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Comorbidity and polypharmacy in chronic heart failure: a cross-sectional study of 1.4 million patients in primary care

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How This Fits In

Comorbidity is known to be a common problem in patients with heart failure, but previous studies have been based on a small number of comorbid conditions using mainly non-primary care data sources. The current study compared prevalence rates of comorbidity in those with and without chronic heart failure due to left ventricular systolic dysfunction (LVSD) using nationally representative primary care data from 314 general practices and 1,421,756 patients in Scotland. Compared with standardised controls, the LVSD group had elevated comorbidity, with 25/31 physical and 6/7 mental health conditions being significantly more common. Polypharmacy of 11 or more drugs was also more common in the LVSD group.

Abstract

Background

Comorbidity is common in heart failure, but previous prevalence estimates have been based on a limited number of conditions using mainly non-primary care data sources.

Aim

To compare prevalence rates of comorbidity and polypharmacy in those with and without chronic heart failure due to left ventricular systolic dysfunction (LVSD).

Design

Cross-sectional study

Setting

314 general practices and 1,421,756 patients in Scotland.

Methods

Data on the presence of LVSD, 31 other physical and seven mental health comorbidities and prescriptions were extracted. Comorbidity prevalence were compared in patients with and without LVSD, standardised by age, gender and deprivation

Results

17,285 people (1.2%) had a diagnosis of LVSD. Compared with standardised controls, the LVSD group had more comorbidity, with the biggest difference found for seven or more conditions (OR 4.10 95% CI 3.90-4.32). Twenty-five physical conditions and six mental health conditions were significantly more prevalent in those with LVSD relative to standardised controls. Polypharmacy was higher in the LVSD group compared with controls, with the biggest difference found for 11 or more repeat prescriptions (OR 4.81; 95% CI 4.60 to 5.04). However, these differences in polypharmacy were attenuated after controlling for

the number of morbidities, indicating that much of the additional prescribing was accounted for by multimorbidity rather than LVSD per se.

Conclusions

Extreme comorbidity and polypharmacy is strikingly more common in patients with chronic heart failure due to LVSD. The efficient management of such complexity requires the integration of generalist and specialist expertise.

Keywords: heart failure; multimorbidity; general practice; comorbidity

Introduction

Chronic heart failure constitutes a major public health problem.[1, 2] The prevalence of chronic heart failure is increasing.[3,4] and despite improvements in mortality,[5] approximately 50% of those diagnosed die within five years.[6] Chronic heart failure also impacts on quality of life[7] and increases "treatment burden" [8, 9] and challenging self-care demands.[10]

Patients with chronic disease often have multiple conditions[11]. More than half of all hospitalisations of heart failure patients are related to non-cardiovascular causes.[12] Comorbidity is common in heart failure,[13,14,15] especially in older patients.[16,17] Comorbidities in heart failure increase mortality and resource utilisation[18,19,.20]and worsen self care.[21]

However, much of this evidence on comorbidity in heart failure comes from studies of hospital discharge records, studies considering a relatively limited number of chronic conditions, or studies with relatively small sample sizes.[22,23] Data from primary care - the location of most health care interactions with heart failure patients -is scarce. The aim of the present study was to examine the prevalence of convergent and divergent comorbidity in chronic heart failure using a large, nationally representative cross-sectional UK primary care dataset. Polypharmacy was also examined.

Methods

We used data from the Primary Care Clinical Informatics Unit at the University of Aberdeen on 1,424,378 individuals, aged 18 years or older, who were alive and permanently registered with 314 general practices (31% of all practices in Scotland) on March 31, 2007 registered with a participating practice. These practices had recorded routine electronic clinical data as part of the Scottish Programme for Improving Clinical Effectiveness in Primary Care (SPICE-PC), which was a voluntary scheme run by the Scottish Government, and was a nationally representative sample in terms of patients age, gender, and socioeconomic status.[24] Socioeconomic status was measured using the Carstairs score (grouped into quintiles). The dataset provided information on age, gender, socioeconomic status and 39 long term conditions. In total 18,899 individuals were identified as having heart failure through having a Read Code for heart failure recorded in their primary care electronic medical record (EMR). Heart failure due to left ventricular systolic dysfunction (LVSD) is one of a number of chronic conditions, whose accurate diagnosis and optimal management has been incentivised through the UK Quality and Outcomes Framework (QOF) pay-for-performance programme since 2004. We restricted analysis to 17,285 individuals who have been diagnosed heart failure due to LVSD who were identified using QOF indicator heart failure 03.[25] The control group were defined as the entire population of adults without LVSD.

To control for differences between the two populations in age, gender and deprivation levels we adopted a similar approach to that undertaken in previous papers[26 27] and generated standardised prevalence rates by age groups (18 to 24 years; 25 to 34; 35 to 44; 45 to 54; 55 to 64; 65 to 74; 75 to 84 and 85 and over), gender and deprivation quintile using the direct method. These age-gender-deprivation standardised rates were then used to calculate odds

ratio (ORs) and 95% confidence intervals (95% CI) for those with LVSD compared to those without (controls) for the prevalence of 31 physical conditions. There were seven mental health conditions (depression, alcohol misuse, learning disability, anorexia/bulimia, 'anxiety and other neurotic, stress-related and somatoform disorders', 'schizophrenia and related conditions', and dementia). For all statistical analyses, a p-value less than 0·05 was considered statistically significant. All analyses were performed in Stata version 13. The NHS Grampian Research Ethics Service approved the anonymous use of these data for research purpose.

Results

Demographics

There were 17,285 (1.2% of the sample) patients with a code for LVSD (table 1). Men were over-represented in the LVSD group compared to (unadjusted) controls (53.5% vs. 49.1% for controls; p <0.001). Individuals with LVSD were on average older (mean age 72.3 years vs. 47.6 years for controls; P <0.001). People with LVSD were marginally more likely to be living in the most deprived areas compared to unadjusted controls (LVSD most deprived quintile 20% vs controls 17.8%; p<0.001). Overall only 3.2% of individuals with heart failure had no other condition compared to 52.0% of unadjusted controls with no recorded condition (table 2)

Comorbidity: LVSD compared with standardised controls

After standardising for age, sex and social deprivation (table 2) higher levels of comorbidity were evident in the LVSD group who were less likely to have none, one or two conditions but more likely to have three conditions (LVSD 17.5% vs. controls 4.0%; OR 4.10 95% CI 3.90-4.32). The biggest difference found was for seven or more conditions (LVSD 13.9% vs. controls 1.1%; OR 4.10 95% CI 3.90-4.32). A similar, though even more striking, pattern was found when restricting analysis to physical health comorbidities (table 2) with a five-fold difference between LVSD and controls being found in those with seven or more conditions (OR 5.10 (95% CI 4.79 to 5.43)).

Mental comorbidity was also more common in those with LVSD who were less likely to have no mental condition (LVSD 71.9% vs. controls 84.9%; OR 0.67 95% CI 0.65-0.70) and were more likely to have one, two or three or more mental health conditions ranging from OR 1.41 95% CI 1.36 to 1.47 (LVSD 20.3% vs. controls 11.5%) for one condition to OR 1.39 95% CI 1.19 to 1.61 (LVSD 20.3% vs. controls 11.5%) for three or more mental health conditions (table 2).

Physical health individual conditions: LVSD compared with controls

For the LVSD group, 25 (including all 6 concordant conditions) out of 31 physical conditions were significantly more prevalent relative to controls (figure 1). The largest differences after standardisation for age, sex and deprivation were for 'concordant' conditions; coronary heart disease (CHD) (OR 7.98, 95% CI 7.72-8.25) atrial fibrillation (OR 6.84, 95% CI 6.57-7.12) and chronic kidney disease (CKD) (OR 3.81, 95% CI 3.18-3.46). However, large differences

were also found for non-cardiometabolic conditions such as chronic pain (OR 3.01, 95% CI 2.90-3.12) and COPD (OR 2.51, 95% CI 2.38-2.65).

Mental health conditions: LVSD compared with controls

Table 3 highlights that those with LVSD had significantly higher prevalence for six of the mental health conditions with no difference found for anorexia/bulimia. The biggest difference after standardisation for age, sex and deprivation was for anxiety and stress related conditions (LVSD 11.0% vs. controls 3.8%; OR 1.83, 95% CI 1.73-1.94), followed by alcohol problems (LVSD 4.9% vs. controls 3.0%; OR 1.73, 95% CI 1.62-1.86). The highest prevalence for a mental health condition was found for depression with prevalence 16.3% for those with LVSD compared to 10.1% of controls (OR 1.48 95% CI1.41-1.54.)

Polypharmacy: LVSD compared with controls

Polypharmacy (defined as 5 or more repeat drugs) was substantially higher in the LVSD group compared with controls even after standardisation for age, gender, and deprivation (table 4). However, these differences were substantially attenuated after additional standardisation to account for the number of morbidities, indicating that much of the additional prescribing was accounted for by comorbidity rather than LVSD per se (see figure 2).

Discussion

Summary

This analysis has found that comorbidity of physical and mental health chronic conditions are more common in those with LVSD even after standardisation for age, sex and deprivation.

Strengths and limitations

Strengths of our study were that we used a large nationally representative primary care database. We used LVSD as our measure for heart failure prevalence. The percentage of heart failure due to LVSD of 91.5% is similar to that found for all Scottish practices recorded in the QOF in the same year of 88.7%.[28] A limitation is that no data was available on the number of those with LVSD who had been identified using an echocardiogram. However, heart failure is routinely investigated in NHS Scotland using an echocardiogram. We included 39 morbidities in addition to LVSD, substantially more than most other studies of comorbidity and LVSD. However, the study was cross sectional and there was no data on outcomes.

Comparison with existing literature

Direct comparison of the current study with existing literature is difficult as most previous studies have focused on the elderly, included a smaller number of conditions, not had a control group, and not been primary care based. However, the markedly higher prevalence of comorbidity in heart failure is consistent across studies, as is the finding of high levels of 'concordant' conditions such as CHD, CKD, and atrial fibrillation. The high level of chronic pain in the LVSD group in the present study appears to be a novel finding, which is worthy of further investigation.

Its is possible of course that the higher level of comorbidities in LVSD in part reflects higher rates of diagnosis, since these patients would be invited for annual review under QOF. Similarly, the higher levels of polypharmacy could also relate to this and the fact that QOF recommends putting LVSD patients on at least two drugs (ACEi/ARB and b-blocker).

Implications for research and practice

Recent heart failure clinical guidelines acknowledge the issue of comorbidity but do not address the specific challenges.[29 30] The evidence underpinning recommendations in LVSD guidelines is largely created from randomised controlled trials which exclude older and more comorbid individuals.[31 32] Many evidence gaps remain in the clinical management of comorbidity in LVSD. For example, the safety and efficacy of many treatments for comorbidities in the context of LVSD as well as the drugs recommended for LVSD remain uncertain.

In conclusion, the current study has provided a comprehensive picture of current patterns of comorbidity in primary care in those with chronic heart failure due to LVSD. Comorbidity is clearly the norm in LVSD. Clinical guidelines and health care services need to put greater emphasis on management of such complexity in LVSD, which will require the application and integration of generalist and specialist expertise.

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Ethics

The NHS National Research Ethics Service had previously approved the anonymous use of these data for research purposes, therefore this study did not need individual ethics approval.

Competing Interests

All authors declare that they have no competing interests

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

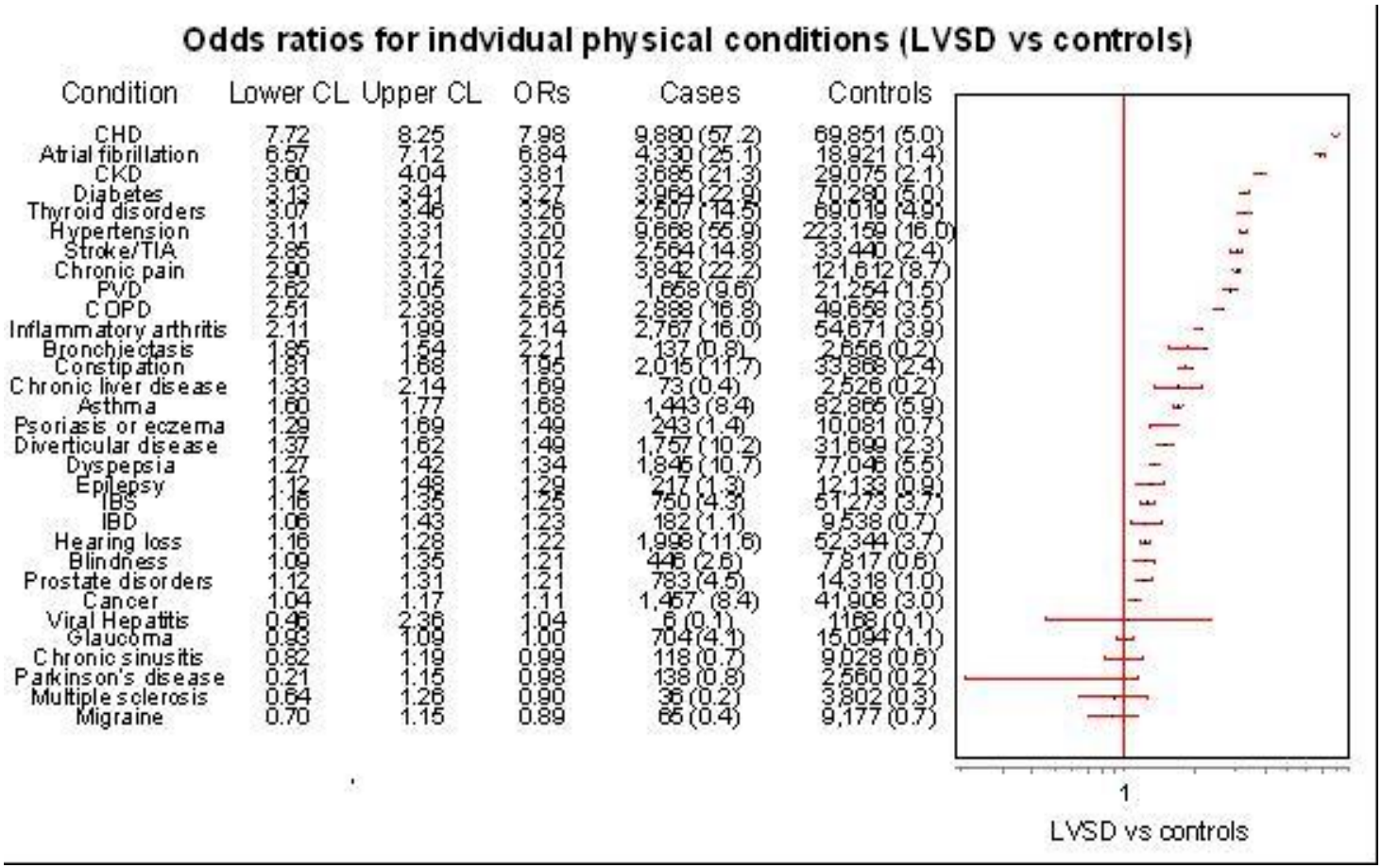
Variable	LVSD N=17,825 (1.2% of all patients) No. (%)	Controls N=1,404,471 (98.8%) of all patients No. (%)
Men	9,242 (53.5%)	88,967 (49.1%)
Mean Age (sd)	72.3 (13.1)	47.6 (18.1)
Age Group		
18-24	39 (0.2)	151,650 (10.8)
25-34	126 (0.7)	229,266 (16.3)
35-44	396 (2.3)	278,567 (19.8)
45-54	1,129 (6.5)	252,579 (18.0)
55-64	2,573 (14.9)	216,542 (15.4)
65-74	4,654 (26.9)	150,120 (10.7)
75-84	5,902 (31.2)	93,009 (6.6)
85 and over	2,966 (17.3)	32,738 (2.3)
Deprivation quintile		
Least Deprived	3,526 (20.4)	268,122 (19.1)
2	3,531 (20.4)	300,086 (21.4)
3	3,644 (21.1)	317,963 (22.6)
4	3,127 (18.1)	267,710 (19.1)
Most deprived	3,457 (20.0)	250,590 (17.8)

Table 2 LVSD status and number of morbidities

	LVSD N (%) N=17,285	**Controls (%)** N=1,404,471	**Age, gender and deprivation standardised Odds Ratio (95% CI)** [a]
Total number of morbidities			
None	558 (3.2)	729,975(52.0)	0.90 (0.10 to 0.80)
One	1.831 (10.6)	300,219 (21.4)	0.47 (0.45 to 0.50)
Two	2,555 (14.8)	160,823 (11.5)	0.77 (0.73 to 0.81)
Three	3,023 (17.5)	94,847 (6.8)	1.22 (1.77 to 1.88)
Four	2,835 (16.4)	55,726 (4.0)	1.67 (1.60 to 1.75)
Five	2,375 (13.7)	31,401 (2.2)	2.23 (2.12 to 2.34)
Six	1,707 (9.9)	16,748 (1.2)	2.75 (2.59 to 2.91)
Seven or more	2,401 (13.9)	14,732 (1.1)	4.10 (3.90 to 4.32)
Number of physical morbidities			
None	635 (3.7)	800,019 (57.0)	0.90 (0.10 to 0.80)
One	2,154 (12.5)	292,513 (20.8)	0.51 (0.49 to 0.54)
Two	2,916 (16.9)	147,369 (10.5)	0.84 (0.81 to 0.88)
Three	3,302 (19.1)	81,222 (5.8)	1.38 (1.32 to 1.44)
Four	2,947 (17.1)	43,876 (3.1)	1.97 (1.89 to 2.06)
Five	2,272 (13.1)	22,241 (1.6)	2.67 (2.54 to 2.81)
Six	1,479 (8.6)	10,261 (0.7)	3.40 (3.20 to 3.62)
Seven or more	1,580 (9.1)	6,970 (0.5)	5.10 (4.79 to 5.43)
Number of mental morbidities			
None	12,425 (71.9)	1,193,418 (84.9)	0.67 (0.65 to 0.70)
One	3,487 (20.3)	161,011 (11.5)	1.41 (1.36 to 1.47)
Two	1,172 (6.8)	42,968 (3.1)	1.35 (1.27 to 1.43)
Three or more	201 (1.2)	7,074 (0.5)	1.39 (1.19 to 1.61)

p=<0.001 unless stated

Figure 1. Prevalence and odds ratios for individual physical conditions (standardised by age, gender and deprivation score)



Key; CHD=Coronary Heart Disease; CKD=Chronic Kidney Disease; PVD= Peripheral arterial disease; IBS=Irritable bowel syndrome; IBD=Inflammatory bowel disease .

Table 3 Prevalence and odds ratios for individual mental conditions (standardised by age, gender and deprivation score)

	LVSD N (%) N=17,285	**Controls N (%)** N=1,404,471	**Age, gender and deprivation standardised Odds Ratio (95% CI)**
Anxiety & stress related	1,906 (11.0)	53,41 (3.8)	1.83 (1.73 to 1.94)
Alcohol problems	851 (4.9)	41,374 (3.0)	1.73 (1.62 to 1.86)
Depression	2,810 (16.3)	140,587 (10.1)	1.52 (1.43 to 1.56)
Learning Disability	57 (0.3)	4,950 (0.4)	1.50 (0.82 to 1.)
Dementia	562 (3.3)	10,936 (0.8)	1.45 (1.26 to 1.67)
Schizophrenia and bipolar disorder	199 (1.2)	12,237 (0.9)	1.19 (1.03 to 1.38) p=0.01
Anorexia or bulimia	58 (0.3)	5,235 (0.4)	1.04 (0.87 to 1.39) p=0.34

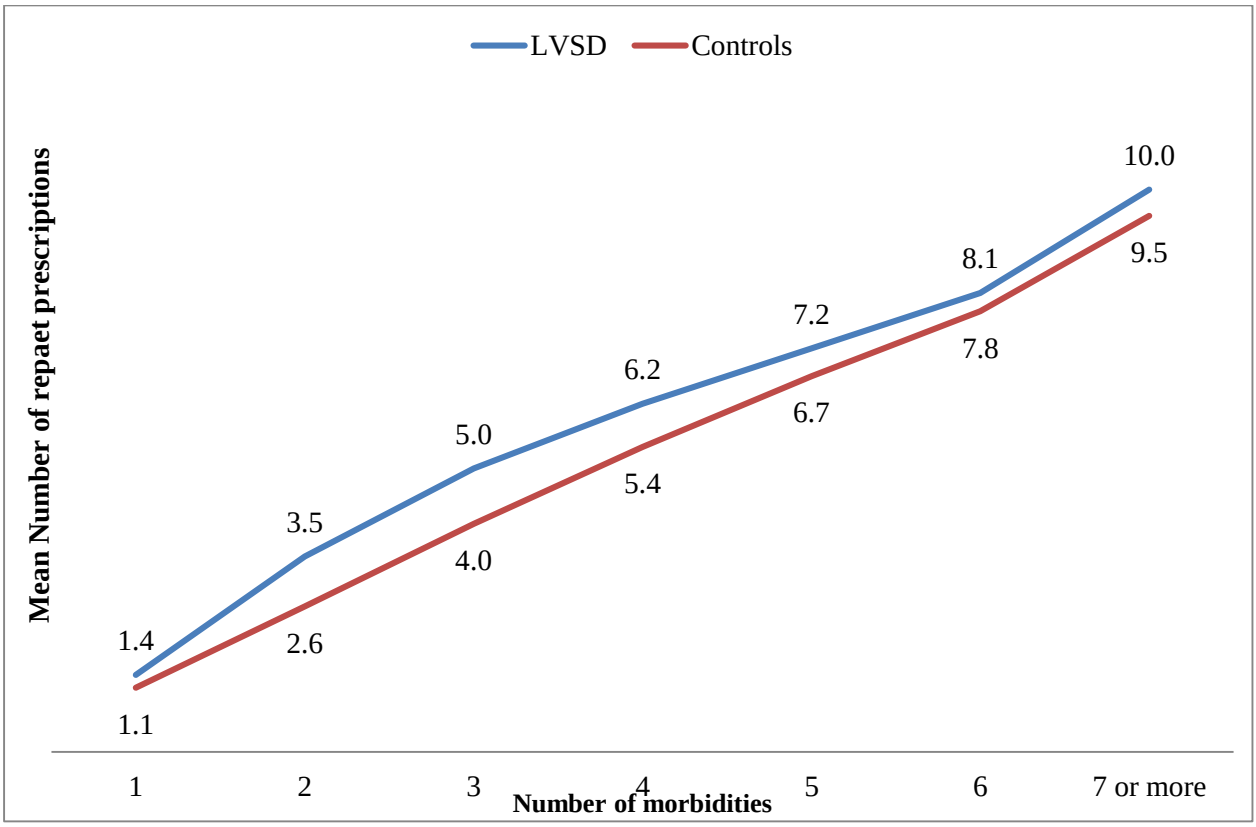
p=<0.001 unless stated

Table 4 LVSD status and number of repeat medications

Number of medications	**LVSD N (%)** N=17,285	**Controls N (%)** N=1,404,471	**Age, gender and deprivation standardised Odds Ratio (95% CI)**	**Age, gender, deprivation and morbidity count standardised Odds Ratio (95% CI)**
None	1,322 (7.7%)	864,813 (61.5%)	0.16 (0.15 to 0.18)	0.46 (0.46 to 0.52)
One or two	1,226 (7.1%)	242,533 (17.2%)	0.33 (0.31 to 0.35)	0.63 (0.59 to 0.67)
Three or four	2,251 (13.0%)	126,833 (9.0%)	0.64 (0.61 to 0.67)	0.76 (0.72 to 0.79)
Five or six	3,527 (20.4%)	80,170 (5.7%)	1.45 (1.39 to 1.51)	1.26 (1.21 to 1.32)
Seven or eight	3,470 (20.1%)	46,595 (3.3%)	2.39 (2.29 to 2.49)	1.56 (1.49 to 1.63)
Nine or ten	2,433 (14.1%)	24,322 (1.7%)	3.00 (2.85 to3.14)	1.56 (1.48 to 1.64)
Eleven or more	3,056 (17.7%)	21,827 (1.6%)	4.81 (4.60 to 5.04)	1.81 (1.72 to 1.91)

p=<0.001 unless stated

Figure 2 Mean number of repeat prescriptions by number of morbidities in patients with LVSD and controls



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