

Impact of mental illness on care for somatic comorbidities in France: a nation-wide hospital-based observational study

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Aims. People with a mental illness have a shorter lifespan and higher rates of somatic illnesses than the general population. They also face multiple barriers which interfere with access to healthcare. Our objective was to assess the effect of mental illness on the timeliness and optimality of access to healthcare for somatic reasons by comparing indicators reflecting the quality of prior somatic care in hospitalised patients.

Methods. An observational nation-wide study was carried out using exhaustive national hospital discharge databases for the years 2009–2013. All adult inpatient stays for somatic reasons in acute care hospitals were included with the exception of obstetrics and day admissions. Admissions with coding errors were excluded. Patients with a mental illness were identified by their admissions for a psychiatric reason and/or contacts with psychiatric hospitals. The quality of prior somatic care was assessed using the number of admissions, admissions through the emergency room (ER), avoidable hospitalisations, high-severity hospitalisations, mean length of stay (LOS) and in-hospital death. Generalised linear models studied the factors associated with poor quality of primary care.

Results. A total of 17 620 770 patients were included, and 6.58% had been admitted at least once for a mental illness, corresponding to 8.96% of hospital admissions. Mentally ill patients were more often hospitalised (+41% compared with non-mentally patients) and for a longer LOS (+16%). They also had more high-severity hospitalisations (+77%), were more often admitted to the ER (+113%) and had more avoidable hospitalisations (+50%). After adjusting for other covariates, regression models found that suffering from a mental illness was significantly associated with a worse state for each indicator of the quality of care except in-hospital death.

Conclusion. Inadequate primary care of mentally ill patients leads to more serious conditions upon admission to hospital and avoidable hospitalisations. It is, therefore, necessary to improve primary care and prevention for those patients.

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Introduction

Worldwide, mental disorders affect at least one in three adults during their lifetime (Narrow *et al.* 2002). Those affected are generally in less good health than the general population (Sokal *et al.* 2004), with a much shorter lifespan (Laursen *et al.* 2007; Tidemalm *et al.* 2008; Viron & Stern, 2010) and higher rates of somatic illnesses (Sokal *et al.* 2004; Druss, 2007; Viron & Stern, 2010; Stubbs *et al.* 2016). The prevalence of diabetes, for example, was found to be significantly higher in mentally ill patients than in other patients,

and they also present an increased risk of hospitalisation for diabetes complications, diabetes-related mortality and all-cause mortality (Mai *et al.* 2011b). Mentally ill patients have also been shown as having a much higher rate of avoidable hospitalisations, which may be indicative of the poor quality of the primary care they receive (Mai *et al.* 2011a). The reasons for this are many and varied as mentally ill patients face barriers which interfere with timely and optimal access to healthcare. These barriers are dependent on different factors relative to the organisation of healthcare systems, providers and patients (Druss, 2007; Lawrence & Kisely, 2010; Viron & Stern, 2010). At a healthcare system level, this includes systematic separation of mental and somatic healthcare and lack of clarity and consensus about who should be

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responsible for detecting and managing physical problems in patients with a mental illness (Druss, 2007; van Hasselt *et al.* 2013; Small *et al.* 2017). At the provider level, time and resource constraints, stigma and regarding physical complaints as psychosomatic symptoms can also lead to a suboptimal quality of care offered by clinicians to patients with a mental illness (Lawrence & Kisely, 2010; De Hert *et al.* 2011), while patient-related factors include health risk factors and lifestyle (e.g. substance abuse, poor diet, smoking and lack of exercise), side effects of medications, cognitive impairment, suspiciousness, difficulties communicating physical needs and more often than not disadvantaged social circumstances (Lawrence & Kisely, 2010; De Hert *et al.* 2011; van Hasselt *et al.* 2013).

Previous research on the association between mental illness and quality of care has often been limited by their cross-sectional study design (Frayne *et al.* 2005; Brown *et al.* 2010), their focus on the consequences of a single mental illness (Daumit *et al.* 2006; Bradford *et al.* 2008; Schoepf *et al.* 2014) or physical disease (Rathore *et al.* 2008; Mai *et al.* 2011b; Druss *et al.* 2012; Lee *et al.* 2016), or their use of only one indicator to assess access to healthcare (Miller *et al.* 2006; Mai *et al.* 2011a). In addition, few studies have applied rigorous methods to define the mentally ill population using linked data.

Our objective is to compare acute somatic hospitalisations in patients admitted at least once for a mental illness to other patients' and to assess the effect of mental illness on the timeliness and optimality of access to healthcare for somatic reasons with a wide range of indicators.

Methods

Study design and data sources

We carried out an observational study comparing indicators of quality of care in hospitalised patients with and without a diagnosed mental illness over a 5-year period.

Two linkable exhaustive hospital discharge databases were used. First, the acute in-hospital care database (*Programme de Médicalisation des Systèmes d'Information: Médecine, Chirurgie, Obstétrique*, Programme of medicalisation of information systems: medicine, surgery and obstetrics) for the years 2009–2013 provided information on all acute hospitalisations using diagnosis-related groups (DRG). It records variables on the characteristics of patients (age, sex, national anonymous identification number) and their admissions (principal and secondary diagnoses, using the 10th edition of the international classification of diseases (ICD-10), length of stay (LOS),

year and month of discharge, etc.). Second, the psychiatric care database for the years 2007–2013 (*Recueil d'Information Médicalisée en Psychiatrie*, Summary of medical information for psychiatry) provided information on inpatient (full-time and part-time) psychiatric care by all hospitals and institutions providing psychiatric care, with similar information on patients and their admissions. Patients have a single national anonymous identification number present in both databases.

As there is no individual socioeconomic indicator in the discharge databases, we used an ecological proxy, the FDep (Rey *et al.* 2009), to account for patients' deprivation. Similarly to the Carstairs and Townsend indices (Townsend *et al.* 1988; Carstairs & Morris, 1989), the FDep is based on patients' zip code of residence but it has been developed specifically for the French context and has been validated against the Carstairs and Townsend indices (Rey *et al.* 2009). It contains four variables: the percentage of blue-collar workers in the labour force, the percentage of high school graduates in the population aged 15 and over, the unemployment rate in the labour force and the median income per household, all derived from data from the National Institute of Statistics and Economic Studies.

Study population

The study population included all adult inpatient stays for somatic reasons in acute care hospitals between 2009 and 2013 with the exception of obstetric and day admissions. Patients with a mental illness were identified as any patient who had at least one episode of inpatient care between 2007 and 2013 in the psychiatric care database, who had at least one hospitalisation for a psychiatric reason (with an ICD-10 psychiatric diagnosis coded as the principal diagnosis, i.e. as the reason for the admission) recorded in the acute care database, or who had a transfer to or from a psychiatric hospital between 2009 and 2013. As such, only patients who had been admitted at least once for a mental illness in the past were considered to be mentally ill in this study. Patients' national anonymous identification number was used to identify those patients in the study population.

Indicators of quality of primary care

The quality of care received prior to an admission for somatic reasons was assessed using six indicators reflecting patient severity at admission and health outcome during the hospitalisation. As there are no direct measures of quality of care – especially of quality of primary care – in French databases, we used as

proxy patients' health status upon admission under the assumption that poor or absent care in primary care settings would lead to poor health, which in turn would lead to more admissions, more avoidable admissions and more admissions through the emergency room (ER), and that those admissions would have poorer outcomes, i.e. longer LOS, more severe admissions and more in-hospital mortality. These six indicators have been used as proxies of quality of prior care trajectories in the literature in the past. They were measured over the 5-year period of the study and were as follows: number of overnight admissions (Azevedo Da Silva *et al.* 2015), under the assumption that poor primary care would increase the number of admissions due to a lack of management of chronic illnesses, poor prevention etc.; number and proportion of admissions through the ER (Cowling *et al.* 2013; O'Malley, 2013), under the assumption that poor primary care would lead to more ER visits which would, in turn, increase the likelihood to be admitted through the ER; number and proportion of avoidable hospitalisations (Weissman *et al.* 1992; IMS Health, 2006; Rosano *et al.* 2013), hospitalisations that could have been avoided if primary care had been timely and adequate (through immunisation, management of a disease episode, etc.), under the assumption that poor primary care would lead to an increase in avoidable admissions; mean LOS, under the assumption that due to a poorer health state at admission, patients' LOS would be longer; number and proportion of high-severity hospitalisations, under the assumption that patients with poor primary care would arrive at a later stage of the disease at the hospital and would, therefore, be more severe; and in-hospital death (Jerant *et al.* 2012), under the assumption that mortality would be increased due to the poorer health state at admission. The severity of a hospitalisation was based on patients' DRG whose last character reflects patient severity on a one-to-four scale (with increasing severity). Severity levels one and two were grouped together as non-severe hospitalisations, and severity levels three and four corresponded to severe hospitalisations. Avoidable hospitalisations were identified with their principal diagnosis (i.e. the reason for the hospitalisation), when they corresponded to one of the 12 conditions described as avoidable by Weissman *et al.*: pneumonia, congestive heart failure, asthma, cellulite, perforated or bleeding ulcer, pyelonephritis, diabetes with ketoacidosis or coma, perforated appendix, malignant hypertension, hypokalaemia, immunising conditions and gangrene (Weissman *et al.* 1992). While common, those inpatient admissions could potentially be prevented by appropriate and timely outpatient care in the majority of cases – for example,

urinary tract infections if diagnosed and treated early should not lead to pyelonephritis.

Statistical analysis

A descriptive analysis was first carried out. Means were computed for continuous indicators, proportions were calculated for categorical indicators and both were computed for count variables for patients identified as having a mental illness and for other patients. In order to ensure comparability between the two groups, proportions and means were standardised in the mentally ill group according to the age and sex structure of the other group. No statistical test was performed as the study used exhaustive data. Subgroup analyses were also carried out in three subgroups of patients: patients suffering from cancer (CR group), from diabetes (DB group) and from a cardiovascular disease (CV group). Patients were classified in one of the subgroups if they had at least one hospitalisation with a principal diagnosis associated with one of those diseases between 2009 and 2013.

Generalised linear models were then carried out for each indicator to assess the effect of mental illness on the quality of care after adjusting for other potential explanatory variables like sex, age and the three main types of chronic diseases making up our subgroups. Additional explanatory variables included severity level (for the in-hospital death model), in-hospital death (models for the number of hospitalisations, number of avoidable hospitalisations, number of high-severity hospitalisations, number of admissions through the ER and mean LOS), number of hospitalisations (models for the number of avoidable hospitalisations, number of high-severity hospitalisations and number of admissions through the ER) and patients' length of follow-up in the database (for the number of hospitalisation model). The type of generalised linear model was determined according to the distribution of the outcome variables. For in-hospital death (binary variable), a logistic regression was carried out. For count variables, negative binomial regressions were used to account for overdispersion that was observed in the data. For the LOS, a model with gamma log distribution was developed.

Results

Patients' characteristics

Out of 34 831 518 adult patients hospitalised at least once in acute care between 2009 and 2013 (for a total of 121 760 556 hospitalisations), 17 620 770 were included in the study population for a total of 37 334 602 hospitalisations (Fig. 1). A total of 1 159 672 patients

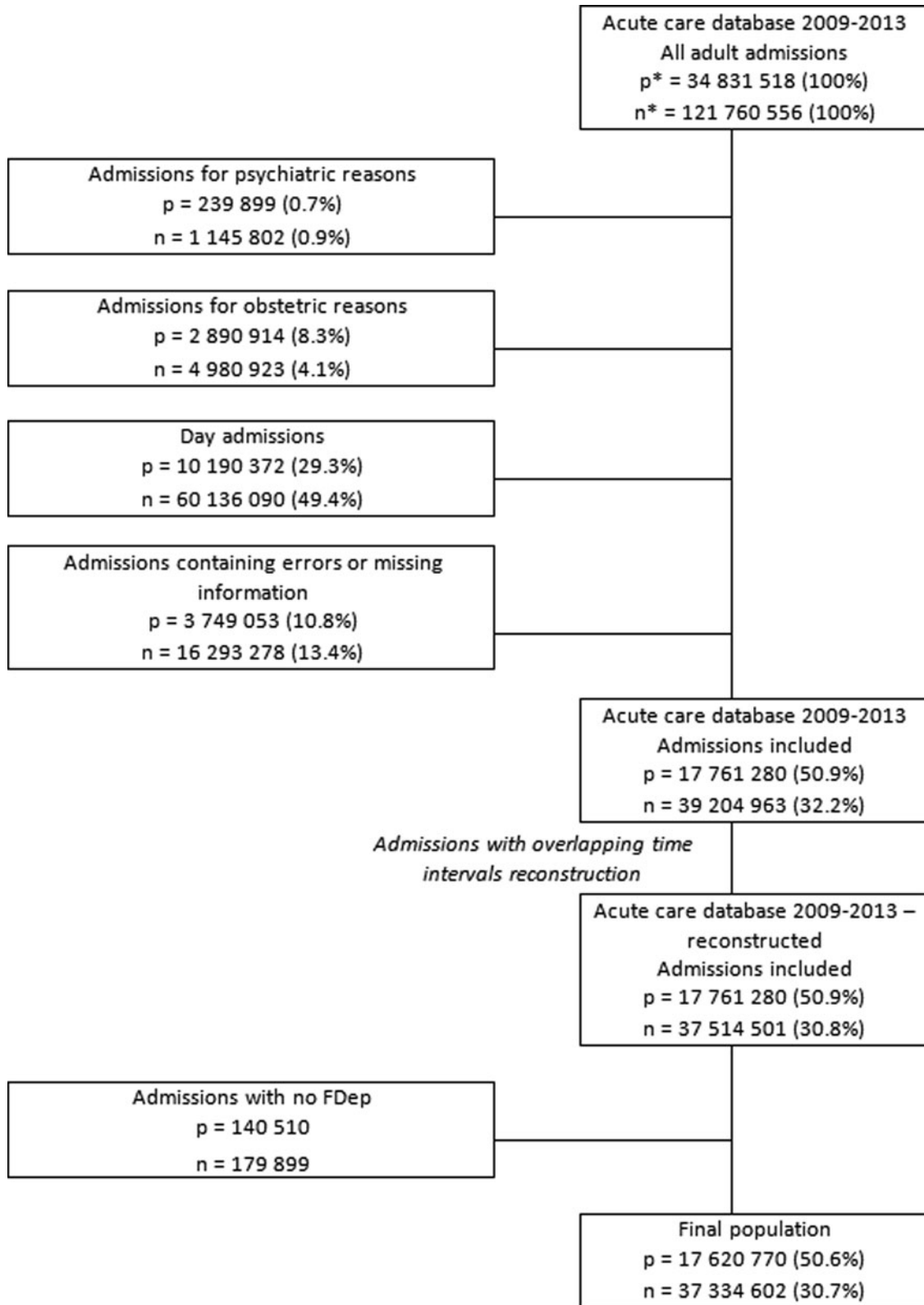


Fig. 1. Flow diagram p = number of patients; n = number of hospitalisations in acute care.

(6.58%) were identified as being diagnosed with a mental illness, corresponding to 3 343 464 (8.96%) hospitalisations, and 16 461 098 patients (93.42%) were not (33 991 138 hospitalisations, 91.04%).

Patients identified as having a mental illness had the same age (58 years old) as patients without a mental illness at their first hospitalisation (Table 1) and there was roughly the same percentage of men in both groups (46.28 and 47.39%, respectively). Among mentally ill patients, 9.30% had cancer diagnosis, 12.03% suffered from diabetes and 44.83% had cardiovascular disease. The distribution of diabetes and cardiovascular diseases was similar in non-mentally ill patients (11.48 and 43.52%, respectively) but cancer was more

frequent (13.25%). In addition, patients with a mental illness were more likely to live in deprived areas than not (Table 1).

Descriptive analysis of the indicators of quality of primary care

Patients identified as being mentally ill had worse outcomes than other patients for all indicators except in-hospital death, although the magnitude of the difference between the two groups varied depending on the indicator (Table 2). On average, mentally ill patients were more often hospitalised (+41% compared with non-mentally ill patients) and for a longer LOS

Table 1. Patients' characteristics at first admission in an acute care hospital for a somatic problem

	Patients with a mental illness	Patients without a mental illness	Total
	All patients		
<i>n</i> (%)	1 159 672 (6.58)	1 6461 098 (93.42)	1 7620 770
Age, mean (s.d.)	58.07 (20.23)	58.04 (19.86)	58.04 (19.89)
Men, <i>n</i> (%)	5 36 745 (46.28)	78 00 910 (47.39)	8 337 655 (47.32)
FDep quintile 1, <i>n</i> (%)	2 66 015 (22.94)	42 38 784 (25.75)	45 04 799 (25.57)
FDep quintile 2, <i>n</i> (%)	2 47 122 (21.31)	34 15 231 (20.75)	36 62 353 (20.78)
FDep quintile 3, <i>n</i> (%)	2 13 539 (18.41)	28 35 691 (17.23)	30 49 230 (17.30)
FDep quintile 4, <i>n</i> (%)	2 19 511 (18.93)	29 92 186 (18.18)	32 11 697 (18.23)
FDep quintile 5, <i>n</i> (%)	2 13 485 (18.41)	29 79 206 (18.10)	31 92 691 (18.12)
	Patients with cancer		
<i>n</i> (%)	1 07 883 (9.30)	21 80 371 (13.25)	2 288 254 (12.99)
Age, mean (s.d.)	67.44 (14.92)	67.18 (14.12)	67.20 (14.16)
Men, <i>n</i> (%)	56 806 (52.66)	11 70 739 (53.69)	12 27 545 (53.65)
FDep quintile 1, <i>n</i> (%)	25 405 (23.55)	5 66 246 (25.97)	5 91 651 (25.86)
FDep quintile 2, <i>n</i> (%)	23 081 (21.39)	4 54 572 (20.85)	4 77 653 (20.87)
FDep quintile 3, <i>n</i> (%)	20 262 (18.78)	3 81 104 (17.48)	4 01 366 (17.54)
FDep quintile 4, <i>n</i> (%)	20 281 (18.80)	3 97 432 (18.23)	4 17 713 (18.25)
FDep quintile 5, <i>n</i> (%)	18 854 (17.48)	3 81 017 (17.47)	3 99 871 (17.47)
	Patients with diabetes		
<i>n</i> (%)	1 39 505 (12.03)	1 890 235 (11.48)	2 029 740 (11.52)
Age, mean (s.d.)	67.45 (15.48)	67.94 (14.11)	67.90 (14.21)
Men, <i>n</i> (%)	68 269 (48.94)	10 32 824 (54.64)	11 01 093 (54.25)
FDep quintile 1, <i>n</i> (%)	29 615 (21.23)	4 36 747 (23.11)	4 66 362 (22.98)
FDep quintile 2, <i>n</i> (%)	28 133 (20.17)	3 68 724 (19.51)	3 96 857 (19.55)
FDep quintile 3, <i>n</i> (%)	25 741 (18.45)	3 28 323 (17.37)	3 54 064 (17.44)
FDep quintile 4, <i>n</i> (%)	27 920 (20.01)	3 62 488 (19.18)	3 90 408 (19.23)
FDep quintile 5, <i>n</i> (%)	28 096 (20.14)	3 93 953 (20.84)	4 22 049 (20.79)
	Patients with a cardiovascular disease		
<i>n</i> (%)	5 19 938 (44.83)	7 163 927 (43.52)	7 683 865 (43.61)
Age, mean (s.d.)	69.07 (16.45)	69.12 (15.19)	69.11 (15.28)
Men, <i>n</i> (%)	2 39 214 (46.01)	36 13 161 (50.44)	38 52 375 (50.14)
FDep quintile 1, <i>n</i> (%)	1 14 801 (22.08)	16 96 636 (23.68)	18 11 437 (23.57)
FDep quintile 2, <i>n</i> (%)	1 06 786 (20.54)	14 48 706 (20.22)	15 55 492 (20.24)
FDep quintile 3, <i>n</i> (%)	97 706 (18.79)	12 81 050 (17.88)	13 78 756 (17.94)
FDep quintile 4, <i>n</i> (%)	1 02 521 (19.72)	13 71 727 (19.15)	14 74 248 (19.19)
FDep quintile 5, <i>n</i> (%)	98 124 (18.87)	13 65 808 (19.07)	14 63 932 (19.05)

Table 2. Descriptive results for each indicator of quality of prior somatic care trajectories in the population with and without a mental illness as well as in patients with cancer, cardiovascular disease and diabetes

	Patients with a mental illness ^a	Patients without a mental illness	Ratio
All patients	<i>n</i> = 1 159 672	<i>n</i> = 16 461 098	
Number of hospitalisations, mean (s.d.)	2.91 (2.80)	2.06 (2.02)	1.41
Length of stay, mean (s.d.), d	6.62 (7.29)	5.70 (7.21)	1.16
Number of high-severity hospitalisations, mean (s.d.)	0.53 (0.92)	0.30 (0.76)	1.77
Proportion of high-severity hospitalisations (%)	18.00%	14.49%	1.24
Number of admissions through the ER, mean (s.d.)	1.36 (1.79)	0.64 (1.05)	2.13
Proportion of admissions through the ER (%)	47.65%	31.04%	1.54
Number of avoidable hospitalisations, mean (s.d.)	0.21 (0.60)	0.14 (0.52)	1.50
Proportion of avoidable hospitalisations (%)	7.11%	6.98%	1.02
In-hospital deaths, <i>n</i> (%)	NA (7.57)	1 225 396 (7.44)	1.02
Patients with cancer	<i>n</i> = 1 07 883	<i>n</i> = 21 80 371	
Number of hospitalisations, mean (s.d.)	4.86 (3.86)	3.60 (3.22)	1.35
Length of stay, mean (s.d.), d	9.46 (8.88)	8.77 (9.31)	1.08
Number of high-severity hospitalisations, mean (s.d.)	1.11 (1.40)	0.74 (1.13)	1.50
Proportion of high-severity hospitalisations (%)	23.17%	20.09%	1.15
Number of admissions through the ER, mean (s.d.)	1.67 (2.11)	0.84 (1.33)	1.99
Proportion of admissions through the ER (%)	35.05%	23.42%	1.50
Number of avoidable hospitalisations, mean (s.d.)	0.29 (0.73)	0.17 (0.59)	1.71
Proportion of avoidable hospitalisations (%)	6.06%	4.81%	1.26
In-hospital deaths, <i>n</i> (%)	NA (23.08)	5 61 543 (25.75)	0.90
Patients with diabetes	<i>n</i> = 1 39 505	<i>n</i> = 18 90 235	
Number of hospitalisations, mean (s.d.)	4.39 (3.73)	3.15 (2.91)	1.39
Length of stay, mean (s.d.), d	8.77 (7.42)	7.97 (8.27)	1.10
Number of high-severity hospitalisations, mean (s.d.)	1.05 (1.40)	0.68 (1.17)	1.54
Proportion of high-severity hospitalisations (%)	23.81%	21.18%	1.12
Number of admissions through the ER, mean (s.d.)	1.96 (2.34)	1.03 (1.50)	1.90
Proportion of admissions through the ER (%)	45.28%	32.81%	1.38
Number of avoidable hospitalisations, mean (s.d.)	0.45 (0.99)	0.34 (0.87)	1.32
Proportion of avoidable hospitalisations (%)	10.32%	10.81%	0.95
In-hospital deaths, <i>n</i> (%)	NA (12.45)	2 47 894 (13.11)	0.95
Patients with a cardiovascular disease	<i>n</i> = 5 19 938	<i>n</i> = 71 63 927	
Number of hospitalisations, mean (s.d.)	3.88 (3.27)	2.76 (2.52)	1.41
Length of stay, mean (s.d.), d	8.61 (7.91)	7.55 (8.34)	1.14
Number of high-severity hospitalisations, mean (s.d.)	0.93 (1.25)	0.57 (1.02)	1.63
Proportion of high-severity hospitalisations (%)	24.01%	20.24%	1.19
Number of admissions through the ER, mean (s.d.)	1.81 (2.12)	0.94 (1.34)	1.93
Proportion of admissions through the ER (%)	47.53%	34.00%	1.40
Number of avoidable hospitalisations, mean (s.d.)	0.36 (0.83)	0.26 (0.71)	1.38
Proportion of avoidable hospitalisations (%)	9.42%	9.54%	0.99
In-hospital deaths, <i>n</i> (%)	NA (13.00)	9 40 376 (13.13)	0.99

^aMean/proportion standardised on the sex and age at first hospitalisation of the non-mentally ill patient group.

(+16%). They also had more high-severity hospitalisations (+77%), were more often admitted through the ER (+113%) and had more avoidable hospitalisations (+50%). Moreover, mentally ill patients had a higher chance of being admitted through the ER, and for high-severity admissions (Table 2, Fig. 2). However in-hospital mortality was similar in both populations. The analysis by chronic disease subgroups showed very similar trends, with one notable exception: patients with a mental illness who also had cancer

had a higher chance of having an avoidable hospitalisation (Table 2).

Multivariate modelling of the indicators of quality of primary care

After adjusting for other covariates, multivariate regression models found that, 'all things being equal', suffering from a mental illness was significantly

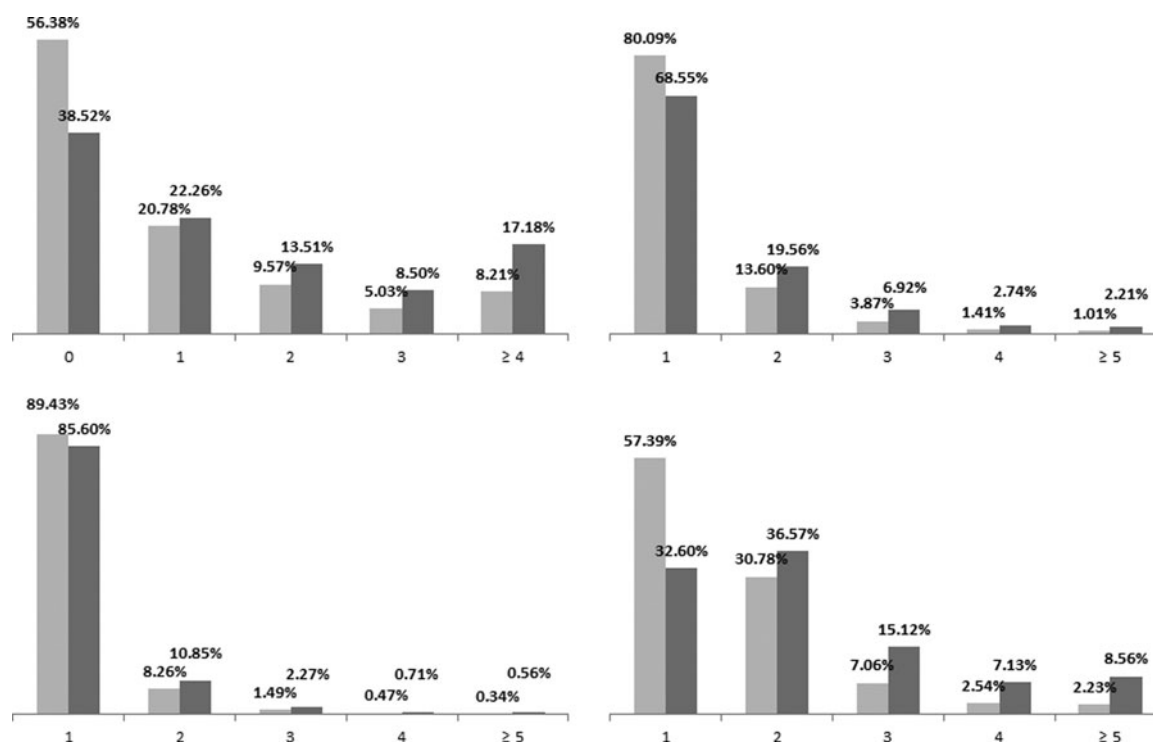


Fig. 2. Patients' repartition per number of hospitalisations, high-severity hospitalisations, admissions through the ER and avoidable hospitalisations Y-axis: % of patients X-axis: (clockwise from top left to bottom left) number of hospitalisations, number of high-severity hospitalisations, number of admissions through the ER, number of avoidable hospitalisations Light grey bars: patients without a mental illness Dark grey bars: patients with a mental illness.

associated with a worse state for each indicator of the quality of care except in-hospital death (Table 3). Indeed, patients showing a mental illness had 37% more hospitalisations, 45% more high-severity hospitalisations, 70% more admissions through the ER and 5% more avoidable hospitalisations. They also had a 19% higher LOS. Mental illness, however, appeared to decrease the risk of in-hospital death by 13% after adjusting on other variables, unlike cancer and cardiovascular diseases. We also found a clear gradient of deprivation on all indicators (Table 3).

Discussion

We found that patients identified as carrying a mental illness were more often hospitalised and for a longer LOS. They were also more admitted through the ER, for more severe hospitalisations and had more avoidable admissions than patients without a mental illness. As each of these indicators was chosen to reflect the quality of primary care, our findings suggest that access to healthcare for somatic reasons may be delayed, inadequate and/or non-optimal in patients with an identified mental illness.

Our study is the first to look at the association between mental illness and somatic comorbidities at

the national level using multiple indicators and exhaustive data over a 5-year period. However, some limits have to be acknowledged. The main one concerns the population identified as being mentally ill, who is only considered to be so if they have been hospitalised for a mental disorder at some point in their past. Patients not treated for their illness or treated only in an ambulatory care setting could not be identified in the databases because of their structure. Therefore there are patients with a mental illness in our 'patients without a mental illness' group, which could lead to an underestimation of the effect of mental health on quality of care. Another limit is that neither database records drug prescriptions and/or side effects, which makes it impossible to differentiate a hospitalisation for a side effect from one for an unrelated somatic illness. Additionally, the psychiatric care database provides very few clinical characteristics (for example, it does not record disease severity) and its ICD-10 diagnoses are unreliable due to the difficulty of making a diagnosis in psychiatry and the different schools of thoughts in France, which is why we did not carry out an analysis per diagnosis. Our study also used hospital proxies as indicators of quality of primary care as they were the only ones available to us in the French databases. It would be interesting to

Table 3. Results of the multivariate regression models for each indicator of quality of prior somatic care trajectories

	Rate ratios/odds ratios ^a	95% confidence interval	p-value
Number of hospitalisations ^b			
Intercept	0.86	0.86–0.87	<0.0001
Sex (men)	1.02	1.02–1.02	<0.0001
Age	1.00	1.00–1.00	<0.0001
Mental illness	1.37	1.37–1.37	<0.0001
Cancer	1.67	1.66–1.67	<0.0001
Diabetes	1.27	1.27–1.27	<0.0001
Cardiovascular disease	1.52	1.52–1.52	<0.0001
In-hospital death	1.17	1.16–1.17	<0.0001
Follow-up, in months	1.01	1.01–1.01	<0.0001
FDep quintile 2	1.04	1.04–1.05	<0.0001
FDep quintile 3	1.07	1.07–1.07	<0.0001
FDep quintile 4	1.06	1.05–1.06	<0.0001
FDep quintile 5	1.05	1.05–1.05	<0.0001
Number of avoidable hospitalisations ^b			
Intercept	0.01	0.01–0.01	<0.0001
Sex (men)	1.00	0.99–1.00	0.6359
Age	1.02	1.02–1.02	<0.0001
Mental illness	1.05	1.04–1.05	<0.0001
Cancer	0.51	0.50–0.51	<0.0001
Diabetes	1.31	1.31–1.32	<0.0001
Cardiovascular disease	2.07	2.06–2.08	<0.0001
Number of hospitalisations	1.28	1.28–1.28	<0.0001
In-hospital death	1.65	1.64–1.66	<0.0001
FDep quintile 2	1.01	1.00–1.01	0.0237
FDep quintile 3	1.02	1.02–1.03	<0.0001
FDep quintile 4	1.05	1.04–1.05	<0.0001
FDep quintile 5	1.06	1.05–1.06	<0.0001
Number of high-severity hospitalisations ^b			
Intercept	0.01	0.01–0.01	<0.0001
Sex (men)	1.02	1.02–1.02	<0.0001
Age	1.04	1.04–10.4	<0.0001
Mental illness	1.45	1.45–1.46	<0.0001
Cancer	1.32	1.32–1.33	<0.0001
Diabetes	1.22	1.21–1.22	<0.0001
Cardiovascular disease	1.83	1.83–1.84	<0.0001
Number of hospitalisations	1.25	1.25–1.25	<0.0001
In-hospital death	1.99	1.98–2.00	<0.0001
FDep quintile 2	1.01	1.00–1.01	0.0008
FDep quintile 3	1.01	1.01–1.01	<0.0001
FDep quintile 4	1.03	1.03–1.03	<0.0001
FDep quintile 5	1.05	1.05–1.05	<0.0001
Number of admissions through the ER ^b			
Intercept	0.18	0.18–0.18	<0.0001
Sex (men)	1.05	1.05–1.05	<0.0001
Age	1.01	1.01–1.01	<0.0001
Mental illness	1.70	1.70–1.71	<0.0001
Cancer	0.70	0.69–0.70	<0.0001
Diabetes	1.02	1.02–1.02	<0.0001
Cardiovascular disease	1.27	1.27–1.27	<0.0001
Number of hospitalisations	1.22	1.22–1.22	<0.0001
In-hospital death	1.50	1.49–1.50	<0.0001
FDep quintile 2	1.08	1.08–1.08	<0.0001
FDep quintile 3	1.15	1.15–1.15	<0.0001

Continued

Table 3. Continued

	Rate ratios/odds ratios ^a	95% confidence interval	p-value
FDep quintile 4	1.12	1.12–1.13	<0.0001
FDep quintile 5	1.13	1.13–1.13	<0.0001
	Mean length of stay ^c		
Intercept	2.12	2.12–2.12	<0.0001
Sex (men)	1.04	1.04–1.04	<0.0001
Age	1.01	1.01–1.01	<0.0001
Mental illness	1.19	1.19–1.19	<0.0001
Cardiovascular disease	1.31	1.31–1.31	<0.0001
Diabetes	1.17	1.17–1.17	<0.0001
Cancer	1.32	1.32–1.32	<0.0001
In-hospital death	1.66	1.65–1.66	<0.0001
FDep quintile 2	0.99	0.99–0.99	0.0003
FDep quintile 3	1.01	1.00–1.01	<0.0001
FDep quintile 4	1.02	1.02–1.02	<0.0001
FDep quintile 5	1.03	1.03–1.03	<0.0001
	In-hospital death ^d		
Sex (men)	1.43	1.42–1.43	<0.0001
Age	1.04	1.04–1.04	<0.0001
Mental illness	0.87	0.86–0.87	<0.0001
Cardiovascular disease	1.50	1.49–1.50	<0.0001
Diabetes	0.97	0.97–0.98	<0.0001
Cancer	4.67	4.65–4.69	<0.0001
Number of hospitalisations	1.13	1.13–1.13	<0.0001
Mean severity	2.90	2.90–2.91	<0.0001
FDep quintile 2	1.04	1.04–1.05	<0.0001
FDep quintile 3	1.05	1.05–1.06	<0.0001
FDep quintile 4	1.08	1.07–1.09	<0.0001
FDep quintile 5	1.13	1.12–1.13	<0.0001

^aFor the negative binomial regression and generalised linear model (GLM), exponential transformation was used on the estimation to obtain the rate ratio.

^bA negative binomial regression was carried out.

^cA generalised linear model (GLM) with gamma log distribution was carried out.

^dA logistic regression was carried out.

perform smaller, additional studies using true primary care indicators, similar to the study carried out using the Quality and Outcomes Framework in the NHS (Jacobs *et al.* 2015). In addition, the number of hospitalisations may not be a satisfactory indicator of late or poor access to healthcare. Indeed recent research (Zhao *et al.* 2013) has found a U-shaped association between primary healthcare visits and hospitalisations and therefore an increased number of hospitalisations may not be synonymous with poor primary care. That being said, given that all our other indicators are consistent with a poor quality of primary care, it seems unlikely that our patients with a mental illness would find themselves in the rising portion of the U. Finally, the large sample size of our study must lead us to question statistical significance *v.* clinical relevance, as other studies have pointed out in the past (Page, 2014; Slobogean *et al.* 2015; Lee & Yoon,

2017). Indeed while we found that the vast majority of our associations were significant, some may not be clinically relevant, in particular age and sex whose rate ratios – while significant – were very close to one. However, those variables were only used as adjustment variables. With regard to mental illness, all rate ratios were consistently far greater than one except for avoidable hospitalisations, which would imply clinical relevance as well.

Other studies have looked at the association between mental illness and individual indicators of quality of care in the past. Regarding mortality, one study found that the aggregated standardised mortality ratio from all causes of death was 3.2, corresponding to 417 excess deaths ($p < 0.001$) (Miller *et al.* 2006). However, there was no association with in-hospital death, similarly to our findings. Another study on patients with acute coronary syndrome found similar

findings, with no significant differences in mortality (HR=0.91; 95% CI 0.81–1.02) between patients with and without severe mental illness (Plomondon *et al.* 2007). Those studies seem to indicate that people with a mental illness die more often outside the hospital, and indeed one study found that leading causes of death were heart disease (21%) and suicides (18%) (Miller *et al.* 2006). Death by heart disease, in particular, could be due for example to a lack of patient education on the warning signs and symptoms that lead other patients to consult a doctor or call emergency services when an acute event occurs, on top of the underdiagnosis and undertreatment of heart diseases in that population. Additionally most studies – including our own – use existing data and therefore can only consider that a patient has a mental illness if said patient has sought treatment or been involuntarily committed in the past and is identified – by himself or the healthcare system – as being mentally ill.

Regarding other indicators, many studies have found that mental illness increases potentially preventable hospitalisations (Li *et al.* 2008; Mai *et al.* 2011a), as did we. Indeed people with a mental illness obtain fewer general preventive healthcare services (Crews *et al.* 1998; Haupt *et al.* 2009; Blane *et al.* 2017). For example, it has been found that patients with a coronary heart disease and two or more mental health comorbidities were more than twice as likely of being current smokers than those with no mental health conditions, and yet they were also less likely to receive smoking cessation advice (Blane *et al.* 2017). In general, people with a mental illness tend to receive medical care sporadically and at later stages of their illness (Salsberry *et al.* 2005; Li *et al.* 2008; Woodhead *et al.* 2016). This may explain why they also have more admissions through the ER: patients with a severe mental illness have high rates of ER use for medical illness, with one study reporting that in a randomly selected sample of 200 psychiatric outpatients, 37% had made one or more visits to the ER for medical concerns in the past year *v.* 20% for those in the general population (Hackman *et al.* 2006), which can then lead to more admissions to hospital. This is particularly important as one study found that over a 5-year period the number of ER visits by people with mental health comorbidities increased by 53.3% while decreasing for those without a mental illness (Capp *et al.* 2016). Regarding admission, a French study found that in a cohort of 15 811 employees, participants with a mental disorder had significantly higher rates of all-cause hospitalisation with an incidence rate ratio of 1.20 (Azevedo Da Silva *et al.* 2015), rather similar to our findings, although they did not find any association for cancer admissions. We also found that once admitted, patients with a

mental illness had an increased LOS (+20%) compared with patients without a mental illness. This was also reported in other studies: for example, one study focusing on the burden of mental illness on hospital and patient outcomes among asthma hospitalisations found that any mental illness was associated with a 10% increase in the LOS (Becerra *et al.* 2016).

Interestingly, we found a lower prevalence of cancer in mentally ill patients compared with non-mentally ill patients (9.30 *vs.* 13.25%). This result joins the conflicting literature currently available on the subject, some studies reporting a lower incidence (Pinquart & Duberstein, 2010; Chou *et al.* 2011), others the same (Catts *et al.* 2008) and others still a higher incidence (Lichtermann *et al.* 2001; Gross *et al.* 2010) depending on the mental disorder under consideration and sometimes even within a given mental disorder. The lower prevalence could be due to less frequent screening associated with higher mortality rates (Howard *et al.* 2010). This population also had a higher chance of avoidable hospitalisations. There is little on the subject in the literature but patients with both a mental illness and cancer could be more likely to decompensate other somatic illnesses such as heart disease or diabetes due to their lack of previous care or be more prone to infections for other reasons, such as poor living conditions.

Finally, one must consider that quality of somatic care can also have an impact on psychiatric care. Indeed one study found that physical comorbidities were more common among readmitted patients than single admission patients in psychiatry (Šprah *et al.* 2017) and another found that while hospitalised in psychiatry, half of the patients needed one or more referrals for a somatic disorder, with a positive linear trend between LOS and number of referrals (Douzenis *et al.* 2012).

Conclusions

Our results show that mental illness has a major impact on acute care hospitalisation for somatic comorbidities and psychiatrists should, therefore, be aware of concomitant somatic conditions in their patients. There is a need for increased and better ambulatory care for patients with a mental illness in order to reduce inequalities in access to care. This should include improved interactions and coordination between mental and physical care, including preventive medicine, and may require developing somatic skills during psychiatric residency.

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Conflict of interest

The authors declare no conflict of interest.

Ethical standards

In accordance to French laws, this study was approved by the French Data Protection Authority (*Commission nationale de l'informatique et des libertés*) which granted access to the databases. As no patient was included in this study, no ethics committee approval was required.

Availability of data and materials

The database is available to researchers after they comply with French laws with regard to its access.

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