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Schizophrenia is associated with excess multiple physical-health comorbidities but low levels of recorded cardiovascular disease in primary care: cross-sectional study

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ABSTRACT

Objective: To assess the nature and extent of physical-health comorbidities in people with schizophrenia and related psychoses compared with controls.

Design: Cross-sectional study.

Setting: 314 primary care practices in Scotland.

Participants: 9677 people with a primary care record of schizophrenia or a related psychosis and 1 414 701 controls. Main outcome measures Primary care records of 32 common chronic physical-health conditions and combinations of one, two and three or more physical-health comorbidities adjusted for age, gender and deprivation status.

Results: Compared with controls, people with schizophrenia were significantly more likely to have one physical-health comorbidity (OR 1.21, 95% CI 1.16 to 1.27), two physical-health comorbidities (OR 1.37, 95% CI 1.29 to 1.44) and three or more physical-health comorbidities (OR 1.19, 95% CI 1.12 to 1.27). Rates were highest for viral hepatitis (OR 3.98, 95% CI 2.81 to 5.64), constipation (OR 3.24, 95% CI 3.00 to 4.49) and Parkinson's disease (OR 3.07, 95% CI 2.42 to 3.88) but people with schizophrenia had lower recorded rates of cardiovascular disease, including atrial fibrillation (OR 0.62, 95% CI 0.51 to 0.73), hypertension (OR 0.71, 95% CI 0.67 to 0.76), coronary heart disease (OR 0.75, 95% CI 0.61 to 0.71) and peripheral vascular disease (OR 0.83, 95% CI 0.71 to 0.97).

Conclusions: People with schizophrenia have a wide range of comorbid and multiple physical-health conditions but are less likely than people without schizophrenia to have a primary care record of cardiovascular disease. This suggests a systematic under-recognition and undertreatment of cardiovascular disease in people with schizophrenia, which might contribute to substantial premature mortality observed within this patient group.

ARTICLE SUMMARY

Article focus

- People with a diagnosis of schizophrenia are known to be at high risk of poor physical-health outcomes and premature mortality due to cardiovascular disease, diabetes, obesity and smoking-related lung disease.
- The nature and extent of multiple physical-health comorbidities within this patient group are poorly understood.
- In a large primary care dataset of almost 1.8 million individuals, we assessed how patterns of multiple physical-health comorbidities in schizophrenia are influenced by age, gender and social deprivation.

Key messages

- People with schizophrenia have a wide range of multiple-comorbid physical-health problems compared with people without schizophrenia, even after controlling for the effects of age, gender and social deprivation.
- Recorded rates were highest for viral hepatitis, constipation and Parkinson's disease but were lower than expected for a number of cardiovascular disorders, including atrial fibrillation, hypertension, coronary heart disease and peripheral vascular disease.
- This suggests a systematic under-recognition and undertreatment of cardiovascular disease of people with schizophrenia within primary care, which might contribute to the substantial cardiovascular-related morbidity and premature mortality observed in this patient group.

INTRODUCTION

Individuals with chronic-mental disorders such as schizophrenia have increased standardised death rates compared with the general population.[1–4] On average, men with schizophrenia die 20 years earlier and women die 15 years earlier than people without major mental illness.[5 6] Although death due to suicide is a contributing factor, approximately two-thirds of this premature

ARTICLE SUMMARY

Strengths and limitations of this study

- The strengths of this study include the large representative sample of almost 1.8 million individuals, of which almost 10 000 had a recorded diagnosis of schizophrenia or related psychosis.
- The rate of a recorded diagnosis of schizophrenia or a related psychotic disorder of 0.7% was slightly lower than might be expected, with most estimates of the prevalence of schizophrenia being approximately 1%.

mortality are attributable to cardiovascular disease, smoking-related lung disease and type II diabetes.[4 6–8] Rates of smoking in schizophrenia are estimated at 70% compared with 20% in the general population[9], and at least 10% of patients prescribed long-term antipsychotic medications will develop type II diabetes, more than twice the rate in the general population.[10] There may also be a shared genetic vulnerability between psychosis and risk of diabetes.[11]

To date, there have been very few large-scale representative studies from primary care which assess the nature and extent of physical-health comorbidity in people with schizophrenia, as well as the influence of age, gender and socioeconomic deprivation. Here, we examine the range and number of the most common physical-health comorbidities within a sample of 9677 people with a recorded diagnosis of schizophrenia or a related psychosis, identified from a large Scottish primary care database of almost 1.8 million individuals.[12]

METHODS

We used a dataset from the Primary Care Clinical Informatics Unit at the University of Aberdeen which consists of all 1 751 841 registered patients who were alive and permanently registered with 314 general practices on 31 March 2007. This sample represents approximately one-third of the Scottish population. Data on the presence of 32 of the most common chronic physical-health conditions were extracted (listed in table A1). A more detailed explanation on how these conditions were selected and defined is available elsewhere.[12]

People were identified as having 'schizophrenia or related non-organic psychosis' (hereafter referred to as 'schizophrenia') based on the recording ever of any of the following primary care read codes (where % is noted, this means 'this code and any below it in the code hierarchy'): E10% schizophrenic disorders; E121 chronic paranoid psychosis; E12z paranoid psychosis NOS; E13% other non-organic psychoses; E13z non-organic psychosis/psychotic episode; NOS E1z non-organic psychosis NOS; Eu20% schizophrenia; Eu22% persistent delusional disorder or the recording in the last 12 months of Eu23% acute/transient psychotic disorder. We restricted our analyses of this dataset to individuals aged 18 and over and the sample was divided into the following age groups for analysis: 18–24; 25–34; 35–44; 45–54; 55–64; 65–75 and 75 and over. Eight individuals with schizophrenia who were under age 18 were excluded. Deprivation status was measured using the Carstairs deprivation score which is widely used in health research (divided into quintiles).[13]

Differences between those with schizophrenia (cases), all other individuals (controls) and between female and male individuals with schizophrenia were calculated by age, deprivation and number of physical conditions. We used t tests to analyse differences between groups and one-way analysis of variance for differences across age groups and deprivation quintiles. Logistic regression was used to calculate ORs and 95% CIs in those with schizophrenia compared with controls for the prevalence of all 32 physical conditions, as well as no physical disorder, one comorbid disorder and two or more comorbid disorders. OR calculations were adjusted for age, gender and deprivation score. All analyses were performed in Stata V.11. The NHS National Research Ethics Service approved the anonymous use of these data for research purposes.

Results

Age, gender and deprivation status, schizophrenia versus controls

We identified 9677 people with schizophrenia (0.7% of the entire sample) and 1 414 701 controls (table 1). Those with schizophrenia were more likely to be male (schizophrenia 51.5% men vs controls 49.1% men; p<0.001) and tended to be older than controls (schizophrenia mean age 51.6 years vs controls mean age 48 years; p<0.001), although the magnitude of these differences was small. Individuals with schizophrenia were more socially deprived on average (schizophrenia Carstairs score 0.34 vs controls −0.17; p<0.001), with 23.3% living in the most deprived quintile of postcodes versus 17.8% of controls.

Physical-health comorbidity in people with schizophrenia versus controls

Physical-health comorbidities were very common in people with schizophrenia, even after adjusting for age, gender and deprivation score. Compared with individuals without schizophrenia, they were significantly less likely to have no recorded comorbidity (OR 0.61, 95% CI 0.58 to 0.64) and significantly more likely to have one comorbidity (OR 1.21, 95% CI 1.16 to 1.27), two comorbidities (OR 1.37, 95% CI 1.29 to 1.44) and three or more comorbidities (OR 1.19, 95% CI 1.12 to 1.27; table 2).

For each of the 32 individual physical conditions assessed, prevalence was significantly higher for people with schizophrenia for 16 conditions, lower for 6 conditions and with no difference for the remaining 10 conditions (table 2 and figure 1). Prevalence was highest for schizophrenia versus controls for viral hepatitis (OR 3.98, 95% CI 2.81 to 5.64), constipation (OR 3.24, 95% CI 3.00 to 4.49) and Parkinson's disease (OR 3.07, 95% CI 2.42 to 3.88). People with schizophrenia also had

Table 1 Age, gender and deprivation status, schizophrenia versus controls

Variable	Schizophrenia Number (%)	Controls Number (%)	Difference 95% CI (p<t)
Total	9677 (0.7)	1414701 (99.3)	
Gender (% male)	4961 (51.5)	694468 (49.1)	2.4 (1.2 to 3.2) (p<0.001)
Age mean (SD)	51.6 (16.5)	48.0 (18.3)	3.6 (3.2 to 4.0) (p<0.001)
Deprivation mean (SD)	0.53 (3.5)	−0.18 (3.3)	0.71 (0.64 to 0.77) (p<0.001)
Age group (years)			
18–24	298 (3.1)	151395 (10.7)	−7.6 (7.0 to 8.1) (p<0.001)
25–34	1216 (12.6)	228180 (16.1)	−3.5 (2.8 to 4.3) (p<0.001)
35–44	2140 (22.1)	276853 (19.6)	2.5 (1.8 to 3.3) (p<0.001)
45–54	2079 (21.5)	251715 (17.8)	3.7 (2.9 to 4.5) (p<0.001)
55–64	1771 (18.3)	217562 (15.4)	2.9 (2.2 to 3.6) (p<0.001)
65–74	1094 (11.3)	154186 (10.9)	0.4 (−0,2 to 1.0) (p=0.20)
75 and over	1079 (11.2)	134810 (9.5)	1.7 (1.1 to 2.2 (p<0.001)
Deprivation quintile			
1—Least deprived	1260 (13.0)	270769 (19.1)	−6.1 (5.3 to 6.9) p<0.001)
2	1714 (17.7)	302440 (21.4)	−3.1(2.8 to 4.5) (p<0.001)
3	2263 (23.4)	319984 (22.6)	0.8 (−0.0 to 1.6 (p=0.07))
4	2190 (22.6)	269194 (19.0)	3.6 (2.8 to 4.4) (p<0.001)
5—Most deprived	2250 (23.3)	252314 (17.8)	5.5 (4.7 to 6.2) (p<0.001)

higher rates of several important chronic health conditions, including diabetes (9% in schizophrenia vs 5.2% in controls; p<0.001), chronic obstructive pulmonary disease (COPD; (6% vs 3.1%; p<0.001) and chronic pain (13.8% vs 8.8%; p<0.001).

The most commonly diagnosed condition for individuals with schizophrenia was hypertension (16%), although this rate was lower than in controls (16.5%). It is also noteworthy that for the six conditions in which the relative prevalence for schizophrenia patients was lower, four were cardiovascular-related, including atrial fibrillation (OR 0.62, 95% CI 0.51 to 0.73), hypertension (OR 0.71, 95% CI 0.67 to 0.76), coronary heart disease (OR 0.75, 95% CI 0.61 to 0.71) and peripheral vascular disease (OR 0.83, 95% CI 0.71 to 0.97).

Gender differences within the schizophrenia group

We assessed whether there might be differences between men and women with schizophrenia in terms of the number of recorded physical-health comorbidities, as well as age and deprivation status (table 3). Physical comorbidity was high in all schizophrenia patients, with two-thirds of women and 50% of men having at least one recorded comorbid physical condition (table 2). Women with schizophrenia were significantly more likely to have two or more physical conditions (18.1% vs 12.9%; p<0.001) and three or more physical conditions (23.9% vs 12.6%; p<0.001).

Discussion

In keeping with several recent reports, this study highlights that multiple physical-health comorbidity is a major issue for people with schizophrenia and related psychoses.[1–4 6–8 14 15] A majority of people with schizophrenia had at least one chronic physical comorbidity and one-third had two or more. Compared with patients without schizophrenia, patients with schizophrenia were much more likely to have a primary care record of both single and multiple physical-health problems, even after taking into account age, gender and deprivation status. We found three conditions to be particularly over-represented in the schizophrenia group (viral hepatitis, constipation and Parkinson's disease), as well as high rates of diabetes, chronic pain, epilepsy, COPD, dyspepsia, liver disease and irritable bowel syndrome.

Under-recording of cardiovascular disease

Perhaps the most notable finding in this study was that individuals with schizophrenia and related psychoses had significantly lower recorded rates of cardiovascular disorders (including atrial fibrillation, hypertension, congestive heart disease and peripheral vascular disease) than individuals without schizophrenia. This finding is somewhat unexpected, given that several previous studies have found high rates of cardiovascular morbidity and mortality in schizophrenia.[15 16] However, a population-based study of administrative claims data in the USA has found that rates of hypertension and ischaemic heart disease were lower than expected in individuals with schizophrenia compared with controls.[14] Similarly, a recent meta-analysis of prescribing data for patients with and without major mental illness (including schizophrenia) found that those with severe mental illness had much lower than expected rates of being prescribed medications for cardiovascular disease.[16] In a recent Swedish national cohort study, people with incident schizophrenia were more likely to die prematurely than the general population (15 years earlier for men

Table 2 Prevalence and adjusted ORs for physical-health comorbidity (adjusted for age, gender and deprivation score)

	Schizophrenia number (%)	Controls number (%)	OR (95% CI)
No physical comorbidity	4069 (42.1)	796039 (56.3)	0.61 (0.58 to 0.64) (p<0.001)
One physical comorbidity	2363 (24.4)	290950 (20.6)	1.21 (1.16 to 1.27) (p<0.001)
Two physical comorbidities	1493 (15.4)	148231 (10.5)	1.37 (1.29 to 1.44) (p<0.001)
Three or more physical comorbidities	1752 (18.1)	179481 (12.7)	1.19 (1.12 to 1.27) (p<0.001)
Individual conditions			
Viral hepatitis	33 (0.3)	1142 (0.1)	3.98 (2.81 to 5.64) (p<0.001)
Constipation	873 (9.0)	35543 (2.5)	3.24 (3.00 to 3.49) (p<0.001)
Parkinson's disease	73 (0.8)	2668 (0.2)	3.07 (2.42 to 3.88) (p<0.001)
Epilepsy	213 (2.2)	12171 (0.9)	2.42 (2.11 to 2.77) (p<0.001)
Dyspepsia	1106 (11.4)	78098 (5.5)	1.92 (1.80 to 2.05) (p<0.001)
Liver disease	36 (0.4)	2578 (0.2)	1.66 (1.19 to 2.31) (p<0.001)
Irritable bowel syndrome (IBS)	540 (5.6)	51597 (3.7)	1.57 (1.44 to 1.72) (p<0.001)
Diabetes	870 (9.0)	73961 (5.2)	1.52 (1.40 to 1.64) (p<0.001)
Blindness	104 (1.1)	8274 (0.6)	1.44 (1.18 to 1.75) (p<0.001)
Thyroid disorders	738 (7.6)	71205 (5.0)	1.43 (1.32 to 1.54) (p<0.001)
Pain	1332 (13.8)	124799 (8.8)	1.39 (1.30 to 1.47) (p<0.001)
Psoriasis and eczema	101 (1.0)	10268 (0.7)	1.34 (1.10 to 1.63) (p<0.001)
Chronic obstructive pulmonary disease (COPD)	577 (6.0)	52530 (3.1)	1.31 (1.20 to 1.43) (p<0.001)
Migraine	79 (0.8)	9172 (0.7)	1.27 (1.02 to 1.59) (p=0.03)
Asthma	696 (7.2)	83809 (5.9)	1.22 (1.12 to 1.31) (p<0.001)
Heart failure	167 (2.0)	18703 (1.3)	1.15 (0.99 to 1.32) (p=0.06)
Hearing loss	495 (5.1)	54239 (3.8)	1.14 (1.04 to 1.25) (p<0.001)
Sinusitis	69 (0.7)	9096 (0.6)	1.10 (0.86 to 1.34) (p=0.42)
Stroke and TIA	350 (3.6)	36195 (2.6)	1.07 (0.96 to 1.20) (p=0.19)
Crohn's disease	71 (0.7)	9680 (0.7)	1.03 (0.81 to 1.33) (p=0.80)
Bronchiectasis	23 (0.2)	2791 (0.2)	0.99 (0.66 to 1.50) (p=0.99)
Diverticular disease	283 (2.9)	33530 (2.4)	0.96 (0.84 to 1.09) (p=0.61)
Chronic kidney disease	291 (3.0)	33275 (2.4)	0.95 (0.84 to 1.08) (p=0.48)
Glaucoma	123 (1.3)	15796 (1.2)	0.88 (0.73 to 1.04) (p=0.15)
Multiple sclerosis	23 (0.3)	3824 (0.3)	0.88 (0.59 to 1.33) (p=0.56)
Prostate disease	114 (1.2)	15119 (1.1)	0.86 (0.71 to 1.03) (p=0.11)
Peripheral vascular disease	167 (1.7)	23073 (1.6)	0.83 (0.71 to 0.97) (p=0.02)
Inflammatory arthritis	389 (4.0)	57619 (4.1)	0.82 (0.74 to 0.91) (p<0.001)
Cancer	288 (3.0)	43376 (3.1)	0.81 (0.72 to 0.91) (p<0.001)
Coronary heart disease	579 (5.9)	80888 (5.7)	0.75 (0.69 to 0.82) (p<0.001)
Hypertension	1551 (16.0)	232763 (16.5)	0.71 (0.67 to 0.76) (p<0.001)
Atrial fibrillation	137 (1.4)	23839 (1.7)	0.62 (0.51 to 0.73) (p<0.001)

TIA, transient ischaemic attack.

and 12 years earlier for women) and the leading causes of death were cardiovascular disease and cancer. However, in this study, the rates of recording of cardiovascular disease and cancer were not much increased in people with schizophrenia, even though these individuals had more healthcare system contacts, suggesting that cardiovascular disease and cancer are significantly underdiagnosed and/or under-recorded in this population.[4]

There may be several possible explanations for our findings. People with schizophrenia may be less likely to consult their general practitioner (GP) with symptoms of cardiac or vascular disease because of low awareness of cardiovascular risk and associated symptoms,[17] or they may be more likely to not have these areas investigated, diagnosed[18] and monitored.[19] They might also expect that their physical health needs are being met by their community mental health teams.[4] In general, rates of consultation in individuals with major mental illness are comparable to the general population[20] but it is possible that relatively asymptomatic conditions such as atrial fibrillation are less likely to be identified than constipation, irritable bowel syndrome, Parkinson's disease, dyspepsia and epilepsy. It is also possible that, even when these patients do attend, GPs may not be assessing and/or recording cardiac problems as often as they might with patients who do not have schizophrenia.[18] It is well documented that patients with mental illness and comorbid physical problems do not receive the same level of assessment and treatment for their physical problems as patients without mental illness.[21 22]

Hypertension was the most common comorbidity recorded within the schizophrenia group but was

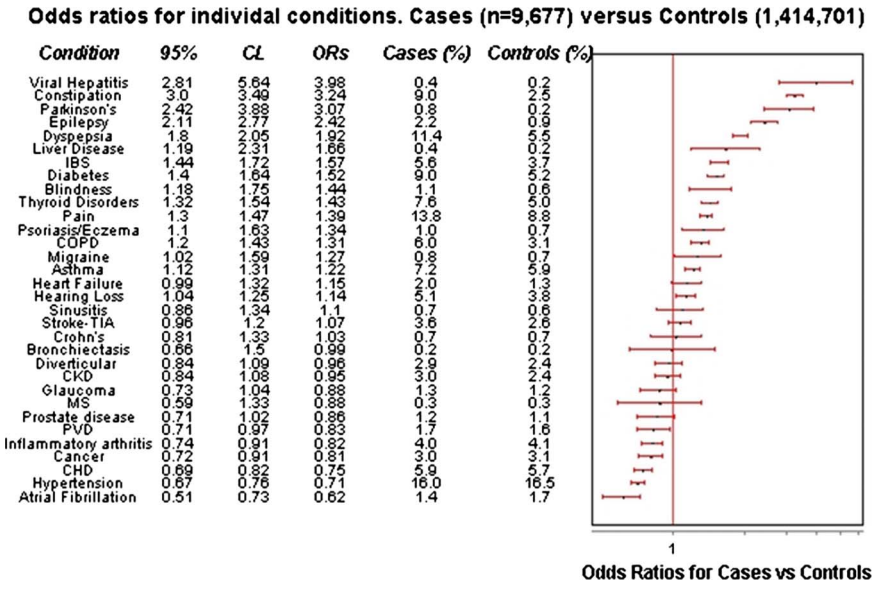

Figure 1 ORs for individual physical-health comorbidities, schizophrenia versus controls (adjusted for age, gender and deprivation status).

significantly less common than in the control group (OR 0.71, 95% CI 0.67 to 0.76). It is possible that this could be due to the use of antihypertensive agents for symptoms such as anxiety or akathisia in the schizophrenia group or the hypotensive effect of some antipsychotic medications, but the most likely explanation in our view would be less frequent monitoring of blood pressure in primary care for patients with schizophrenia relative to controls. Having said this, a recent systematic review of features of metabolic syndrome in schizophrenia and related disorders found increased rates of hypertension, so this is an area in need of more research.[23] Although it will be important for our findings to be replicated, this and other studies are consistent with a systematic underdiagnosis of cardiovascular disease in patients with schizophrenia, which, coupled with the undertreatment of the diagnosed disease, may contribute to the high rates of cardiovascular morbidity and premature mortality observed in this patient group.

Other medical comorbidities

Although difficult to clarify within this dataset, it is possible to speculate on the reasons for the high rates of viral hepatitis, constipation and Parkinson's disease

Table 3 Differences between women and men with schizophrenia

Variable	Women Number (%)	Men Number (%)	Difference 95% CI (p<t)
Total	4716 (48.7)	4961 (51.3)	
Age mean (SD)	55.6 (17.0)	47.8 (15.2)	7.8 (7.2 to 8.4) (p<0.001)
Deprivation mean (SD)	0.29 (3.4)	0.77 (3.5)	−0.5 (−0.34 to −0.68) (p<0.001)
Age group (years)			
18–24	102 (2.2)	196 (4.0)	−1.8 (−1.1 to −2.4) (p<0.001)
25–34	400 (8.5)	816 (16.5)	−8.0 (6.7 to 9.2) (p<0.001)
35–44	865 (18.3)	1275 (25.7)	−7.4 (−5.7 to −9.0) (p<0.001)
45–54	968 (20.5)	1111 (22.4)	−1.9 (−0.2 to −3.5) (p=0.03)
55–64	935 (19.8)	836 (16.9)	2.9 (1.4 to 4.5) (p<0.001)
65–74	663 (14.1)	431 (8.7)	5.4 (4.1 to 6.6) (p<0.001)
75 and over	783 (16.6)	296 (6.0)	10.6 (9.9 to 11.3) (p<0.001)
Deprivation quintile			Difference 95% CI (p<t)
1—Least deprived	678 (14.4)	582 (11.7)	2.6 (1.3 to 3.9) (p<0.001)
2	862 (18.3)	852 (17.2)	1.1 (−0.4 to 2.0) (p=0.15)
3	1146 (24.3)	1117 (22.5)	1.8 (0.0 to 3.4 (p=0.04)
4	1060 (22.5)	1130 (22.8)	−0.3 (−1.9 to 0.3) (p=0.26)
5—Most deprived	970 (20.6)	1280 (25.8)	−5.2 (−3.6 to −6.9) (p<0.001)
Number of comorbidities			
No physical	1577 (33.4)	2492 (50.2)	− 16.8 (−14.9 to 3.9) (p<0.001)
One physical	1155 (24.5)	1208 (24.4)	0.1 (−1.5 to 1.8) (p=0.87)
Two physical	855 (18.1)	638 (12.9)	5.2 (3.8 to 6.7) (p<0.001)
Three or more	1129 (23.9)	623 (12.6)	11.3 (9.8 to 12.9) (p<0.001)

within the schizophrenia group. For example, this sample (which comprised 'schizophrenia and related psychoses') is likely to include a proportion of people with a history of drug misuse who will be at higher risk of viral hepatitis. It is possible that this has contributed to the higher recorded rates of viral hepatitis within the schizophrenia group.

Constipation is an important though often neglected side effect of antipsychotic medication,[24 25] and it is of interest that it was much more commonly recorded in the schizophrenia group than in controls. However, most estimates suggest that between 20% and 30% of all patients taking antipsychotic medications will have constipation.[25] The prevalence of 9% within the schizophrenia group in our study is therefore likely to be an underestimate of the true figure.

Although relatively rarely recorded, Parkinson's disease was significantly more common in the schizophrenia group than in controls (0.8% vs 0.2%, OR 3.07, 95% CI 2.42 to 3.88) and could also represent a common extrapyramidal side effect of antipsychotic medication.

Gender differences

We found that patients with schizophrenia (and particularly men) were over-represented in areas of higher social deprivation. It is well documented that socioeconomic disadvantage and urban residence contribute to the risk of developing a psychotic disorder,[26] but the cross-sectional nature of our data make it difficult to assess whether our finding is due to this or is a consequence of social drift. Additionally, we found that women with schizophrenia were more likely than men with schizophrenia to have multiple comorbidities—this gender difference was also observed in the Swedish national cohort study noted above.[4] In our dataset, it might be explained by the fact that women with schizophrenia were older on average than men with schizophrenia (possibly due to the greater premature mortality for men) and the possibility that women are more likely to consult with their GP than men.[27] Future work should seek to explore these gender differences in more detail, for example, by assessing the help-seeking behaviours of men and women with schizophrenia and how these behaviours are influenced by age and socioeconomic background.

Strengths and limitations

The strengths of this study include the large sample size (almost 1.8 million individuals), which is representative of the Scottish population, but some potential limitations should be noted. The rate of a recorded diagnosis of schizophrenia or a related psychotic disorder of 0.7% could be considered to be lower than expected, with most estimates of the prevalence of schizophrenia around 1%,[28] although it is recognised that estimates of the incidence and prevalence of schizophrenia can be subject to wide variations across different locations because of the differences in population characteristics, exposure levels and diagnostic assessment.[28] It is possible that some patients with schizophrenia or a related psychotic disorder are known to secondary care services but are not recorded within primary care and that a small additional proportion may not be in contact with either primary or secondary care. Further, these are routine data from 314 primary care practices and there may be some variability of diagnostic coding for major mental illnesses across these practices. Conversely, it is possible that in addition to the under-recognition and under-recording of cardiovascular disease in patients with schizophrenia, some of the prevalence rates for other physical-health comorbidities may be underestimated.

Conclusions

Overall, this study highlights that people with schizophrenia have high rates of multiple comorbid physical health problems, emphasising the importance of an integrated approach to their care.[29 30] It is well documented that physical and mental health problems interact to cause prolonged hospitalisation, treatment failure, poor quality of life and premature mortality.[15 17 31] The current separation between specialist physical and mental health services, and between primary and secondary care services in the UK and other countries, makes the co-ordinated care of the physical health of patients with schizophrenia difficult. Several recent reports have highlighted that more integrated services are needed but how best to achieve this is currently unclear.[32–35] This issue may be particularly relevant for cardiac disease because, although many studies have found that patients with schizophrenia have high rates of cardiovascular morbidity and mortality, our findings and other recent evidence suggest that they have lower than expected rates of being diagnosed with and treated for cardiovascular disorders.

Integrated care requires the delivery of preventive and curative health services which vary according to individual needs over time and across different levels of the healthcare system and can be difficult to achieve. Given that cardiovascular risk assessment has been shown to be acceptable to many people with psychosis,[36] a more systematic use of such screening in both primary and secondary care may improve early detection and treatment of hypertension, hypercholesterolaemia, diabetes and smoking. Further research is needed to evaluate the effectiveness of such approaches to improve the physical health and life expectancy of people with schizophrenia.

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Contributors DJS, JL, BG and SWM conceived the idea of the study, GMcL carried out statistical analyses, DJS wrote the first draft and all authors contributed to revisions of this draft. All authors approved the final version before submission. SWM is the guarantor for this study.

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APPENDIX

Table A1 Definitions of 32 physical-health conditions assessed

Condition	Variable name	Variable definition
Coronary heart disease	CHD	Read code ever recorded
Chronic kidney disease	CKD	Read code ever recorded
Asthma (active)	Asthma	Read code ever recorded AND any prescription in the previous year
Atrial fibrillation	Atrial fibrillation	Read code ever recorded
Epilepsy	Epilepsy	Read code ever recorded AND epilepsy prescription in the previous year
New cancer in the last 5 years	Cancer	Read code first recorded in the last 5 years (Relevant Read Code recorded)
Thyrotoxicosis/thyroid disorders (includes hypothyroidism)	Thyroid disorders	Read code ever recorded (Relevant Read Code recorded)
Diabetes	Diabetes	Read code ever recorded
Parkinson's disease	Parkinson's disease	Read code ever recorded (Relevant Read Code recorded)
Multiple sclerosis	Multiple sclerosis	Read code ever recorded (Relevant Read Code recorded)
Stroke or transient ischaemic attack	Stroke or TIA	Read code ever recorded (Relevant Read Code recorded)
Blindness and low vision	Blindness	Read code ever recorded (Relevant Read Code recorded)
Glaucoma	Glaucoma	Read code ever recorded (Relevant Read Code recorded)
Hearing loss	Hearing loss	Read code ever recorded (Relevant Read Code recorded)
Hypertension	Hypertension	Read code ever recorded (Relevant Read Code recorded)
Heart failure	Heart failure	Read code ever recorded
Peripheral vascular diseases	PVD	Read code ever recorded (Relevant Read Code recorded)
Chronic sinusitis	Sinusitis	Read code ever recorded (Relevant Read Code recorded)
Bronchitis, emphysema & other chronic obstructive pulmonary diseases	COPD	Read code ever recorded (Relevant Read Code recorded)
Bronchiectasis	Bronchiectasis	Read code ever recorded (Relevant Read Code recorded)
Crohn's disease and ulcerative colitis	Inflammatory bowel disease	Read code ever recorded (Relevant Read Code recorded)
Diverticular disease of the intestine	Diverticular disease	Read code ever recorded (Relevant Read Code recorded)
Rheumatoid arthritis, other inflammatory polyarthropathies and systematic connective tissue disorders	Inflammatory arthritis	Read code ever recorded (Relevant Read Code recorded)
Hyperplasia of prostate and prostate disorders	Prostate disease	Read code ever recorded (Relevant Read Code recorded)
Psoriasis or eczema	Psoriasis/eczema	Read code ever recorded (M11% & M12%) AND $\geq$ 4 prescription in last year (BNF 13.4, excluding hydrocortisone and BNF 13.5)
Viral hepatitis	Viral hepatitis	Read code ever recorded (Relevant Read Code recorded)
Irritable bowel syndrome	Irritable bowel syndrome	Read code ever recorded (Relevant Read Code recorded) OR $\geq$ 4 antispasmodic prescription in the previous year (POM only, exclude kolanticon, alverine citrate and peppermint oil)

Continued

Table A1 Continued

Condition	Variable name	Variable definition
Cirrhosis/chronic liver disease/alcoholic liver disease	Chronic liver disease	Read code ever recorded (Relevant Read Code recorded)
Migraine	Migraine	≥ 4 anti-migraine prescriptions in last year (BNF 040704%, POM only exclude migraleve)
Dyspepsia	Dyspepsia	≥ 4 prescriptions in last year BNF 0103% excluding antacids AND NOT ≥4 NSAIDS OR ≥4 aspirin/ clopidogrel
Constipation	Constipation	≥4 prescriptions in last year, BNF 0106%
pain	pain	≥4 specified analgesic prescriptions in the previous year (opioids/>8 mg cocodamol/NSAIDS) OR ≥4 specified antiepileptics in the absence of an epilepsy Read code in last year (gabapentin, pregabalin and carbamazepine)

BNF, British National Formulary; NSAIDS, non-steroidal anti-inflammatory drugs; POM, prescription only medicine.

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