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Multimorbidity within households and use of health and social care

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Abstract

Background: The daily management of long-term conditions falls primarily on individuals and informal carers, but the impact of household context on health and social care activity among people with multimorbidity is understudied.

Aim: To test whether co-residence with a multimorbid person (compared with a non-multimorbid co-resident) is associated with utilisation and cost of primary, community and secondary health care and formal social care.

Design and Setting: Linked data from health providers and local government in Barking and Dagenham for a retrospective cohort of people aged 50+ in two-person households in 2016-2018.

Methods: Two-part regression models were applied to estimate annualised use and cost of hospital, primary, community, mental health and social care by multimorbidity status of individuals and co-residents, adjusted for age, gender and deprivation. Applicability at the national level was tested using the Clinical Practice Research Datalink.

Results: Over 45% of multimorbid people in two-person households were co-resident with another multimorbid person. They were 1.14 (95% CI 1.00, 1.30) times as likely to have community care activity and 1.24 (95% CI 0.99,1.54) times as likely to have mental health care activity compared to those co-resident with a healthy person. They had more primary care visits (8.5 (95% CI 8.2,8.8) vs 7.9 (95% CI 7.7,8.2)) and higher primary care costs. Outpatient care and elective admissions did not differ. Findings in national data were similar.

Conclusions: Care utilisation for people with multimorbidity varies by household context. There may be potential for connecting health and community service input across household members.

Keywords

multiple conditions; comorbidity; social context

How this fits in

- We know that care utilisation and cost are higher for people with multiple conditions (or "multimorbidity") but not whether this association varies by health status of household co-residents.
- We found greater primary care, community care and mental health care activity where a multimorbid person was co-resident with another person with multimorbidity.
- This affirms the need to identify and support informal carers.
- The potential to improve how health and care services are connected across people within a household should be considered.

Introduction

Meeting the needs of people with multiple long-term conditions (multimorbidity) is a key challenge facing health and social care systems. In the UK, 23-27% of people (depending on the conditions included) have two or more conditions and their care needs account for over 50% of primary and secondary care costs and a substantial portion of community and social care costs.(1) (2) (3) Trials of initiatives to improve outcomes and reduce hospital or emergency care use of those with multimorbidity have not shown success, at least in the short term.(4) (5) Initiatives have focused on providing patient-centred care for people with multimorbidity(6) but if we are to reduce elements of care use and costs then we need more research on their drivers.

The potential for considering the household context in the management of ongoing conditions has so far received little attention.

The daily responsibility for managing their conditions usually falls primarily on the individuals themselves and on their informal carers. Around half of carers in England provide care for someone in the same household.(7) However, studies of the household context and its impact on service use and cost among people with multimorbidity have focused on household size(8) and not household members' health status. Co-residents are at increased risk of having long-term conditions (9) (10) because of shared lifestyle (11), social risk factors and the tendency to select a similar partner. Co-resident's illness may make it more difficult for them to provide practical, financial or emotional support.

This study examined whether co-residence with another multimorbid person (compared with a non-multimorbid co-resident) is associated with higher use and cost of primary, community and secondary health care and formal social care. Difficulty in identifying households within electronic health records (EHRs) likely contributes to the lack of research in this area. To address this, we used a local sample of EHRs linked to household composition data from local authority records and replicated the analysis in a national study where co-residence was inferred from anonymised address data.

Methods

The study included people aged 50 and over in two-person households. Multimorbidity prevalence rises with age and the combination of conditions also

varies with age, with mental and physical comorbidities being more prevalent at younger ages (1). Our study therefore focuses in middle and older age, when people may be experiencing changes in health and functioning. People in households with three or more occupants were excluded to remove institutions or situations where there could be multiple people providing help.

Main analytical sample - Barking & Dagenham

Linked information from local government services, health providers and health commissioners includes sociodemographic, health and household information alongside activity data for five care settings (primary care, hospital, community, inpatient and outpatient mental health services, and social care). Residents of Barking and Dagenham, a borough in Outer London, from 1st April 2016 to 31st March 2018 were included. Those who moved out of Barking and Dagenham or who died before the 1st April 2018 were excluded, given the known increase in health care utilisation at the end of life(12). Household composition was derived using the unique property reference number in local government records. The analytical sample was 9,222 individuals in 4,611 two-person households.

Measuring multimorbidity

We included long-term conditions associated with higher treatment needs, poorer quality of life or greater risk of premature death.(1) (13) (14) Sixteen long-term mental and physical health conditions were identified from diagnosis codes recorded in primary care (Supplementary Table 1). People with 2+ conditions were classified as “multimorbid” and those with 0-1 condition as “healthy”. Individuals were assigned to one of four categories: multimorbid person co-resident with healthy person

("MM/healthy" - the reference group); multimorbid person co-resident with another multimorbid person ("MM/MM"); healthy person co-resident with healthy person ("healthy/healthy"); healthy person co-resident with multimorbid person ("healthy/MM").

Health and social care activity and cost

We examined the following health and social care activity and cost outcomes over two years: number and cost of primary care consultations with a general practitioner (GP), nurse or other clinical staff; days in hospital and cost of hospital care (broken down into outpatient consultations, elective admissions, non-elective admissions, and emergency department attendances); cost of mental health inpatient and outpatient care; cost of community health services; and cost of local government funded social care.

Local unit level costs were used for community and mental health activity and social care services. All other costs were based on activity using national reference costs for the relevant year. Mean cost for the relevant activity was used where an activity code could not be matched to a national reference cost. Costs were indexed to 2018 prices. See Supplementary Table 2 for more detail on the costing method.

Statistical analysis

The distributions of care costs and days in hospital show a substantial proportion of people having zero activity. We used two-part mixture models to account for their semi-continuous distributions. The first part used a logistic model to estimate the likelihood of having any versus no care. The second part used a gamma model to

estimate the cost or utilisation among the subset where this was non-zero. Gender, age group, deprivation (Index of Multiple Deprivation quintile for the patient's residence), and multimorbidity status were included as covariates for both parts. We also estimated mean costs and activity across both parts of the model combined. Individual level analysis with robust standard errors allowed for the non-independence of individuals within households.

Replication in a national sample

Nationally representative data were obtained from the Clinical Practice Research Datalink (CPRD; approved protocol ISAC17_150RMn2). CPRD comprises de-identified records of over 14 million patients (15) linked to Hospital Episode Statistics for consenting practices in England. Individuals registered in up-to-standard practices from 1st April 2014 to 31st March 2016 were included.

The CPRD pseudonymised family number (based on the first line of the patient's address) was used to select a sample where exactly two patients shared a family identifier and were registered within one year of each other. This households where members are not registered at the same GP practice. From an initial random sample of 300,000 children and adults with linked HES data, 10,528 met inclusion criteria and formed the analytical sample for this study.

The presence of 36 mental and physical health conditions recorded in primary care(16) was determined on 1st April 2014 based on diagnosis (using Read codes) and prescribing data (Supplementary Table 3). There is considerable overlap with the 16 broader groups of long-term conditions included in the main analysis. GP and

hospital care activity and costs were calculated using the same approach but mental health care, community health care and social care data were not available.

Results

Sample description: main sample

Multimorbidity prevalence was 43% for over 50s living in two-person households in Barking and Dagenham. Forty-eight per cent of multimorbid people lived with another multimorbid person (Table 1). Older people and those in deprived areas were over-represented in households with two multimorbid residents.

Over 97% of people had at least one primary care consultation, but over 30% had no outpatient attendance, 80% had no emergency department attendance and over 80% had no inpatient admission (Supplementary Table 4).

Model results: main sample

The association between each person's household multimorbidity status and the likelihood of having any care activity is shown in Table 2 (see column labelled "OR for any activity"). We focus on differences between a multimorbid person co-resident with a multimorbid versus healthy person. Controlling for gender, age, and socioeconomic deprivation, the "Both MM" group were 1.14 (95% CI 1.00, 1.30) times as likely to have any community care activity. In addition, the "Both MM" group were 1.24 (95% CI 0.99, 1.54) times as likely to have any mental health care activity, and 1.24 (95% CI 0.96, 1.59) times as likely to have any social care activity as the "MM/healthy" reference group.

For those with any activity, exponentiated gamma coefficients show the association between household multimorbidity status and level of care activity or cost. The coefficient of 1.08 (95% CI 1.03, 1.12) for primary care visits shows the number of visits for the “Both MM” group was 8% (95% CI 3% to 12%) higher than the reference group. A similar difference in cost of primary care visits was seen. There was no evidence of difference in costs between these groups for other outcomes.

The adjusted means combine estimates from both parts of the model, including those with and without the relevant activity. Adjusted mean annual primary care costs and number of visits were higher for the “Both MM” group than the reference. Community care costs for the “Both MM” group were also higher (£559 versus £428), as were mental health care costs (£543 versus £318) though confidence intervals overlapped (Figure 1).

Although not the focus of this study, those who were not multimorbid (in the “Both healthy” or the “Healthy/MM” group) were less likely to have any activity than the reference group and had lower adjusted mean costs for all types of care.

Replication in the national sample

The national sample was younger than the main sample (32% vs 25% aged 50-59) and less socioeconomically deprived (Table 1). Multimorbidity prevalence was 48% in the national sample and 58% of multimorbid people were co-resident with another multimorbid person. The “Both MM” group were more likely to have a non-elective hospital admission (OR 1.19 (95% 1.02,1.39)) or elective admission and somewhat

more likely to have any emergency department visit (OR 1.11 (95% 0.98,1.26)) compared with the reference group.

In the subset with non-zero cost or activity, primary care costs were 13% (95% CI 7%, 19%) higher in the "Both MM" group compared with the reference, and the "Both MM" group also had more primary care visits. There was a suggestion of higher emergency department costs (exponentiated gamma coefficient 1.11 (95% CI 0.99,1.25, p=0·06)) with no evidence of difference in costs between these groups for other outcomes

As in the local sample, combined estimates across both parts of the model showed significantly higher adjusted primary care costs and number of visits for the "Both MM" group (10.5 visits) than the reference (9.6 visits).

Discussion

Summary

This study shows that the household context matters for the care use of people with multimorbidity, independently of age, gender and area deprivation. Evidence from one local and one national sample showed higher primary care costs and visits for multimorbid people co-resident with another multimorbid person compared with a healthy one. Where data were available (in the local sample only), these showed a greater likelihood of using community care activity and a trend towards greater likelihood of using mental health care where a multimorbid person was co-resident with another. Differences in secondary care according to co-resident's multimorbidity status were inconsistent in direction in the local and national datasets, although both

showed a trend to slightly higher ED costs for multimorbid people co-resident with another multimorbid person.

Strengths and limitations

Two-part models were used to model cost and utilisation outcomes. Outcomes were based on electronic health records and not subject to recall or reporting bias. Two large samples were used to test our hypothesis, with similar proportions of own and co-resident multimorbidity. We were able to replicate the findings in a national sample for primary care. This provides reassurance that the pseudonymised variable based on the first line of the patient's last known address in combination with current registration date is a reasonable approach to identifying two-person households in primary care records.

While novel data linkage allowed us to examine mental health, community and social care in Barking and Dagenham, these data are not available nationally. Replication in other local sites is needed to assess whether higher levels of community and mental health care use where both people in a two-person household are multimorbid are seen in other contexts.

We could not distinguish partners from other types of co-resident as partnership status is infrequently recorded in EHRs.(17) The influence of a partner may be different from that of a non-intimate co-resident although short-term co-residents are probably rare among the over fifties. Neither could we identify informal caregivers because this also is not well recorded in administrative records. In this study, less than 5% had a Read code relating to caring whereas the 2011 census found over

17% of people aged 50 and over in England were providing informal care for someone with a long-term physical or mental health condition or disability.(18)

We did not consider the number or severity of conditions or acquisition of new conditions through follow-up, although our adjustment for age and socioeconomic deprivation may partly capture this. Different lists of conditions were used to derive multimorbidity in the two datasets, but there was considerable overlap and the main comparison of interest for this study was within-dataset differences between the "Both MM" and reference groups. These findings should not be extrapolated to younger households, though household health context has previously been associated with children's healthcare use.(19)

Comparison with existing literature

Though unobserved confounding cannot be excluded, there are three substantive mechanisms that could underlie observed associations. These are tentative and were not directly tested in this study. First, a co-resident with multimorbidity may have less capacity to provide informal support than a healthy co-resident. Lack of informal support has sometimes been associated with greater health care utilisation(20). The substitution of informal and formal care may depend on the specific type of health care utilisation. A study based in the US found evidence of substitution for home health, nursing home care, and physician visits but not for secondary care (21). Community care investigated in our study could be considered broadly equivalent to home health care in the US, in which case our finding that community care and primary care costs varied according to co-resident's health status but hospital costs did not show alignment with the US study if co-resident's

health status is an indicator of informal support provision. Researchers have proposed that informal care and hospital care are different products so substitution of one for the other would not be expected (21).

A second plausible explanation is that a co-resident living with multimorbidity has more information about available health services based on the management of their own long-term conditions than one who is not multimorbid. There is evidence that caregivers can act as advocate in ways that increase some types of care use, by helping a patient overcome denial about their need for care or being more proactive in seeking help(21), though it is not known whether this advocacy role depends on the caregiver's health status.

A third possible explanation is that the multimorbid person may be providing care for their multimorbid co-resident. Caregiving can be a stressful experience with negative health consequences, especially in the context of low levels of formal care,(22) and this could contribute to increased use of health care although carers have reported greater difficulty accessing primary care compared with non-carers(23) and may avoid treatment because of their caring responsibilities.(24) This third explanation is supported by our data showing that a healthy person co-resident with a multimorbid person also had higher primary care costs and more primary care visits than their counterparts co-resident with a healthy person.

Implications for research and practice

The largest cost differences between a multimorbid person co-resident with a healthy person and one co-resident with another multimorbid person were for community

care and mental health care. However, most people did not have any activity for these services and consequently, confidence intervals were wide. It was not possible to replicate this in CPRD and this highlights the need for programmes to facilitate national linkage of primary, secondary, community and social care.(25)

Our findings raise questions about how to deliver health and social care that acknowledges the household context for people with multimorbidity. This could include more systematic use of information about the health status of patients and their co-residents for efficient scheduling of community care for people with multiple long-term conditions, potentially reducing the total number of visits to a household that would be needed and enabling community care practitioners to increase the amount of time spent with patients in their home. It could also include developing health care initiatives to households based on the principles of the group care approach.(26) In group consultations, multiple patients see one or more clinicians together. This combines features of the clinician-patient consultation with features of patient support groups (27) and has the potential to increase available consultations and peer support. If this is to be achieved, then household context data will need to be made available to service providers within integrated care systems. This will require information governance standards to be upheld whilst at the same time ensuring household data can be shared for patient and public benefit.

The findings re-affirm the importance of identifying and supporting those who receive and/or provide informal care. Though we were not able to examine carer status, the high level of multimorbidity within households (around 50% of multimorbid patients in these samples are living with another multimorbid person) suggests that some carers

may be managing complex care for themselves and their care recipients. The long-term plan for the NHS(28) and other government initiatives(29) commit to better identifying and supporting carers and our study suggests this has the potential to benefit people living with multimorbidity as both givers and recipients of informal care.

The number of people with multimorbidity is rising and our study suggests that multimorbidity may cluster in households. These trends potentially impact on care systems, notably primary care and community care, and treatment burden for patients. In addition to preventive measures to modify risk factors that are common within households,(30) research is needed to test whether connecting service input across household members could lead to efficiency savings for health and care service providers or reduce treatment burden for those living with multimorbidity.

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Conflicting interests

The authors declare that there is no conflict of interest.

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Table 1. Description of the study samples i) primary sample from Barking and Dagenham, ii) national sample from Clinical Practice Research Datalink

	MM / healthy co-resident		Both MM		Healthy / MM co-resident		Both healthy		All participants	
	n	%	n	%	n	%	n	%	n	%
B & D sample	2049	22.2	1884	20.4	3240	35.1	2049	22.2	9222	
Age										
50-59	337	14.4	205	8.8	1240	53.1	554	23.7	2336	25.3
60-69	620	20.9	566	19.1	1124	37.9	655	22.1	2,965	32.2
70-79	644	26.0	663	26.8	595	24.0	575	23.2	2477	26.9
80+	448	31.0	450	31.2	281	19.5	265	18.4	1444	16.7
Gender										
Male	1044	22.7	928	20.1	1640	35.6	997	21.6	4609	50.0
Female	1005	21.8	956	20.7	1600	34.7	1052	22.8	4613	50.0
IMD quintile										
1 (least deprived)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3	192	21.7	163	18.4	339	38.3	192	21.7	886	9.6
4	768	22.5	617	18.1	1263	37.0	770	22.5	3418	37.1
5 (most deprived)	1089	22.1	1104	22.4	1638	33.3	1087	22.1	4918	53.3
Carer code present	134	6.5	158	8.4	81	2.5	56	2.7	429	4.7
CPRD sample	2107	20.0	2940	27.9	3374	32.0	2107	20.0	10528	
Age										
50-59	530	15.8	372	11.1	1770	52.7	687	20.5	3359	31.9
60-69	791	21.4	915	24.7	1179	31.9	817	22.1	3702	35.2
70-79	568	22.8	1081	43.3	377	15.1	471	18.9	2497	23.7
80+	218	22.5	572	59.0	48	5.0	132	13.6	970	9.2
Gender										
Male	1171	22.3	1464	27.8	1697	32.3	928	17.6	5260	50.0

Female	936	17.8	1476	28.0	1677	31.8	1179	22.4	5268	50.0
IMD quintile										
1 (least deprived)	728	20.0	871	24.0	1306	35.9	729	20.1	3634	34.5
2	491	19.8	674	27.1	825	33.2	496	20.0	2586	24.6
3	426	20.2	598	28.3	662	31.4	425	20.1	2111	20.1
4	302	19.9	510	33.6	410	27.0	296	19.5	1518	14.4
5 (most deprived)	160	20.5	287	36.8	171	22.0	161	20.7	779	7.4
Carer code present	48	2.3	197	6.7	48	1.4	81	3.8	374	3.6

Table 2. Two-part models for health and social care activity: Barking and Dagenham sample of N=9222 people age 50+ in two-person households

	OR for any activity	95% LL	95% UL	Exp gamma coefficient (in the subset with any activity)	95% LL	95% UL	Adjusted means across both parts	95% LL	95% UL
Number of primary care visits									
MM / healthy	Reference			Reference			7·9	7.7	8.2
Both MM	0.44	0.17	1.11	1.08	1.03	1.12	8·5	8.2	8.8
Both healthy	0.12	0.06	0.27	0.62	0.60	0.65	4·8	4.7	4.9
Healthy / MM	0.13	0.06	0.30	0.66	0.64	0.69	5·1	5.0	5.3
Primary care costs									
MM / healthy	Reference			Reference			£198	£192	£205
Both MM	0.44	0.17	1.11	1.08	1.03	1.13	£213	£205	£220
Both healthy	0.12	0.06	0.27	0.64	0.62	0.67	£124	£121	£128
Healthy / MM	0.13	0.06	0.30	0.69	0.66	0.72	£134	£130	£138
Outpatient costs									
MM / healthy	Reference			Reference			£312	£294	£330
Both MM	1.03	0.89	1.19	0.93	0.86	1.00	£293	£275	£311
Both healthy	0.50	0.44	0.56	0.71	0.66	0.76	£172	£162	£182
Healthy / MM	0.51	0.45	0.58	0.73	0.68	0.79	£181	£168	£193
Cost of non-elective admissions									
MM / healthy	Reference			Reference			£609	£532	£686
Both MM	1.01	0.87	1.17	0.99	0.85	1.14	£606	£527	£684
Both healthy	0.45	0.39	0.53	0.76	0.64	0.90	£247	£205	£288
Healthy / MM	0.42	0.35	0.50	0.63	0.53	0.76	£192	£154	£230
Cost of elective admissions									
MM / healthy	Reference			Reference			£443	£396	£491
Both MM	1.05	0.92	1.20	1.00	0.88	1.14	£459	£409	£509
Both healthy	0.57	0.51	0.65	0.91	0.80	1.03	£273	£244	£303

Healthy / MM	0.64	0.56	0.73	0.86	0.75	0.98	£281	£245	£316
ED costs									
MM / healthy	Reference			Reference			£84	£76	£92
Both MM	1.08	0.95	1.23	1.04	0.93	1.16	£91	£82	£99
Both healthy	0.53	0.47	0.60	0.76	0.67	0.85	£43	£38	£47
Healthy / MM	0.52	0.45	0.59	0.78	0.68	0.88	£43	£38	£48
Total hospital costs (outpatient + admissions + ED)									
MM / healthy	Reference			Reference			£1454	£1338	£1570
Both MM	1.06	0.91	1.24	0.99	0.89	1.11	£1458	£1338	£1578
Both healthy	0.49	0.43	0.56	0.62	0.56	0.69	£743	£685	£800
Healthy / MM	0.47	0.41	0.54	0.59	0.53	0.67	£701	£636	£766
Number of days in hospital									
MM / healthy	Reference			Reference			1·58	1.33	1.83
Both MM	0.97	0.84	1.12	0.98	0.80	1.20	1·53	1.28	1.77
Both healthy	0.43	0.37	0.50	0.80	0.63	1.00	0·65	0.51	0.78
Healthy / MM	0.42	0.35	0.50	0.67	0.52	0.87	0·54	0.41	0.67
Community care costs									
MM / healthy	Reference			Reference			£428	£358	£498
Both MM	1.14	1.00	1.30	1.20	0.97	1.49	£559	£468	£650
Both healthy	0.37	0.32	0.43	0.69	0.54	0.89	£141	£111	£171
Healthy / MM	0.36	0.31	0.42	0.51	0.39	0.68	£103	£77	£128
Mental health costs									
MM / healthy	Reference			Reference			£318	£155	£482
Both MM	1.24	0.99	1.54	1.41	0.73	2.71	£543	£281	£795
Both healthy	0.37	0.28	0.50	1.01	0.43	2.40	£127	£31	£224
Healthy / MM	0.40	0.30	0.54	0.76	0.30	1.92	£103	£19	£186
Social care costs									
MM / healthy	Reference			Reference			£439	£320	£559
Both MM	1.24	0.96	1.59	0.86	0.66	1.13	£461	£347	£575
Both healthy	0.29	0.20	0.43	0.58	0.38	0.88	£80	£42	£118
Healthy / MM	0.27	0.18	0.41	0.51	0.32	0.81	£64	£28	£99

Table 3. Two-part models for health care activity: CPRD sample of N=10528 people age 50+ in two-person households

	OR for any activity	95% LL	95% UL	Exp gamma coefficient (in the subset with any activity)	95% LL	95% UL	Adjusted means across both parts	95% LL	95% UL
Number of primary care visits									
MM / healthy	Reference			Reference			9.6	9.2	9.9
Both MM	1.31	0.67	2.56	1.09	1.03	1.15	10.5	10.1	10.8
Both healthy	0.09	0.06	0.14	0.49	0.47	0.52	4.3	4.2	4.5
Healthy / MM	0.12	0.08	0.19	0.56	0.53	0.59	5.0	4.8	5.2
Primary care costs									
MM / healthy	Reference			Reference			£247	£237	£258
Both MM	1.31	0.67	2.56	1.13	1.07	1.19	£280	£269	£290
Both healthy	0.09	0.06	0.14	0.52	0.49	0.55	£117	£112	£123
Healthy / MM	0.12	0.08	0.19	0.55	0.52	0.59	£128	£122	£134
Outpatient costs									
MM / healthy	Reference			Reference			£483	£443	£523
Both MM	1.09	0.95	1.25	1.01	0.92	1.11	£498	£468	£528
Both healthy	0.35	0.31	0.39	0.69	0.60	0.79	£222	£194	£250
Healthy / MM	0.41	0.37	0.47	0.68	0.58	0.79	£239	£207	£271
Cost of non-elective admissions									
MM / healthy	Reference			Reference			£294	£244	£345
Both MM	1.19	1.02	1.39	1.04	0.87	1.24	£351	£302	£401
Both healthy	0.40	0.33	0.49	0.84	0.66	1.08	£111	£84	£139
Healthy / MM	0.47	0.38	0.57	0.85	0.68	1.05	£128	£99	£157
Cost of elective admissions									
MM / healthy	Reference			Reference			£599	£525	£673
Both MM	1.16	1.03	1.31	0.89	0.79	0.99	£587	£528	£645
Both healthy	0.50	0.43	0.57	0.72	0.63	0.82	£255	£218	£292
Healthy / MM	0.54	0.47	0.62	0.70	0.62	0.79	£266	£224	£307

ED costs									
MM / healthy	Reference			Reference			£69	£62	£76
Both MM	1.11	0.98	1.26	1.11	0.99	1.25	£82	£74	£89
Both healthy	0.53	0.47	0.61	0.76	0.67	0.87	£33	£29	£37
Healthy / MM	0.56	0.49	0.64	0.73	0.65	0.81	£33	£29	£36
Total hospital costs (outpatient + admissions + ED)									
MM / healthy	Reference			Reference			£1445	£1314	£1576
Both MM	1.10	0.94	1.29	1.03	0.93	1.15	£1525	£1418	£1630
Both healthy	0.33	0.29	0.38	0.62	0.54	0.71	£631	£558	£703
Healthy / MM	0.38	0.34	0.44	0.45	0.39	0.52	£664	£589	£739
Number of days in hospital									
MM / healthy	Reference			Reference			0.91	0.72	1.11
Both MM	1.08	0.94	1.24	0.89	0.70	1.12	0.86	0.73	0.99
Both healthy	0.36	0.30	0.43	0.83	0.61	1.12	0.31	0.23	0.40
Healthy / MM	0.42	0.35	0.51	0.66	0.50	0.86	0.29	0.22	0.36

Figure 1. Cost of care by household multimorbidity status