those with a co-morbid physical illness

The median age of psychiatric patients who died by suicide and had a co-morbid physical illness was 53 years (interquartile range (IQR) 43–64); significantly older than those without a physical health condition (median age 44, IQR 33–54; $p < .001$). Patients with a physical illness were more likely to be female, white, widowed, and to live alone than other patients (Table 1). They were less likely to be unemployed, unmarried or homeless. Whilst the proportions with a history of self-harm did not differ (around 68% in both groups), those with a physical health condition less often had a history of violence (19% v. 22%; $p < .001$) or of alcohol (42% v. 46%; $p < .001$) or drug misuse (27% v. 35%; $p < .001$). Patients with a physical illness were more likely than those without to have a primary psychiatric diagnosis of affective disorder, and less likely to have schizophrenia (including other delusional

Table 2
Method of suicide and types of substances used in fatal overdose.

	Patients with co-morbid physical illness (N = 3525)		Patients without co-morbid physical illness (N = 11,123)		
	N	%	N	%	*p*
Method of suicide:					
Self-poisoning	1306	37.2	2234	20.2	< 0.001
Hanging/strangulation	1153	32.8	5197	46.8	< 0.001
Jumping/multiple injuries	430	12.2	1817	16.4	< 0.001
Drowning	199	5.7	577	5.2	= 0.29
Suffocation	105	3.0	264	2.4	= 0.045
Gas inhalation	49	1.4	294	2.7	< 0.001
Other	272	7.7	715	6.4	= 0.01
Substances used in overdose:					
Opioids[a]	360	30.2	438	21.5	< 0.001
Paracetamol/opioid compounds	130	10.9	142	7.0	< 0.001
Paracetamol	75	6.3	125	6.1	= 0.846
Other analgesics	19	1.6	18	0.9	= 0.066
SSRI/SNRIs	82	6.9	215	10.5	< 0.001
Tricyclics	115	9.7	236	11.6	= 0.092
Antipsychotics	91	7.6	269	13.2	< 0.001
Benzodiazepines/ hypnotics	41	3.4	89	4.4	= 0.199
Insulin	42	3.5	24	1.2	< 0.001
Cardiac medication	25	2.1	51	2.5	= 0.469
Specified medication for other physical disorders	12	1.0	8	0.4	= 0.031
Any medication for physical disorders[b]	586	49.5	680	33.9	< 0.001
Substance used to self-poison obtained from:					
Prescribed for the patient	523	71.9	688	54.2	< 0.001
Prescribed for someone else	20	2.8	75	5.9	= 0.001
Not prescribed	184	25.3	507	39.9	< 0.001
Substance used to self-poison (for patients who died using any medication for physical illness) obtained from:					
Prescribed for the patient	246	74.3	102	27.2	< 0.001
Prescribed for someone else	15	4.5	49	13.1	< 0.001
Not prescribed	70	21.2	224	59.7	< 0.001

[a] includes morphine, codeine and methadone.
[b] includes opioids, paracetamol/opioid compounds, other analgesics, insulin, cardiac medications, other specified medications for physical illness.

disorders) or personality disorder (Table 1). They were less likely to have been a psychiatric in-patient at the time of death, to have recently (< 3 months) been discharged from psychiatric in-patient care, or to have been under the care of a crisis resolution/home treatment team. They had more often attended their last contact with mental health services and were more likely to have been adherent with medication treatment compared with patients with mental illness alone. Nearly half (47%) had been in contact with services in the week before death, which was significantly fewer than for patients without a physical condition (51%; $p < .001$), with 68% exhibiting psychiatric symptoms at this appointment, proportionally more than other patients (63%; $p < .001$). However, these differences were unlikely to be clinically significant.

3.3. Method of suicide and substances used in self-poisoning

A significantly greater proportion of psychiatric patients who had been diagnosed with a physical illness died by self-poisoning compared to those without physical co-morbidity (37% v. 20%, $p < .001$; AOR 2.47, 95% CI 2.26–2.70; Tables 2 & 3). The proportions who died by hanging/strangulation (33% v. 47%; $p < .001$), jumping/multiple injuries (12% v. 16%; $p < .001$), and gas inhalation (1% v. 3%; $p < .001$) (Table 2) were significantly lower in the physical co-morbidity group, although some of these differences were unlikely to be clinically significant.

It was possible to classify the specific drugs used in cases of self-poisoning in 3283 (86%) of cases; in 445 patients (12%) the data were missing and in 77 (2%) the substances were described as "multiple toxicity". More patients with a physical illness were described as using multiple drugs in the overdose compared to those without a physical illness (37, 3% v. 37, 2%; $p = .02$), although this difference was unlikely to be clinically significant. Opioids were the most common type of drug used in all cases of self-poisoning, but particularly for those with a physical illness, nearly a third (30%) of whom died by opioid overdose compared with those with mental illness alone (22%; $p < .001$) (Table 2). Patients with physical illness were also more likely to use paracetamol/opioid compounds (11% v. 7%; $p < .001$) and insulin (4% v. 1%; $p < .001$) and less likely to use SSRIs/SNRIs (7% v. 11%; $p < .001$) or antipsychotics (8% v. 13%; $p < .001$) in self-poisoning.

Overall, half (586, 50%) of psychiatric patients with a co-morbid physical illness who died by self-poisoning had used medications for a physical health disorder (i.e. opioids, paracetamol/opioid compounds, other analgesics, insulin, cardiac medications, and other specified drugs for physical conditions). This compared to a third (680, 34%) of those without a physical illness ($p < .001$) (AOR 2.10, 95% CI 1.80–2.46; Table 3). The majority (436; 64%) of this latter group had used opioids in overdose.

3.4. Sub-group analyses

3.4.1. Method of obtaining medication

Details of how the substances were obtained were available for 2097 (55%) of the 3805 patients who died by self-poisoning, before excluding cases without data on physical illness. For the 1306 with a physical illness who died by overdose with any medication, data were available on how they obtained the drugs in 727 (56%), of whom 523 (72%) were prescribed those drugs, 20 (3%) used drugs prescribed for someone else, and 184 (25%) used unprescribed drugs.

Focussing specifically on non-psychotropics, of the 586 patients with a comorbid physical illness who overdosed using a medication for a physical disorder, 246 (74% when excluding unknowns) had been prescribed this medication (Table 2). This compared to 102 (27%) of those without a documented physical illness who overdosed using prescribed non-psychoptropics ($p < .001$) (AOR 7.14, 95% CI 4.98–10.24; Table 3). The main substances used in the 102 cases without documented physical illness were opioids (52%), paracetamol/opioid compounds (24%), other substances, e.g. propranolol (15%), and other analgesics (6%). A minority (14%) of this group had a diagnosis of drug dependence/misuse, and 44% had a history of drug misuse; these patients may have been prescribed opioids for drug misuse. Others may have been prescribed medication for a health condition not viewed by the clinician completing the questionnaire as a major physical illness.

A quarter of patients with comorbid physical illness who overdosed using a physical health medication had not been prescribed it. A clinically significant minority had overdosed on prescription-only medications not prescribed for them. Insulin had been prescribed to 32 (86%) of the 37 patients with diabetes who self-poisoned using insulin. Of the 12 patients diagnosed with cardiovascular conditions who self-poisoned using cardiac medications, these were prescribed for 8 (67%). However, it was more common for patients without a documented co-morbid physical health problem to have used medications for a physical disorder prescribed for someone else (13% v. 5%; $p < .001$) or obtained elsewhere (60% v. 21%; $p < .001$), presumably over-the-counter or illicitly.

3.5. Sub-analyses: patients with cancer, diabetes, and pain conditions

When repeating the analysis for patients diagnosed with cancer

Table 3
Univariate associations between characteristics of patients with co-morbid physical illness and death by self-poisoning.

Characteristic	Patients with physical illness N = 3525 N (%)	Patients without physical illness N = 11,123 N (%)	Crude OR	95% CI	*p*	Adjusted OR[a]	95% CI	*p*
Suicide by self-poisoning[b]	1306 (37)	2234 (20)	2.35	2.16–2.55	<0.001	2.46	2.25–2.69	<0.001
Suicide by self-poisoning using medications used for physical disorders*	586 (50)	680 (34)	1.91	1.65–2.22	<0.001	2.10	1.80–2.46	<0.001
Suicide by self-poisoning using **prescribed** medications for physical disorders[b]	246 (74)	102 (27)	7.75	5.54–10.83	<0.001	7.14	4.98–10.24	<0.001
	Patients with specific illness N (%)	**Patients without specific illness N (%)**						
Suicide by self-poisoning using medications for physical disorders in those with cancer[c]	38 (49%)	548 (50%)	0.99	0.63–1.57	=0.973	1.06	0.66–1.71	=0.805
Suicide by self-poisoning using medications for physical disorders in those with diabetes[c]	96 (54%)	490 (49%)	1.23	0.89–1.69	=0.203	1.27	0.91–1.77	=0.158
Suicide by self-poisoning using medications for physical disorders in those with a pain condition[c]	145 (63%)	441 (46%)	2.01	1.49–2.70	<0.001	2.12	1.56–2.88	<0.001

[a] adjusted for age, gender, ethnicity and a diagnosis of drug dependence/misuse;
[b] compared to those without a co-morbid physical illness;
[c] compared to those with other physical illnesses.

compared to those with other physical illnesses, there was no association of death by self-poisoning with medication used for treating physical disorders (49% v. 50%; $p = .973$) (Table 3). Substances used most commonly in overdose in patients with cancer were: opiates (29%), paracetamol/opiate compounds (16%), and paracetamol (12%).

Similarly, there was no association of death by self-poisoning with substances for physical disorders for patients with diabetes (54% v. 49%; $p = .203$) compared to those with other physical illnesses. Substances used most commonly in overdose among patients with diabetes were: insulin (21%), opiates (18%), and tricyclic antidepressants (11%).

However, patients with a pain condition (the largest sub-group) were significantly more likely to overdose with drugs for non-psychiatric conditions compared to other patients with a physical condition (63% v. 46%; $p < .001$; AOR 2.12, 95% CI 1.56–2.88). The majority (67%) of substances used in overdose in patients with a pain condition were pain medications (opioids 46%; paracetamol/opiate compounds 12%; paracetamol 6%; any other pain meds 3%), whilst 9% used tricyclic antidepressants.

3.6. Sensitivity analyses

The above associations remained unchanged in sensitivity analyses using a more stringent definition of drugs that could have been prescribed for treating physical health problems (Supplementary file). A *post hoc* sensitivity analysis to test whether our findings partly reflected the older age of those with co-morbid physical illness and their greater prevalence of affective illness, we found no association between older age or affective disorder and self-poisoning.

4. Discussion

4.1. Main findings

We found that almost a quarter of psychiatric patients who died by suicide over the period 2004 to 2015 had a co-morbid physical health condition, and that over a third of this group died by self-poisoning. Our findings of an association between physical health problems and fatal overdose among psychiatric patients suggest that access to means is a key explanation. We found striking differences in the suicide methods used by psychiatric patients with and without physical health problems. Hanging (followed by overdose) was the most common method used by those with no physical co-morbidities; matching the national picture for psychiatric patients (NCISH, 2017), and the general population (ONS, 2016c). However, self-poisoning (followed by hanging) was the leading method used by patients with physical health problems, suggesting that overdose is the most accessible approach for this patient group if contemplating suicide. Restricting access to this method is more feasible than for hanging.

The substances used in overdose by patients with a co-morbid physical health condition were more likely to be medications prescribed to treat physical health problems, and less likely to be psychotropics, even though these patients probably had access to both. Nearly half of those with a co-morbid physical health condition who died by self-poisoning did so using a medication for such a condition. Of specific sub-groups, patients with pain conditions, for whom chronic pain is itself a risk factor for suicide (Racine, 2018) were most likely to overdose with drugs for physical disorders. This was likely due to a high proportion of this group using toxic pain medications in overdose. The tendency of patients with physical co-morbidities to overdose using non-psychotropics rather than psychotropics may relate to perceived lethality of non-psychotropics, potentially greater lethality of non-psychotropics, or to prescribers being more primed to consider overdose potential when issuing and monitoring potentially cardiotoxic psychotropic drugs (Hawton et al., 2010) than medications used for physical health problems. Whilst acknowledging the poor predictive value of suicide risk classification scales (Steeg et al., 2018), our findings suggest that needs-based assessments of psychiatric patients with physical health problems should focus on addressing modifiable risk factors such as reviewing the need for more toxic medications, particularly opioids (Ilgen et al., 2016), considering safer transdermal routes for opioid administration (Coplan et al., 2017), and addressing inadequately-treated pain (Yarborough et al., 2016). Guidelines on safe prescribing aim not to compromise on optimal pain management, but to reduce the potential for opioid addiction, diversion and fatalities (Volkow et al., 2019).

4.2. Findings in the context of other studies

No other studies have sought to investigate this research question among psychiatric patients. More widely, a systematic review of studies investigating the association between non-psychotropic medications

and attempted suicide found cardiovascular medications not to be associated with any increased risk, but concluded that associations with other medications remained inconclusive (Gorton et al., 2016). Separately, two studies of US veterans with non-cancer pain found an association between dose of opioids and risk of suicide (Ilgen et al., 2016), presumably with dose a marker of pain severity, but no clear excess risk of overdose in these patients over other methods (Ilgen et al., 2013).

4.3. Strengths and limitations

We examined a national, comprehensive case series of all suicides amongst patients with recent contact with psychiatric services over a 12 year period. Consultants completing the questionnaire were unaware of the study's hypotheses, so it was unlikely that clinicians' recall bias for overdose using physical health medications might explain our findings. Our categorisation of physical illnesses was systems-based but also acknowledged the overlapping categories of cancer and pain conditions. We adjusted our models for variables identified as potential confounders *a priori*, such as drug dependence/misuse. Alternative explanations for associations identified are the under-identification of drug dependence/misuse, and the assumption that opioids used in overdose were obtained for a physical health problem rather than for abuse or intentional overdose. We had access to data on how medications were obtained for only 55% of the case series, but findings were similar in a sensitivity analysis confined to those who died from 2012–2015.

The study's main limitation is that its use of survey data captured only those co-morbid physical health problems and overdose medications of which the responding consultant was aware. Under reporting of physical health problems is likely to have occurred where the patient was only briefly under their care (particularly in liaison settings), where clinical notes were unclear regarding physical health conditions or medications, or where the clinician did not judge the condition to be a 'major physical illness'. This may have excluded conditions like acne that contribute significant clinical distress and for which medications prescribed to treat it have been linked with suicide risk (Sundström et al., 2010). Under reporting of specific physical health medications used in overdose is likely to have occurred where the completing clinician's response denoted multiple unspecified drugs. Over half of all general population drug poisoning deaths involve more than one drug and/or alcohol and the substance primarily responsible for the death is not identifiable (ONS, 2016b). We could also not be certain that medications used in overdose had been specifically issued to treat that patient's physical health problem, as opposed to being obtained specifically to attempt suicide. We did not have data specifying whether onset of physical illness had preceded psychiatric illness or vice versa, and it was possible in some cases that patients had been diagnosed with a physical health problem some time before their psychiatric illness commenced. This preceding physical illness may have also influenced some patients in their choice of self-poisoning agent.

Detailed data on how opioids and paracetamol/opioid compounds were obtained were only available from 2012 onwards, but we addressed this in our sensitivity analysis. This extra analysis also ruled out the older age of those with co-morbid physical illness, and their greater prevalence of affective illness, as an explanation for our findings. Finally, by examining a national case series design, without living controls, we could estimate proportional contrasts between the groups but not incidence, or absolute/relative risks.

4.4. Clinical and policy implications

These findings provide evidence to suggest that access to means of lethal overdose may contribute to suicide risk in psychiatric patients with physical co-morbidities, particularly those with chronic pain. Such patients would be more likely than other psychiatric patients to have supplies of prescribed non-psychotropics at home, particularly patients in chronic pain. Such availability creates the potential for suicide attempts with high lethality, particularly during a flare-up of a physical condition. All clinicians involved in the care of these patients should ensure careful prescribing for this patient group, with clear risk management. This could include regular reviews to check that indications remain, referral to pain clinics to consider transdermal opioid administration, and raised frequency of issuing pain medication prescriptions, although the latter may compromise patient convenience and therapeutic alliance. Assertive pain management is critical because inadequately-treated pain is itself a risk factor for suicide (Yarborough et al., 2016). Future research should seek to evaluate the effect of improved pain management pathways and prescribing guidelines on risk of overdose among psychiatric patients.

Restricting access to non-prescribed medications has been partly addressed at the population level (Hawton et al., 2013, 2009) with a restriction on analgesic pack size, but there is also a role for community pharmacists in responding to customers trying to purchase over-the-counter analgesics above recommended limits (MHRA, 2014). A non-confrontational approach that responds to distress, and shows awareness of local service provision is more likely to be acceptable to patients. Our findings also suggest that access to medications prescribed for household members should be considered for psychiatric patients with or without physical illness. Carers have a role in safeguarding their own medications, as well as those of a psychiatric patient at risk.

Finally, our findings show that opioids are a substance commonly used in lethal overdose among psychiatric patients, whether they have physical health problems (30%) or not (22%). Access to naloxone for carers and professionals, accompanied by training, is a high-risk intervention worth considering among some psychiatric patients (Ashrafioun et al., 2016). Qualitative work is needed with carers regarding their attitudes towards such a safeguarding role.

5. Conclusions

Overdose, rather than hanging, is the leading method of suicide in the 24% of psychiatric patients who die by suicide and have co-morbid physical health problems; accounting for over a third of cases. In such patients, particularly for those in chronic pain, the medications used in overdose are more likely to be those for a physical health disorder; primarily opioids. Psychiatric patients with physical health co-morbidities therefore require careful needs-based risk assessment, with clinicians reducing access to the means of overdose where possible. Optimal care includes addressing inadequately-treated pain, reviewing the need for more toxic medications, considering transdermal routes, and involving carers in safeguarding household medications.

Declaration of interest

L A and N K are members of the Department of Health's (England) National Suicide Prevention Advisory Group, of which L A is Chair, for which he has received personal fees. L A is a board member of the CQC, for which he has received personal fees. N K is Chair of the Guideline Development Group for the NICE guideline on depression in adults and is a topic expert for the NICE suicide prevention guideline. All authors declare that there are no other conflicts of interest.

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Data availability

The National Confidential Inquiry case series database is not publically available, but requests to conduct analyses in collaboration with the Centre for Mental Health and Safety team are granted, subject to internal peer review.

Limitations of the study

Use of survey data may have resulted in under-reporting of physical health problems and/or overdose medications.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2019.06.027.

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