

## PATTERNS, PREDICTORS AND IMPLICATIONS OF MULTIMORBIDITY: EXPLORING THE CO-INCIDENCE OF DEPRESSION AND OTHER TYPES OF CHRONIC ILL-HEALTH

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The demographic and epidemiological transitions of the last century have resulted in ageing populations and a rising prevalence of long-term health conditions across western Europe. In the Health Survey for England 2008, 29% of men and 33% of women aged 16 years and over reported long-standing illness that limited their daily activities in some way. The burden of long-term ill-health is felt disproportionately by lower socioeconomic groups and chronic illness is associated with multiple forms of social disadvantage (Bartley *et al.*, 2004). Responding to the challenges presented by long-term ill-health is now a major policy concern across UK health and welfare policy arenas (as well as internationally).

Within this broader policy debate, the high prevalence of comorbidity or multimorbidity is receiving increased attention (Wright *et al.*, 2003). Many individuals with long-term ill-health have more than one condition simultaneously (van den Akker *et al.*, 2000). Multimorbidity complicates responses at individual, family and service-delivery level. Having more than one condition may mean complex self-care needs, multiple health-service visits and conflicting guidance, all with important potential implications for individuals and their families. From a health-service perspective multimorbidity raises issues of polypharmacy, fragmented care, difficulties in applying treatment guidelines and organisational challenges. Comorbidity may make accurate assessment and appropriate care less likely (Wang *et al.*, 2005) and may mean worse treatment outcomes than for single conditions (Fortin *et al.*, 2006). Comorbidity has also been shown to intensify health care utilization and increase medical costs (Ritzwoller *et al.*, 2006). In addition, though subject to limited investigation to-date, comorbidity is likely to present challenges for social care and welfare services. For instance, supporting individuals to maintain social roles in the face of multiple health conditions is difficult (Salway *et al.*, 2007).

The coincidence of mental and physical ill-health is of particular importance and has been widely documented (Scott *et al.*, 2008). The prevalence of depression in the general population is around 8% (Singleton and Lewis, 2003) but is two to three times more likely in people with a chronic physical condition; typically around 20% (National Collaborating Centre for Mental Health, 2009). Pathways of effect seem to operate in both directions. Chronic physical illness has been found to increase the risk of depression both directly and indirectly via aggravation of personal and financial strains (Egede *et al.*, 2002). In addition, people with mental ill-health are disproportionately more likely to develop physical health conditions (DRC, 2006), and long-term psycho-social distress appears to increase the risk of physical health problems (Wilkinson, 2005). Furthermore, the inter-linkages between mental and physical wellbeing are frequently evident in patients' own narratives (Salway *et al.*, 2007).

While few studies have examined the implications of the coincidence of mental ill-health and physical ill-health for the success of treatment/support, available evidence suggests higher costs and poorer health and social outcomes (Strik *et al.*, 2003). People with mental ill-health have been found to experience major inequities in access to other types of healthcare (DRC, 2006) and a variety of poorer health outcomes have been noted. Evidence from a range of sources points to a lack of recognition among non-psychiatric clinicians of symptoms of depression in people with chronic physical disease (Cepoiu *et al.*, 2007). The coincidence of depression has been shown to negatively impact on return to work among individuals with coronary artery disease (Soderman *et al.*, 2003), and depression has been shown to accelerate the pathway of disablement among older people (van Gool *et al.*, 2005).



Despite multimorbidity being increasingly common, most research, service design and clinical practice remains based on a single disease paradigm. There is a need for further population-based studies that: ascertain the distribution and characteristics of co- and multimorbidities in the UK context; identify the key factors associated with increased or reduced risk of co- and multimorbidity; and understand the implications of such morbidity for trajectories of service use and indicators of wellbeing. In response to this evidence gap, the project involved secondary analysis of a large health and well-being survey of Sheffield residents in order to address the following research questions:

- What are the levels and patterns of the coincidence of depression and other chronic health conditions?
- How are levels and patterns of comorbidity involving depression related to measures of social support, health-related behaviour and socioeconomic status?
- How is comorbidity involving depression related to pathways of healthcare use and longevity? Does the presence of depression increase the risk of death and/or sub-optimal service use?

### Key Findings

- Overall, 66% of the sample reported no morbidity, 21% reported one morbidity and 13% reported two or more morbidities; being categorised as 'comorbid'. Prevalence of comorbidity increased with age, particularly among men, being 24% for men and 18% for women in the 55 plus age-group.
- 7% of respondents were categorised as having depression (HAD score  $\geq 10$ ). Of these, around 65% had at least one other health condition, asthma being by far the most common co-condition.
- Rates of depression among respondents with physical conditions were much higher than overall. Respondents with chronic obstructive pulmonary disease and stroke had the highest levels of depression (over one in four).
- Overall, 5% of respondents were comorbid with depression being one of the conditions; 7% among those aged 55+.
- Comorbidity-with-depression was significantly positively associated with: age; minority ethnicity; individual and area level deprivation; smoking; and social isolation.
- Among the 55+ age-group, non-elective admissions to hospital (an indicator of sub-optimal condition management) were statistically significantly higher among those with depression compared to comparator groups without depression.
- Analyses of non-elective inpatient use and survival functions by morbidity status strongly suggest that the presence of depression contributes to poorer outcomes irrespective of chronic physical health conditions, but

that the risks are particularly high for people who are co-morbid with depression.

### Data and methods

Analyses were performed on the second Sheffield Health and Illness Prevalence Survey (SHAIPS 2) plus linked data (Coy *et al.*, 2002). Conducted in 2000, SHAIPS 2 was a cross-sectional postal survey of a stratified random sample of 10,185 Sheffield adults (with a response rate of 66%). The survey measured self-reported health using validated questions enabling seven health conditions to be identified: bronchitis, chronic obstructive pulmonary disease (COPD), asthma, depression, stroke, angina, and diabetes. The survey also included questions on the use of health and social care services, smoking status, long-term illness, social isolation, ethnicity, age, sex, car ownership, and receipt of state benefits. Survey records containing the morbidity information were linked to both area-level deprivation data (via postcodes) and NHS data (via the NHS numbers of respondents), enabling longitudinal analyses up to end of March 2009. The study was approved by Sheffield Local Research Ethics Committee in March 2009.

Initial work involved the definition and operationalisation of measures of multimorbidity and comorbidity. A number of coding decisions were taken with input from clinicians, resulting in a multimorbidity score of 0 to 8 based on the presence or absence of the seven 'core' SHAIPS 2 conditions plus cancer registrations (through data linkage). Comorbidity — a yes/no dichotomous variable — was defined as a multimorbidity score of two or more. Given our focus on the coincidence of depression and other physical morbidities, a 'multimorbidity-with-depression' score was also created that specified that one of the morbidities must be depression. A 'comorbidity-with-depression' variable was then created, which took the value '1' if the 'multimorbidity-with-depression' score was 2 or more, and the value '0' otherwise.

Following the development of these measures and the creation of suitable indicators for the independent variables of interest, descriptive analyses explored the levels and differentials in multimorbidity and comorbidity by key socio-demographic predictors. Logistic regression modelling was also used to explore the relationship between various predictor variables and comorbidity-with-depression versus comorbidity. Subsequently, extensive data processing and linkage to data on mortality and hospital admissions, as well as the tracing of SHAIPS 2 respondents over time, enabled exploration of hospital use and longevity in the years following the survey.

The study used the number of 'non-elective' admissions (also known as unplanned or emergency admissions) for Sheffield residents only as an indicator of sub-optimal condition management and service use. The first approach was to calculate a rate of non-elective admissions per person years over the period 2000-2009; this took account of any exits from the sample due to out-migration from Sheffield or death. The analysis was stratified by age and mean rates were produced by multimorbidity status. The



second approach involved logistic regression and focussed only on Sheffield residents, with the binary outcome variable being whether or not an individual respondent had had a non-elective admission during the study period.

The mortality experience of SHAIPS 2 respondents by multimorbidity status was explored using both logistic regression (outcome dead or alive by end of March 2009) and Cox regression modelling of the number of days survived during the study period.

### Patterns and predictors of multimorbidity and comorbidity

Overall, 66% of the sample reported no morbidity, while 21% reported a single morbidity and 13% reported two or more morbidities and were therefore categorised as 'comorbid'. As expected, the prevalence of comorbidity increased with age, particularly among men, being 24% for men and 18% for women in the 55+ age-group. We were particularly interested in the coincidence of depression and physical health conditions. Overall, 7% of respondents were categorised as having depression (HAD score  $\geq 10$ ) with no significant difference between men and women. Of these, around 65% had at least one other health condition, asthma being by far the most common co-condition. Looking the other way, rates of depression among respondents with physical conditions were much higher than in the sample overall. Respondents with COPD and stroke had the highest levels of depression (over a quarter of each) (Figure 1). Overall, 5% (492) of respondents had more than one health condition in which one of the conditions was depression — i.e. they were 'comorbid-with-depression'. This prevalence was 7% among those aged 55 years and over.

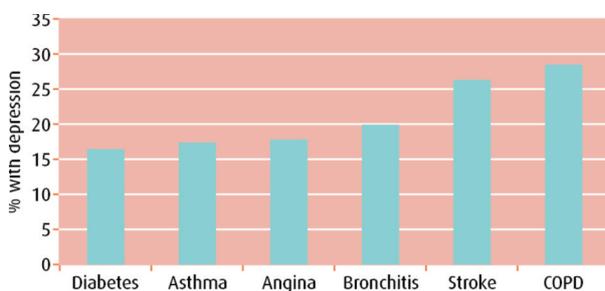


FIGURE 1. PREVALENCE OF DEPRESSION AMONG SHAIPS 2 RESPONDENTS WITH PHYSICAL HEALTH CONDITIONS

Logistic regression models were used to explore the associations between socio-demographic indicators and the odds of 'comorbidity-with-depression'. Model results indicated that age and minority ethnic status were positively associated with 'comorbidity-with-depression', but there was no relationship with sex. Smoking was also a significant predictor. Socioeconomic status, measured by both individual level and area-level deprivation indicators, was a significant predictor. The odds of 'comorbidity-with-depression' were four to five times greater in the most deprived quintile compared with the least deprived. The measure of social isolation also showed a significant,

positive association with odds of 'comorbidity-with-depression' being over 4.5 times greater in the severely socially isolated compared with those not socially isolated even having controlled for IMD quintile, smoking, age, sex and minority ethnicity (Table 1).

	N	p	Odds ratio
<b>IMD 2004 quintile</b>			
Least deprived	2,013		1.00
Below average deprivation	1,899	0.01	1.72 (1.12–2.65)
Average deprivation	1,879	<0.01	1.91 (1.25–2.91)
Above average deprivation	1,740	<0.01	3.54 (2.39–5.23)
Most deprived	1,767	<0.01	4.04 (2.74–5.94)
<b>Social isolation</b>			
None	6,106		1.00
Moderate	1,889	<0.01	2.27 (1.77–2.90)
Severe	1,303	<0.01	4.66 (3.69–5.89)

TABLE 1. ODDS OF COMORBIDITY-WITH-DEPRESSION BY INDICATORS OF SOCIOECONOMIC STATUS AND SOCIAL ISOLATION (ADJUSTED FOR AGE, SEX, ETHNICITY AND SMOKING)

Notes: Cases included in analysis: 9,298. The combined missing values from the predictor variables reduced the sample from 10,185 to 9,298.

### Implications of comorbidity-with-depression

Analyses of non-elective admissions to hospital, which were taken as an indication of sub-optimal condition management and use of health services, suggested an increased risk associated with the presence of depression.

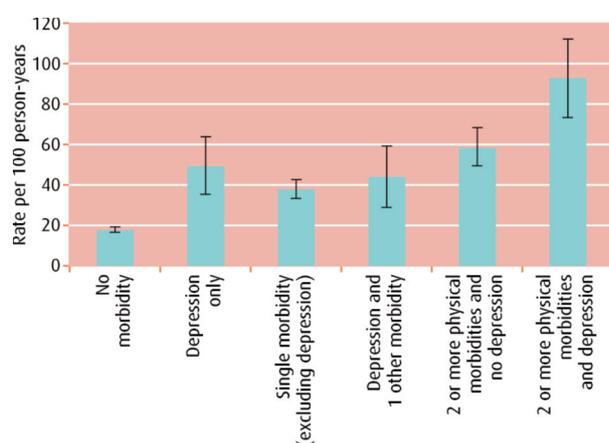
Looking first at the mean admissions by morbidity status within broad age bands, there were no significant differences among 18-34 year olds, although there was a suggestion of a trend towards higher rates for those with depression. In the 35-54 age band, those with 'depression-only' had a statistically higher admissions rate than those with 'no morbidity', although the other results were not statistically different. In the 55 plus age band (Figure 2), there was a statistically significant difference between those with 'depression-only' (mean admission rate of 49) and those with 'no morbidity' (mean admission rate of 18). Similarly, those with 'two-or-more-physical-morbidities-and-depression' had a significantly higher admission rate (93) compared with the other categories. A similar pattern emerged for all ages combined.

Logistic regression modelling of the odds of non-elective admission (yes/no during the follow-up period) for those respondents who remained resident in Sheffield showed that respondents with 'depression-only' were significantly more likely to have an admission than those with 'no morbidity'. The group having '2-or-more-physical-morbidities-and-depression' had significantly higher odds of admission than those with '2-or-more-physical-morbidities-and-no-depression' (Table 2).

Turning now to consider the survival rates of respondents who reported differing multimorbidity statuses at the time



of the survey, findings again suggest a negative impact of depression. Cox regression analysis was undertaken to identify the survival function according to morbidity status controlling for various socio-demographic factors. As shown in Figure 3, by far the worst survival function was found for those respondents with 'depression-and-2-or-more-physical-morbidities'. Even after adjustments for potential confounders this group had worse survival than the comparator group who were multimorbid but did not have depression. Respondents with 'depression only' had worse survival than those with a single physical morbidity. However, survival functions for those with 'depression-and-1-other-morbidity' were virtually identical to those with '2-or-more-physical-morbidities-and-no-depression'. Not surprisingly, those with 'no morbidity' had better survival records than the other morbidity categories.

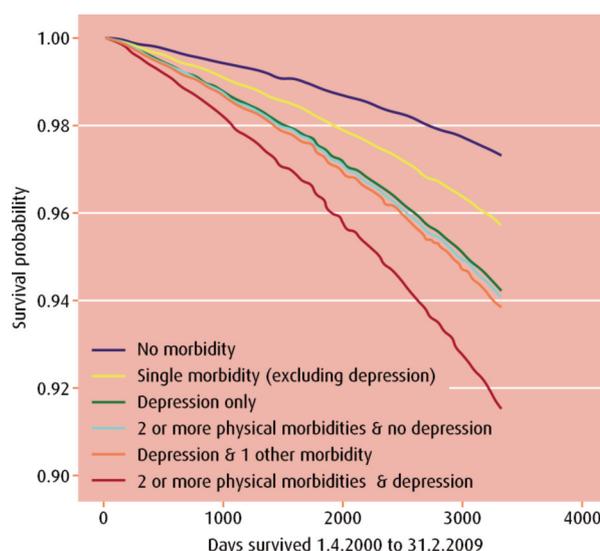


**FIGURE 2. NON-ELECTIVE HOSPITAL ADMISSIONS 2000-2009 AMONG SHAIPS 2 RESPONDENTS AGED 55+, BY MULTIMORBIDITY STATUS**  
Note: N= 4,715. Excludes admissions categorised as chronic renal failure, maternity or mental retardation. Person-years is the time a SHAIPS 2 respondent spent in Sheffield between 1.3.2000 & 31.3.2009

	N	p	Odds ratio
No morbidity	5,356		1.00
Depression only	218	<0.01	2.28 (1.72–3.02)
Single morbidity (excl. depression)	1,519	<0.01	1.82 (1.61–2.05)
Depression & 1 other morbidity	212	<0.01	2.68 (2.00–3.58)
2+ physical morbidities & no depression	665	<0.01	2.81 (2.35–3.35)
2 + physical morbidities incl. depression	220	<0.01	4.75 (3.44–6.55)

**TABLE 2. LOGISTIC REGRESSION ODDS RATIOS OF NON-ELECTIVE ADMISSION BY MULTIMORBIDITY STATUS (ADJUSTED FOR AGE, SEX, ETHNICITY, SOCIOECONOMIC STATUS AND SMOKING)**

Notes: Excludes admissions categorised as chronic renal failure, maternity, and mental retardation.



**FIGURE 3. SURVIVAL FUNCTIONS FOR SHAIPS 2 RESPONDENTS (ADJUSTED FOR AGE, SEX, ETHNICITY, IMD2004 AND SMOKING)**

### Implications for policy and practice

The findings from this project confirm high levels of comorbidity, and particularly coincidence of depression and chronic physical health conditions, among a large sample of Sheffield residents; with older age and low socioeconomic status being positively associated with such comorbidity. Our results also strongly suggest that the presence of depression contributes to non-elective inpatient use and risk of mortality irrespective of chronic physical health conditions, but that the risks are particularly high for people who are co-morbid with depression.

There are a number of limitations in using cross sectional, self-reported health measures that mean that other explanations cannot be completely ruled out, particularly the possibility of undetected morbidities or more severe physical morbidity among those with depression. Nevertheless, the findings are consistent with other recent work reported above and indicate the need to understand more about how depression may complicate care and contribute to poorer outcomes.

The findings suggest that better management of depression among people with chronic health conditions has the potential to improve the lives of individual patients and make better use of NHS resources. The results therefore imply that greater efforts should be made to diagnose and treat depression in primary care, particularly among older people and those with chronic health conditions. Though some relevant initiatives are underway in Sheffield and nationally, this project suggests the importance of expanding such work so that screening tools for depression are used routinely by a wider range of community staff; a recommendation that was endorsed by clinicians and practitioners at our Project Advisory Group meetings. More generally, the findings underscore the need for co- and multimorbidity to receive greater attention among health and social researchers.



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