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A descriptive analysis of health care use by high-cost, high-need patients in England

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The Health Foundation

This working paper was produced as part of a research project to better understand the characteristics and health care utilisation of high-cost populations across seven countries. The results of the international study are available here:

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Abstract

Funding increases for the NHS in England have been less than historical norms since 2010, resulting in pressures across the health service. Despite this, there has been little research to understand the distribution and concentration of health care costs across the population. Identifying 'high-cost, high-need users' and examining the way in which they use health care services might help to find initiatives to reduce costs or to improve efficiency.

In this working paper, we have identified the top 5% of users of primary and secondary care services by cost, using a large nationally representative sample from an administrative dataset. We analysed administrative data for 299,497 patients in 2014/15 from the Clinical Practice Research Datalink (CPRD) linked to Hospital Episode Statistics (HES). Costs were estimated from utilisation activity across different care settings, alongside GP-prescribed drug therapy in primary care. Costs were analysed for the top 5% ('high-cost, high-need patients') and bottom 95% ('all other patients'), as well as by age, gender, deprivation and multimorbidity. Sensitivity analysis excluded patients who had died during the year.

Mean annual costs per patient were over 20 times higher in high-cost, high-need patients compared with all other patients (£9,789 vs £487). This meant that more money was spent overall for the top 5% of patients (£147m) than all other patients (£139m). While most of the difference was attributable to inpatient costs, the high-cost, high-need group had higher attendances across all settings and higher prescriptions. The high-cost, high-need group was older and suffered from a higher-level morbidity, with 55.9% of the group having more than three conditions. Excluding patients who died during the period did not significantly alter the study findings.

The key contribution of this paper is the analysis of the distribution of both primary and secondary health care costs in England. The design, delivery and management of high-cost, high-need patients has important implications for overall health system costs. Interventions that focus on better managing these patients in primary care and the community, reducing the need for unplanned and costly hospital admissions, could help reduce costs and improve the quality of care. However, further work is needed to understand the extent to which these costs (particularly those from in inpatient hospital settings) are avoidable and how strategies and interventions might be used to sustainably manage these costs, as well as to understand the role of system partners such as social care. This analysis is limited to primary and secondary costs and it does not incorporate all costs associated with health care in England.

Contents

Introduction

Between 1997 and 2010, medical spending per capita doubled in real terms in England.[1] Comparatively, the years since 2010 have been characterised by significantly lower increases in health care spending and a rising demand for services. Since 2010, health spending grew by 1.2% per year in real terms, far less than the long-term average of approximately 4% per year.[2] Although an increase in health spending has recently been announced[3], the consequences of a prolonged period of low increases have already been felt across the health service. While these funding increases have remained consistent, they have not been large enough to keep up with the rising use of health care services. Emergency department attendances grew by 13%, while emergency admissions rose by 42% over the 12 years from 2006, both outstripping population growth of 9%.[4]

There are numerous studies examining the overall NHS finances and health care funding in England[5–7], as well as extensive research into the inequities and inequalities of health service use in England.[8–10] A number of studies examine the distribution and concentration of health care spending in secondary care services in England. Results from these studies suggest that hospital expenditure is concentrated in a small section of the population and that spending is concentrated in individuals with multiple long-term conditions.[1,11] Internationally, hospital costs are also highly concentrated; with the top 10% of patients accounting for between 50% and 80% of hospital costs.[12] However, there is limited research analysing the distribution and concentration of health care spending across both primary and secondary care in England.

This working paper describes the methodology used to cost both primary and secondary care data and to identify high-cost, high need users of NHS health care services in England using a sample of patients from the CPRD. Overall results examining the concentration of spending in the NHS in England are presented. The distribution of health care spending is pertinent given the funding pressures it is facing and understanding the distribution of spending can help identify areas where efforts could be made to reduce costs or improve efficiency.[1,13] Furthermore, it is hoped that other researchers will find this costing methodology useful.

Methods

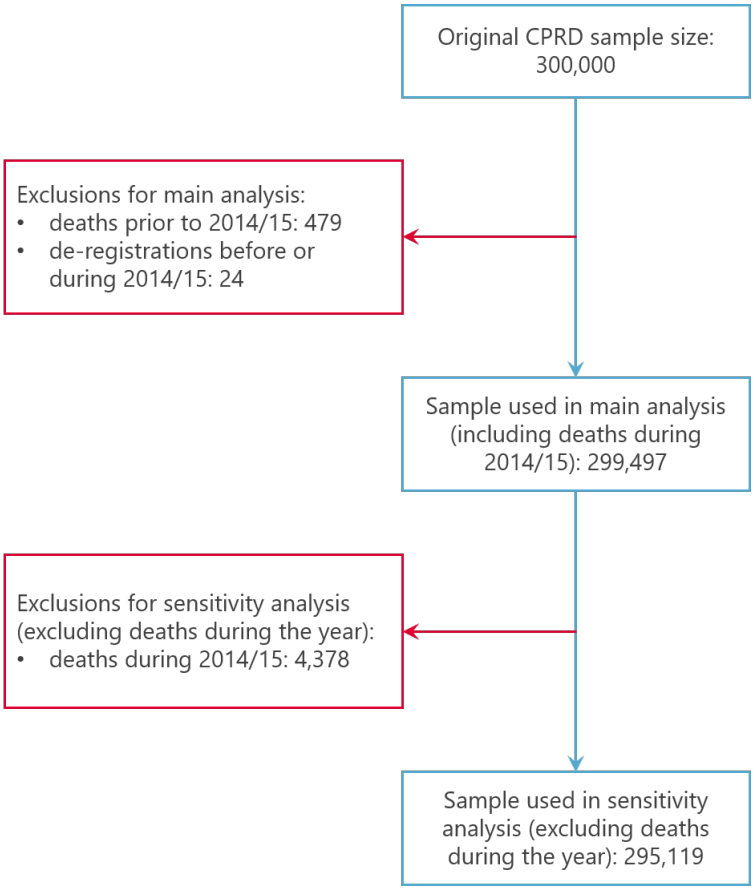
Dataset

This study makes use of anonymised administrative data from a sample of patients from the CPRD linked to HES. CPRD is a managed, ongoing research dataset comprised of administrative and linked data from a number of primary care practices in the UK.[14] Previous research has demonstrated that it is representative of England's population in terms of age, sex and ethnicity.[15]

A random sample of 300,000 patients was taken from the pool of CPRD patients registered in England in 2014/15 and their administrative records were analysed. The dataset included linked data on the deprivation of patients' registered home localities in 2015, based on the Index of Multiple Deprivation (IMD), and data on registered deaths from the Office for National Statistics (ONS).[16] The data analysed in this study included records of consultations, clinical findings and prescribed drug therapies (referred to as GP-prescribed drug therapies) from primary care practices, and linked data from HES on the use of inpatient, emergency department, and outpatient services.

Inclusions and exclusions

Figure 1: Sample flow diagram



The sample for this study and exclusions are illustrated in Figure 1. Patients who were deregistered from the CPRD practices during or prior to a particular year were excluded from analyses relating to that year. Any patients who died prior to the start of the analysis period were also excluded. No exclusions were made for deaths during the analysis period; any patient who died during the year was included in that year of analysis but excluded from future years. The original CPRD dataset had a sample size of 300,000 patients. After excluding patients who deregistered and died prior to the analysis period, there was a total of 299,497 patients in the sample.

In the sensitivity analysis, patients who died during the year were excluded from the analysis. After excluding all deaths during the year, there was a total of 295,199 patients in the sample.

Death status was available from both the practice and the ONS death register. Due to discrepancies across these two sources, patients registered as dead in either data source were regarded as having died.

Estimating health care utilisation and costs

Primary care

The number of consultations was used as the main measure of primary care utilisation. Practice consultations, consultations involving a visit, and telephone consultations were included. Only consultations relating to specific GP, nurse and other clinician role codes were included. A complete list of the consultation codes and roles included in the analysis is available in Appendix 1.

Primary care costs were calculated by multiplying the amount of time recorded against the included consultations by the 2015 unit cost figures from the Personal Social Services Research Unit (PSSRU).[17] In some cases, the time recorded against consultations was either zero minutes, or greater than one hour. In these cases, the minimum time for a consultation was amended to 30 seconds, and the maximum to one hour.[18] The unit cost used for GP consultations was £3.80 per minute and the unit cost used for nurse or other clinician consultations was 93.3p per minute.[17] Only consultations that could be costed using the described approach were included in the measure of utilisation.

The proportion of consultation records not counted or costed was 10.1%. These consultations generally comprised administrative tasks and roles, rather than patient contacts.

GP-prescribed drug therapy

Three measures of utilisation for GP-prescribed drug therapies were used: the number of CPRD therapy records, drugs (based on the 'drug substance' field from the CPRD 'Product' table), and distinct British National Formulary (BNF) chapters of the drug therapies.

Primary care drug therapy records were linked to cost data sourced from the NHS Business Services Authority Dictionary of medicines and devices (dm+d).[19] These costs are available at the level of virtual medicinal product pack (VMPP) codes. The primary care data was available in a combination of virtual and actual medicinal product (VMP, AMP) codes, with a separate quantity variable indicating, for example, the number of pills or volume of product. In order to cost the GP-prescribed drug therapy records, the average cost per unit quantity was derived for the various therapies using the dm+d at the level of VMPP codes. These costs were then merged onto the related VMP and AMP codes in the primary care data and multiplied by the quantities prescribed.

During the mapping process, 3.6% of VMP/AMP codes were not found in the dm+d reference lists of products. Furthermore, not all products had prices associated with them in the dm+d. As a result, 15.5% of therapy records were not costed.

Emergency department care

The number of emergency department (ED) attendances was used as the main measure of ED utilisation. Only ED attendances that could be costed using the following approach were included in the measure of utilisation.

HRG4+ Reference Costs Groupers were used to identify a reference cost Healthcare Resource Group (HRG) code for each attendance, using the relevant grouper.[20] The NHS Improvement Reference Costs were used to cost each attendance for each year.[21] The cost for each attendance varied depending on the type of emergency department (consultant-led emergency departments; consultant-led mono-specialty services; other types of minor injury departments; and NHS walk-in centres), whether the patient was admitted or not, and whether they arrived at the emergency department by ambulance.

The proportion of ED attendances that could not be grouped using the HRG grouper was 4.9%. Due to errors in other fields required for costing using the reference costs, the final proportion of ED attendances not counted or costed was 5.0%.

Inpatient care

Inpatient admissions were used as the main measure of inpatient care utilisation and the number of bed days as a secondary measure of inpatient utilisation. Admissions that could be not be costed using the following approach were not included in the measure of utilisation. Inpatient admissions were broken down into three types of admission (elective; emergency; and all other admissions, which included day cases, maternity, and regular admissions).

HRG4+ Reference Costs Groupers were used to identify both the main and up to 10 unbundled (where applicable) reference cost HRG codes for each spell (and associated episodes, procedures, diagnoses, critical care days, and specialist palliative care days), using the relevant grouper.[20] No adjustment was made for level of neonatal care or rehabilitation days. Likewise, no adjustment was made for the provider-level market forces factor.[22]

The NHS Improvement Reference Costs for each year were then used to cost each spell based on the type of admission (elective; emergency; day case; regular; and maternity) and the number of excess bed days.[21] Spells which could not be costed in this way (for example, those with no type of admission recorded) were costed using the maternity reference cost (which is an average cost of all reference cost HRG codes). The unbundled reference costs were then added to the main spell reference cost.

The proportion of inpatient spells that could not be grouped with the HRG grouper was 1.4%. However, there are also HRG codes that did not have costs associated with them in the reference costs. These zero cost HRGs are dependent on other methods of costing, or are dependent on the provider or patient.[23] As a result, 8.5% of spells were not counted or costed.

Outpatient care

The main measure of outpatient care utilisation was the number of outpatient attendances. Any outpatient attendances that could not be costed using the following approach were not included in the measure of utilisation.

HRG4+ Reference Costs Groupers were used to identify both main and up to six unbundled reference cost HRG codes, where applicable, for each attendance and associated procedures, using the relevant grouper.[20] Any non-attendances (DNAs) or appointments in the future were excluded.

The NHS Improvement Reference Costs for each year were then used to cost each attendance based on the reference cost HRG code, the specialism, and whether the appointment was consultant or non-consultant led.[21] In cases where the staff type was recorded as unknown, it was assumed the attendance was consultant-led. The total cost for the attendance was the sum of the main attendance reference cost and any unbundled reference costs.

The proportion of outpatient attendances that could not be grouped with the HRG grouper was 1.5%. In addition to this, there were some HRGs which could not be costed because costs were not available for some combinations of HRG, specialism and staff type. In total, 1.9% of attendances were not counted or costed.

Ambulatory care sensitive admissions

Ambulatory care sensitive (ACS) admissions are admissions for conditions that could be effectively managed through primary and community care.[24] ACS admissions were identified through first identifying emergency inpatient admissions and then analysing the primary diagnosis code associated with the admission.[24] A total of 23 conditions were used to identify ACS admissions, these are shown in Table 1 in Appendix 2. The costs associated with these ACS admissions were calculated as described in the costing of inpatient care above.

Multimorbidity

Multimorbidity is defined as the coexistence of two or more long-term medical conditions or diseases.[25] The prevalence of multimorbidity was measured using the Cambridge Multimorbidity Score, Version 1.0, developed by Cassell et al., and based on work by Barnett et al.[25,26] Using this approach, read codes and drug product codes were used to identify diagnoses and drug therapies in primary care records. These were then used to identify whether patients experienced any of 37 long-term medical conditions or. The main measure of multimorbidity in this study was the number of identified conditions experienced by patients. The prevalence of each of the 37 individual conditions was also investigated.

Statistical analysis

The high-cost, high-need group was identified as the top 5% of patients who had the highest total calculated costs in 2014/15. The primary analysis consists of descriptive statistics that compare costs and utilisation of health care services between the high-cost, high-need group (top 5%) and all other patients (the bottom 95%), as well as the demographics of the high-cost, high need patients and all other patients by age, gender, deprivation and multimorbidity. A sensitivity analysis was conducted which excludes any patients who died during the year. By excluding patients who died, the focus of the study was the group of patients who incurred sustained high costs, rather than costs associated with the proximity to death.[27,28]

Results

A comparison of costs

Overview

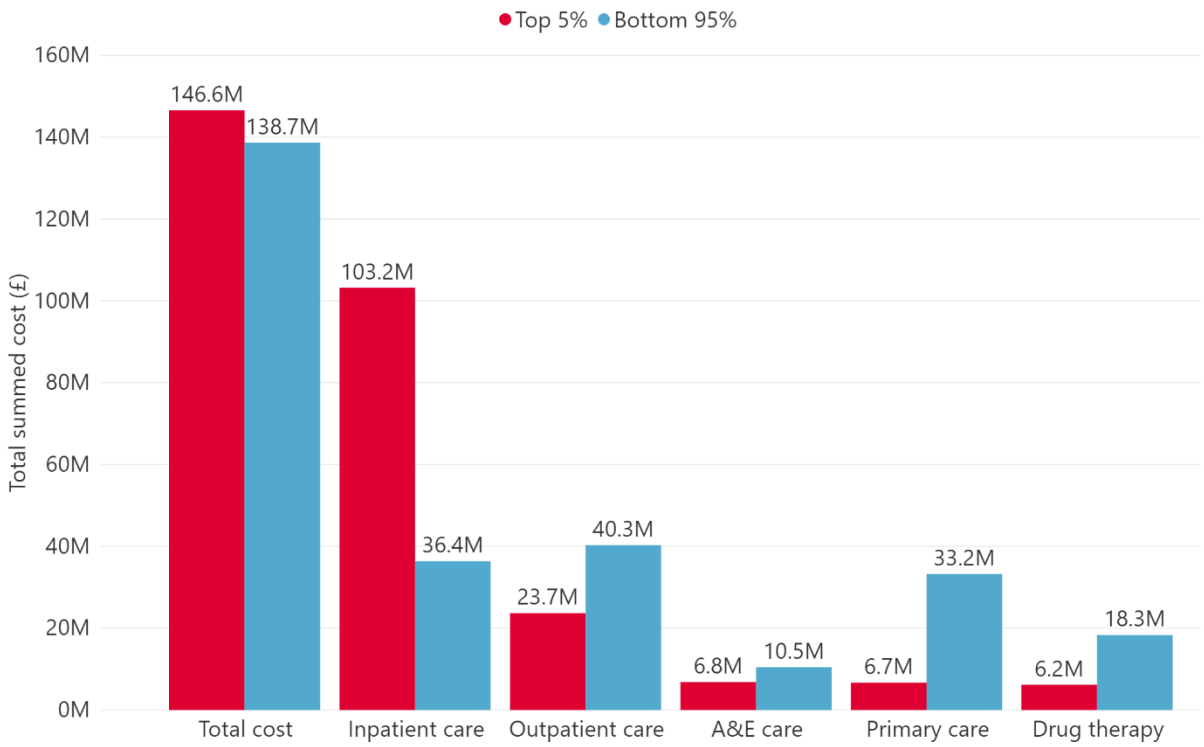
The total costs in 2014/15 across primary care, secondary care, and GP-prescribed drug therapy for 299,497 patients in the sample, amounted to £258.3m. On average, total calculated costs were £959 per person per year. This figure does not include community care, mental health care services, community maternity services and some other primary and secondary services. Previous research suggests that this underestimates the costs of NHS services by 35%.[29] It is important to note that this figure also does not include costs associated with social care nor any fixed or indirect costs, such as capital spending or administration costs.

Concentration of costs

Of the total activity costed, 51% of costs are attributable to the top 5% of patients. Figure 2 shows the total summed costs of all patients by cost group. The total cost associated with the high-cost, high-need group (£146.6m) is slightly higher than across all other patients (£138.7m), despite the latter group containing 95% of the patients.

The breakdown by setting highlights important differences between the high-cost, high-need group and all other patients. Spending on the high-cost, high-need group was dominated by inpatient care (£103.2m), which made up 70.2% of the total for that group. By contrast, the most costly setting for all other patients was outpatient care (£40.3m, 29.0%), followed closely by inpatient care (£36.4m, 26.2%) and primary care (£33.2m, 24.0%). In contrast, A&E care, primary care and GP-prescribed drug therapies only accounted for 4.6%, 4.6%, and 4.2% of the high-cost, high-need group respectively.

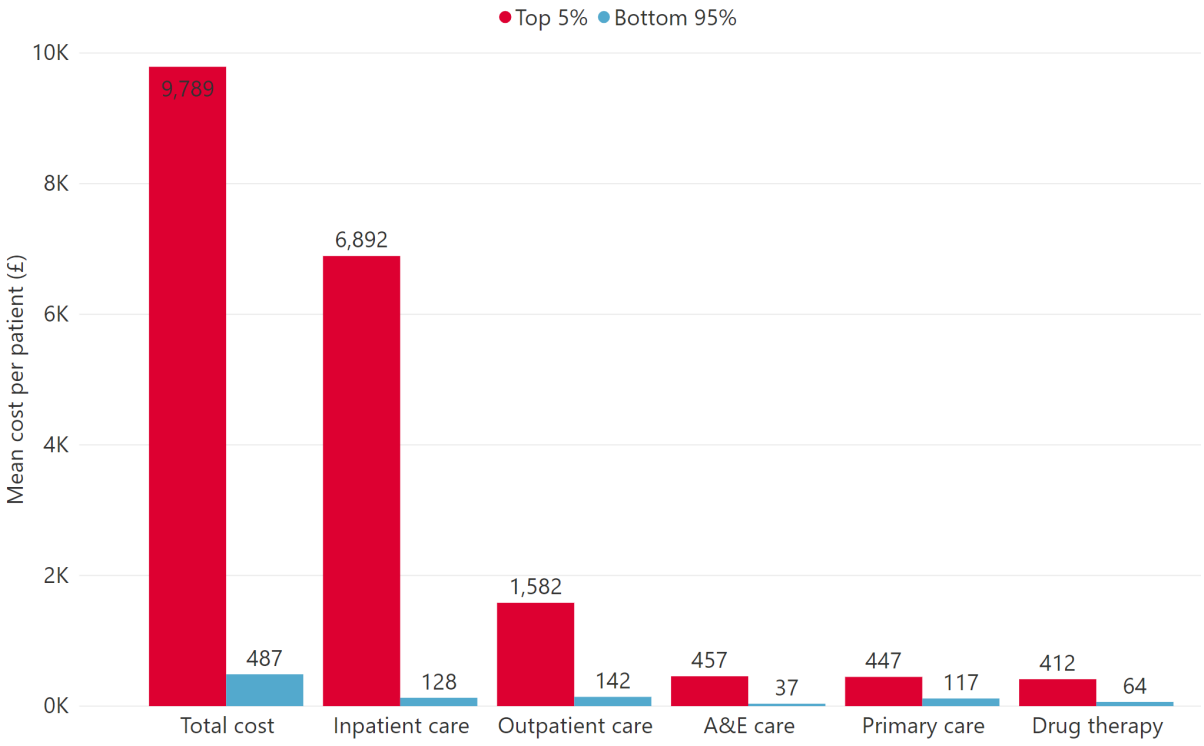
Figure 2: Total summed cost overall and by health care setting (and including GP-prescribed drug therapy) in 2014/15, by cost group



Mean costs

Mean costs per patient in 2014/15 by cost group are shown in Figure 3. The total mean cost per patient in the high-cost, high-need group (£9,789) was 20.1 times higher than the mean cost for all other patients (£487). This large difference between the high-cost, high-need group and all other patients was primarily driven by the difference in mean costs per patient of inpatient care (£6,892 vs £128) and, to a lesser extent, outpatient care (£1,582 vs £142). For inpatient care, the mean costs per patient for the high-cost, high-need group were 53.9 times higher than for all other patients; for outpatient care, they were 11.2 times higher; for A&E care, they were 12.4 times higher; for primary care, they were 3.8 times higher; and for GP-prescribed drug therapy, they were 6.4 times higher.

Figure 3: Mean cost per patient both overall and by health care setting (and including GP-prescribed drug therapy) in 2014/15, by cost group

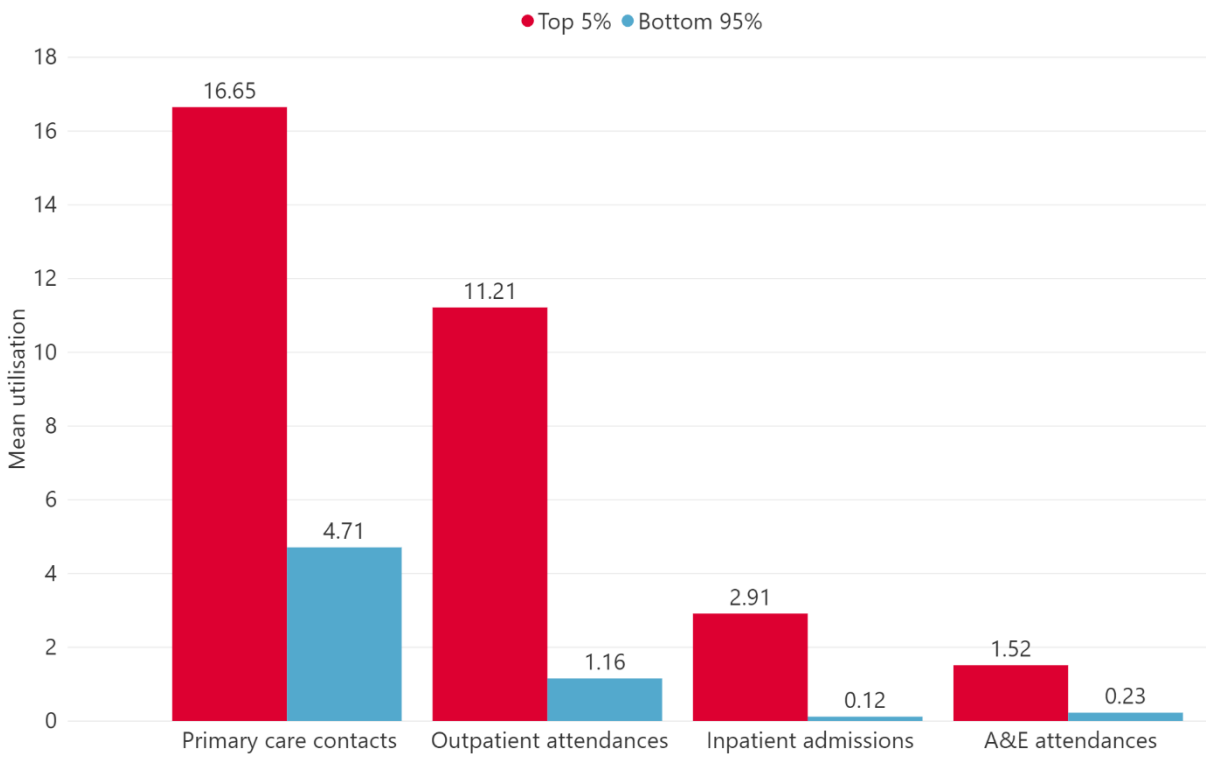


Further analysis of inpatient care suggested that 9% of the mean cost per high-cost, high-need patient could be considered to be an ACS admission and therefore potentially preventable. Within the bottom 95%, 8% of the mean cost per patient could be considered potentially preventable. While the proportions of mean costs per patient are very similar, the total costs associated with potentially preventable admissions are significantly different across the two groups. Approximately £9.7m is spent on potentially preventable admissions in the high-cost, high-need patient group, while only £2.9m is spent on potentially preventable admissions in all other patients.

Utilisation

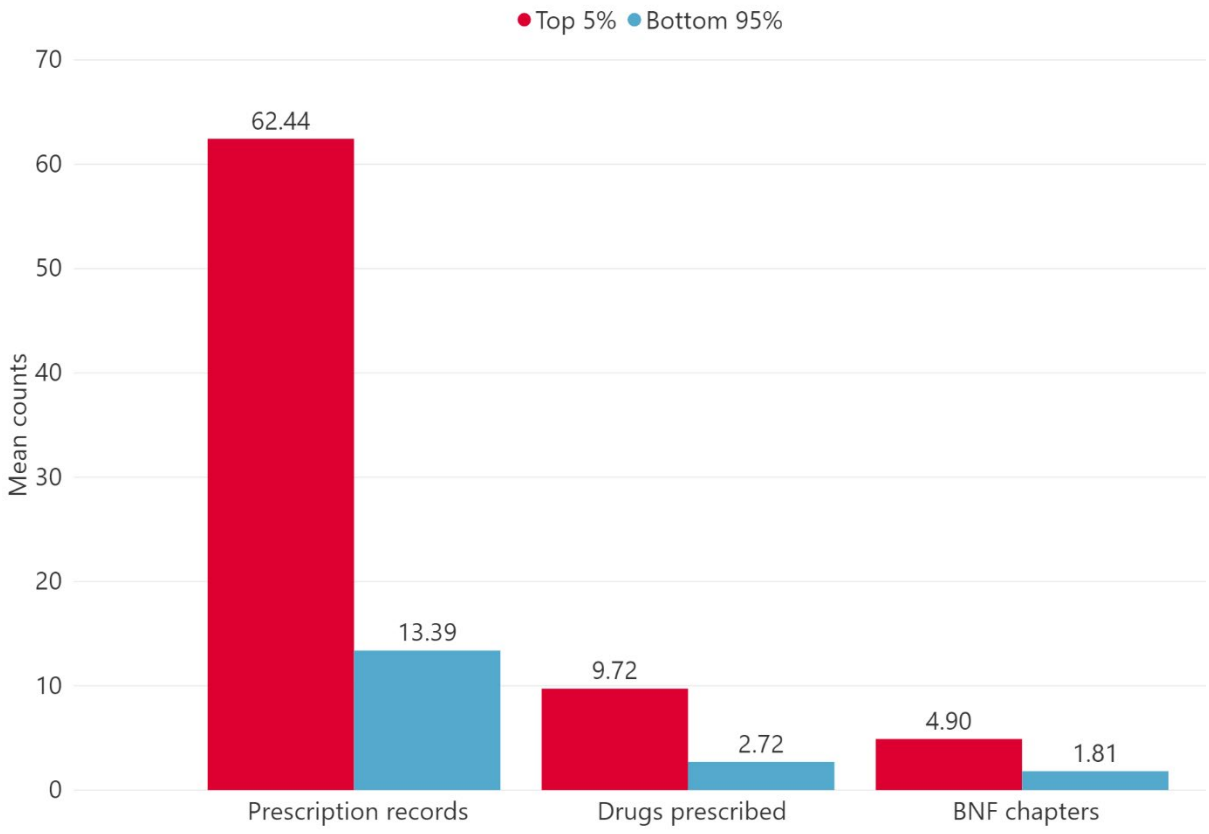
Higher costs can be driven either through higher activity (utilisation) or by higher costs per encounter, and so it is informative to explore a breakdown by utilisation (primary care contacts, A&E attendances, inpatient admissions, and number of prescriptions). Figure 4 shows the mean utilisation of health care services per patient in 2014/15 by setting and cost group. In each case, the high-cost, high-need group had dramatically higher levels of health care utilisation than all other patients. Primary care contacts were 3.5 times higher in the high-cost, high-need group compared with the all other patients (16.65 vs 4.71); outpatient attendances were 9.7 times higher (11.21 vs 1.16); inpatient admissions were 24.3 times higher (2.91 vs 0.12); and A&E attendances were 6.6 times higher (1.52 vs 0.23). Not only were high-cost, high-need patients more likely to be admitted as inpatients more frequently, an investigation into the mean length of stay demonstrates that they also stayed in hospital for longer compared with all other patients. The mean number of bed days per patient per year in the high-cost, high-need group (11.51) was 127.2 times higher than the average for all other patients (0.09).

Figure 4: Mean utilisation per patient in 2014/15, by health care setting and cost group



The differences in GP-prescribed drug therapy utilisation between the two groups was also compared. Figure 5 shows the use of GP-prescribed drug therapies in 2014/15 by the two groups, using three different measures of utilisation: number of prescription records, number of GP-prescribed drugs (based on the 'drug substance' field from the CPRD 'product' table), and the number of different BNF chapters prescribed. In each case, the mean counts per patient were much higher for the high-cost, high-need group compared with all other patients. In terms of prescription records, the high-cost, high-need group had 4.7 times as many records on average per patient compared with all other patients (62.44 vs 13.39). In terms of the number of GP-prescribed drugs, the high-cost, high-need group had 3.6 times as many (9.72 vs 2.72); and in terms of BNF chapters, the high-cost, high-need group had 2.7 times as many (4.90 vs 1.81) compared with all other patients.

Figure 5: Mean prescription records, drugs and BNF chapters per patient prescribed in 2014/15, by cost group



Demographics

Figure 6 shows the age profiles of the two cost groups using 5-year age bands. The high-cost, high-need group was greatly represented in the older age bands (60+ years) and under-represented in the younger and middle age bands (<60 years). For the high-cost, high-need group, 56.0% of the patients were aged between 60 and 89, whereas only 22.9% of all other patients were in this age range. In contrast, 76.1% of all other patients were under 60 years old, compared with only 38.6% of the high-cost, high-need group.

Figure 6: Breakdown of patients in each cost group in 2014/15, by age band

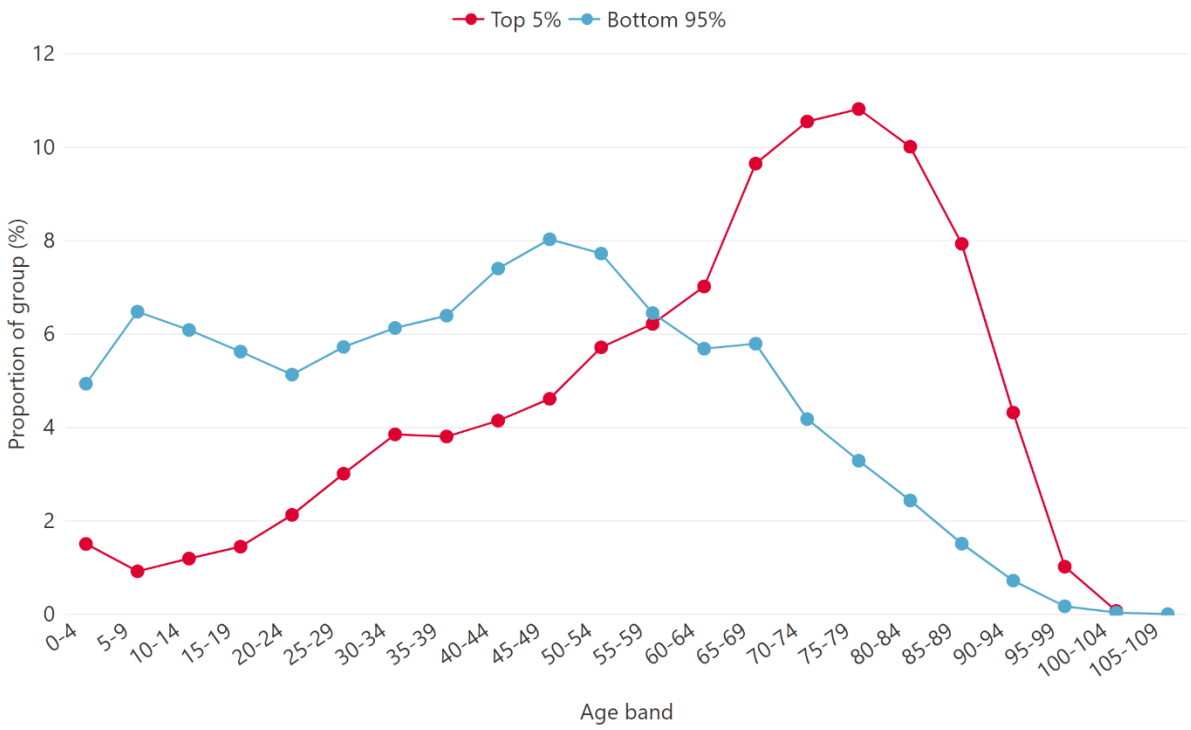


Figure 7 shows the proportion of patients who are in the high-cost, high-need group within a particular age band, by sex. The chart shows a very clear upward trend with age, with the proportion of patients in the high-cost, high-need group rising sharply from the 60-64 years age band; from around 6% for both men and women, to over 20% in females aged 90-94 and approaching 30% in males aged 90-94. In all age bands over 70-74 years, a greater proportion of elderly males are high-cost, high-need patients compared with women. The chart also shows a higher proportion of women in the high-cost, high-need group compared with men between 20 and 44 years of age and since these are childbearing years, this likely relates to the costs of maternity care.

Figure 7: Proportion of patients in the high-cost, high-need group in 2014/15, by age band and sex

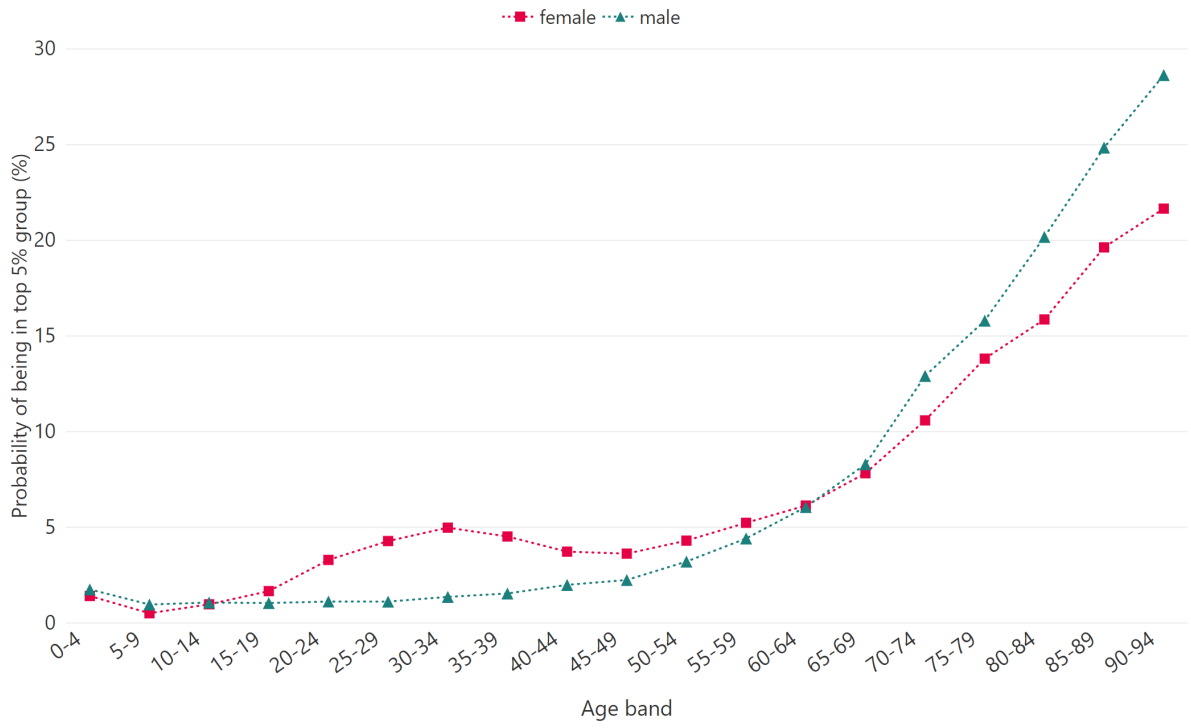
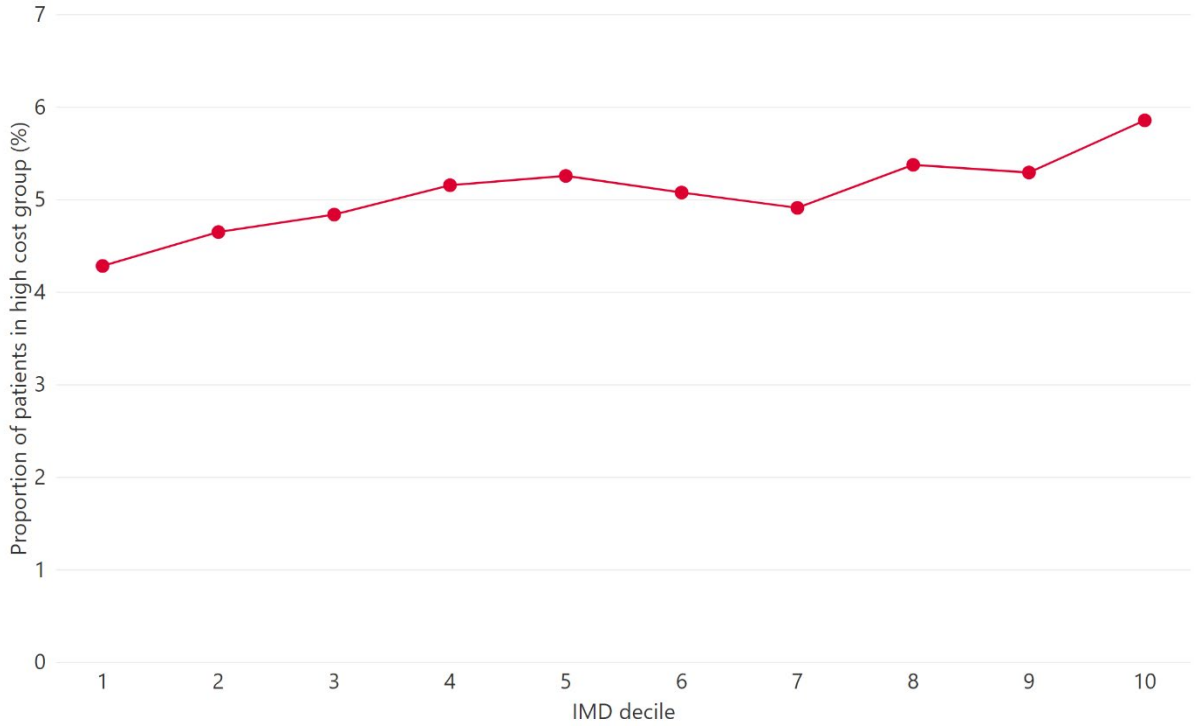


Figure 8 shows the relationship between deprivation and the proportion of patients in the high-cost, high-need group. If there was no association with deprivation, the proportion of patients in the high-cost, high-need group would be constant at 5% across groups, as per the definition. Instead, there is a distinct social gradient, with 4.3% of patients in the most affluent decile, compared to 6% in the most deprived decile featuring in the high-cost, high-need group. This reflects increased health need and morbidity in the most deprived areas of England.

Figure 8: Proportion of patients in the high-cost, high-need group in 2014/15 by deprivation (IMD) by deciles where 1 is the least deprived and 10 is the most deprived)



Morbidity

Multimorbidity (having two or more long term conditions[25]) is more prevalent in the high-cost, high-need group compared with all other patients. Figure 9 shows the proportion of each group by the number of long-term conditions they experienced in 2014/15. For all other patients, 54.9% of the patients had none of the specified conditions diagnosed in their records; whereas 13.4% had three or more. For the high-cost, high-need group, only 14.5% had no conditions diagnosed in their records; and 55.9% had three or more conditions. A substantial minority (28.6%) of this group had five or more conditions.

Figure 9: Proportion of patients in 2014/15 by number of pre-existing conditions from the Cambridge Multimorbidity Score, by cost group

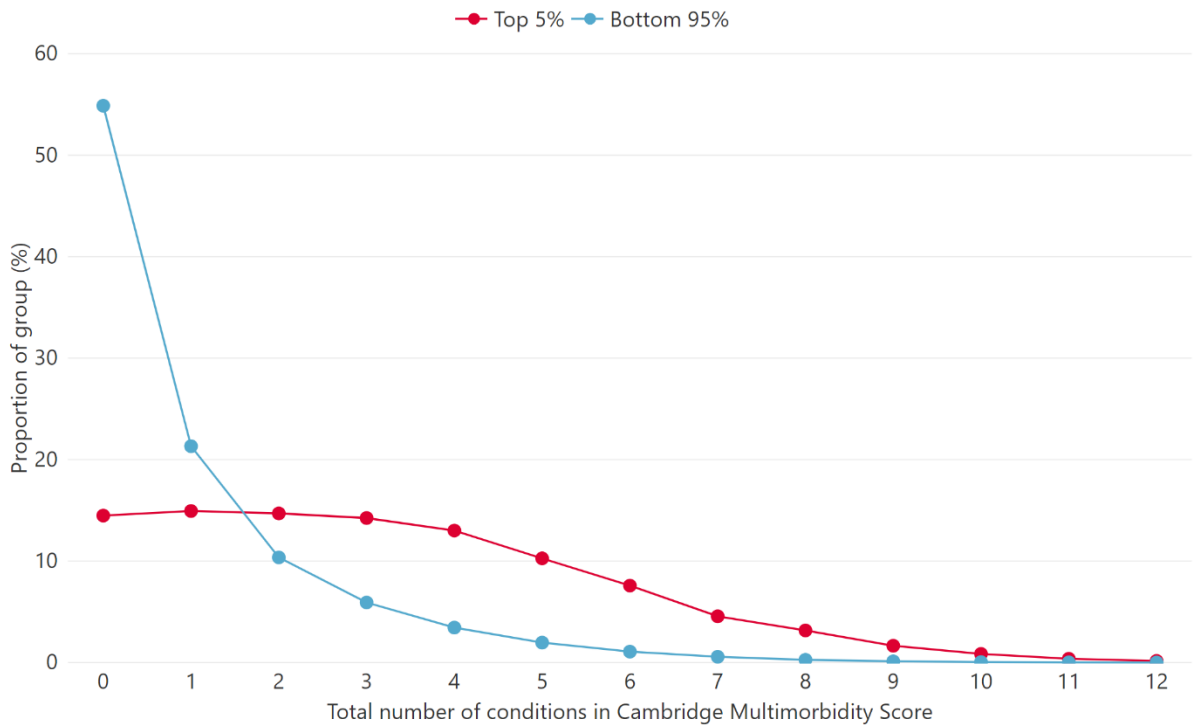


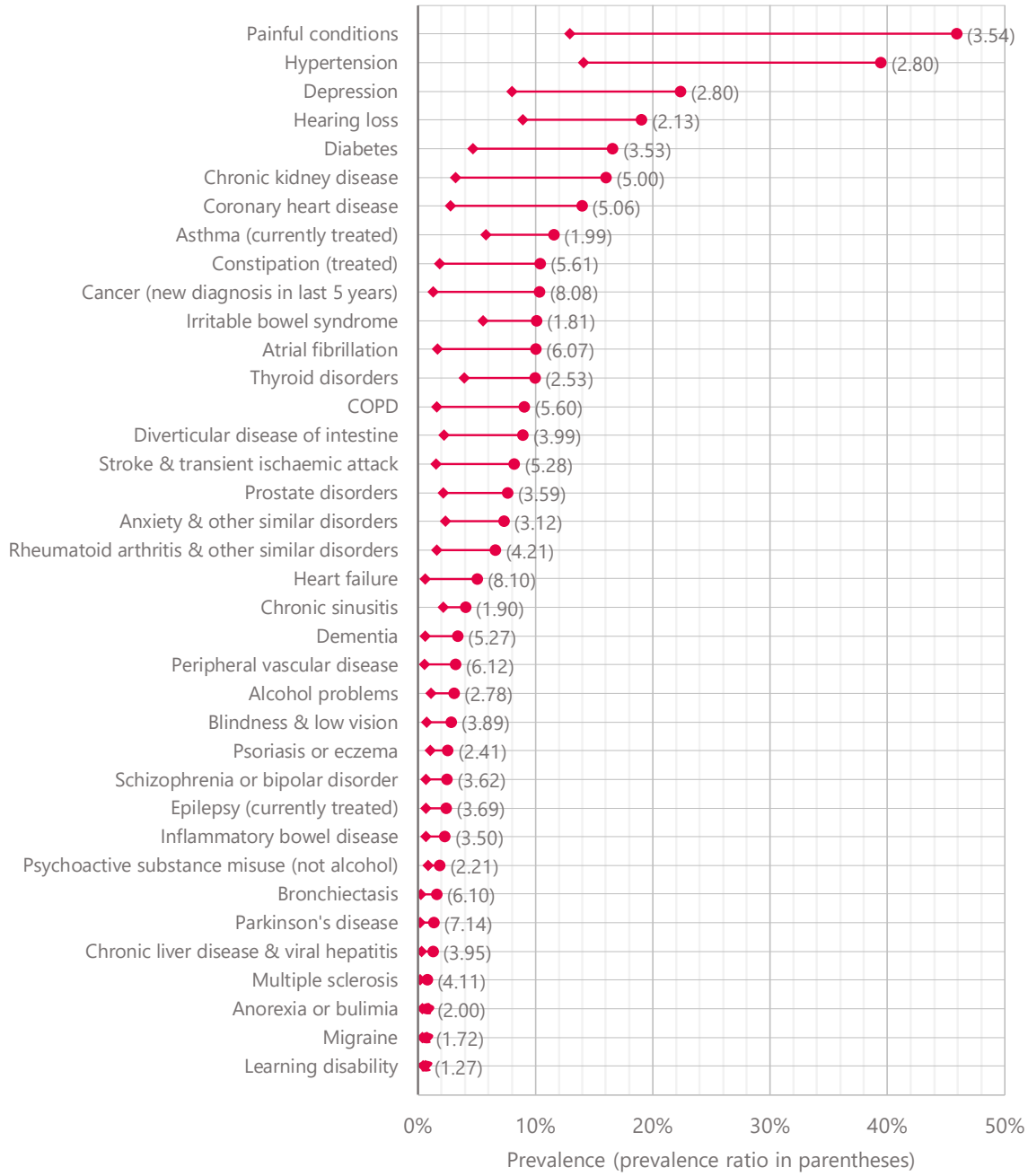
Figure 10 shows the prevalence of pre-existing conditions which are included in the Cambridge Multimorbidity Score[25] in 2014/15 by cost group. The chart is sorted by prevalence in the high-cost, high-need group. Every condition was more prevalent in the high-cost, high need group (rightmost points) compared with all other patients. The chart also shows the ratio of the prevalence rates for the two groups in parentheses.

For both groups, the two highest prevalence conditions were 'painful conditions'* and hypertension. However, the difference in prevalence was very large. 45.9% of the high-cost, high-need group experienced painful conditions, whereas only 13.0% of all other patients did (a ratio of 3.54). For hypertension, 39.4% of the high-cost, high-need group were diagnosed, whereas 14.1% of all other patients were diagnosed (a ratio of 2.80). Depression was the third most common condition for the high-cost, high-need group (22.4%). These conditions may be more prevalent in part because patients in the high-cost, high-need group are comparatively more multimorbid. Furthermore, this group regularly interacts with the health care system and so the higher figures could reflect the fact that these conditions are more likely to be picked up by clinicians.

Other conditions showed more dramatic differences in the prevalence ratios between the two groups. Heart failure and cancer were more than eight times more prevalent in the high-cost, high-need group. A further nine conditions (Parkinson's disease, peripheral vascular disease, bronchiectasis, atrial fibrillation, constipation, Chronic Obstructive Pulmonary Disease [COPD], stroke and transient ischaemic attack, dementia, and coronary heart disease) were more than five times more prevalent in the high-cost, high-need group. Eight conditions (depression, hypertension, alcohol problems, thyroid disorders, psoriasis or eczema, psychoactive substance misuse, hearing loss, and anorexia or bulimia) were between two and three times more prevalent. The lowest prevalent ratios were seen in asthma, chronic sinusitis, irritable bowel syndrome, and migraine (which were between 1.72 and 1.99 times more prevalent), and learning disability, which was 1.27 times more prevalent in the high-cost, high-need group.

* Painful conditions were identified through the prescription of four or more analgesics, excluding anti-epilepsy medication.[25]

Figure 10: Comparison of prevalence of pre-existing conditions included in the Cambridge Multimorbidity Score in 2014/15, by cost group, with prevalence ratios in parentheses

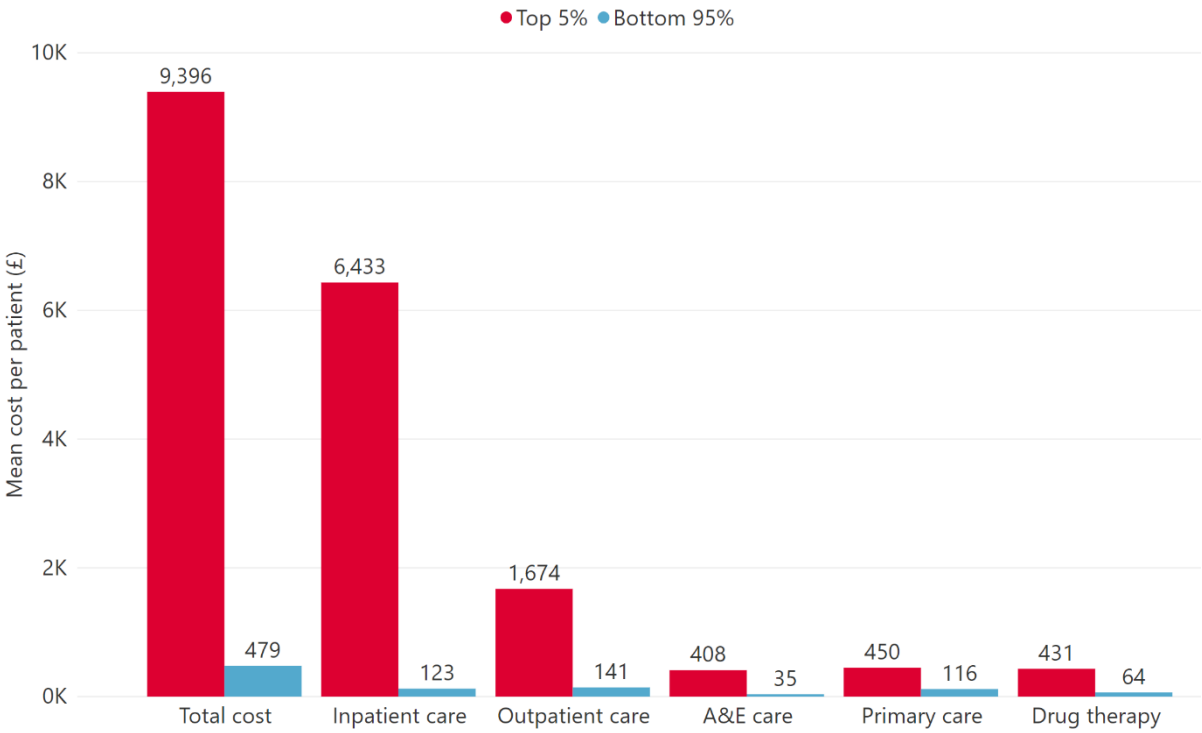


Sensitivity analysis

As a secondary analysis, 4,378 patients who died during 2014/15 were excluded, in order to restrict the analysis to patients with a full year of data. By excluding patients who died, the impact of the costs associated with end-of-life care were minimised and the focus was on patients who incurred sustained high health care costs.[27] This resulted in a sample size of 295,911 compared with the 299,497 included in the original analysis.

Mean costs per patient from the secondary analysis are shown in Figure 11. Exclusion of patients who died during the study period resulted in a decrease in the mean costs for the high-cost, high-need group, compared with those in Figure 1. Compared with the original analysis, mean inpatient costs decreased by 6.6%, and A&E costs decreased by 10.7%, while increases were seen in outpatient costs, primary care costs and GP-prescribed drug therapy costs (by 5.8%, 0.7% and 4.6% respectively). Across all settings and after excluding deaths, the mean cost per patient for the high-cost, high-need group was 4.0% lower. For all other users, mean costs were similar to the original analysis, although there was still a 3.8% reduction in inpatient costs, and a 1.7% reduction overall.

Figure 11: Mean cost per patient, excluding patients who had died, in 2014/15 by cost group



In contrast to the cost analysis, there were only slight differences (approximately ±5%) to the utilisation figures as compared to Figure 3. However, the mean number of inpatient bed days decreased substantially, by 17.2% for all other patients (0.07) and 21.3% for the high-cost, high-need group (9.06).

Discussion

The design, delivery and management of high-cost, high-need patients has important implications for overall health system costs. It is therefore important, particularly for commissioners and health system planners, to understand how health care costs are distributed across populations, and to identify the shared characteristics of these patients.

The main finding highlights the concentration of health care spending in England's population. The top 5% of highest cost users account for around 50% of the total health care budget for primary care, secondary care and GP-prescribed drug therapy. A large systematic review consisting mainly of evidence from the USA and Canada, found similar results, with the top 5% of highest cost users accounting for 55% of total costs (range 29-65%).[30] A similar study found that the top 10% of patients account for between 50-80% of costs across a number of countries.[12]

At a patient level, mean expenditure is around 20 times greater for high-cost, high-need patients than other users (£9,789 vs £487). Although high-cost, high-need patients have higher costs across all categories (primary care, outpatient care, emergency care and GP-prescribed drug therapies), the majority of the difference in costs is explained by inpatient care (£6,892 vs £128). Of the £6,892 inpatient costs per high-cost, high-need patient, 9% on average was related to ACS admissions. This suggests that initiatives to improve efficiency could focus on preventing avoidable inpatient hospital admissions, which is a key tenet of the NHS Long Term Plan.[31] This could potentially be achieved through shifting care towards preventative interventions in the community. However, the reduction of emergency admissions is not a new policy goal and despite longstanding ambitions, emergency admissions have risen by 42% over the last decade.[4] Specific initiatives to reduce emergency admissions through integrated care in the community have had limited success[32], and on their own, these are unlikely to offset the growing needs and demand for emergency services at a population level. Further work is needed to understand the extent to which ACS admissions for complex multimorbid patients could be addressed in alternative settings, as well as the impact that this would have on local health systems.[33,34]

The findings suggest that the strongest drivers of being in the high-cost, high-need group are age, multimorbidity and deprivation, though the relative contribution of these various factors towards health care expenditure is beyond the scope of this analysis. The high-cost, high-need group is far more likely to be aged over 60, which is consistent with literature that shows that per capita health care expenditure rises with age.[35] There is also a social gradient, whereby patients living in deprived areas are over-represented in the high-cost, high-need group compared with those living in affluent areas, which is consistent with other research.[36,37] This suggests the need for a system-wide response to reducing socio-economic inequalities and addressing the social determinants of health, which may yield benefits to health system efficiency.[37] However, such initiatives are most beneficial when

sustained over the longer term, and may have a limited immediate impact on those who are already very ill.

Over half of high-cost, high-need patients had more than three conditions, which is consistent with other research that shows that multimorbidity is a strong driver of costs.[30] The analysis by condition found that cancer and heart failure were over eight times more prevalent in the high-cost, high-need group, and Parkinson's disease was more than seven times more prevalent. It is interesting to note that all three of these conditions could be managed in planned-care settings and primary care, and robust care here could potentially avoid emergency hospital admissions. While these conditions have clear clinical pathways, there are other highly prevalent co-morbidities in the high-cost, high-need group, such as chronic pain, hypertension, depression, hearing loss, and constipation, that, outside of primary care, may not be given the same level of consideration as patients' primary diagnoses. Given that the majority of costs in the high-cost, high-need group are concentrated in secondary care, this level of multimorbidity demonstrates complex patient needs are not being effectively addressed via disease-specific care pathways in hospitals.[25]

Learning disability was only 27% more prevalent in the high-cost, high-need group compared with all other patients. This was lower than expected, as those with functional limitations are known to be a group of patients with particularly high care needs and costs.[38] This analysis likely did not fully capture the complete range of costs associated with the care of patients with a learning disability, as the costs associated with both community care and social care were not available.

The key contribution of this paper is that it explores the distribution of both primary and secondary health care costs in England. While there are studies examining the distribution of secondary care, there are no known papers exploring the distribution of primary care and GP-prescribed drug costs. A large, nationally representative sample was used, so the findings can be generalised to the whole population. A rigorous approach to assigning costs to each patient based on their recorded activity and utilisation was taken, and this costing methodology may be useful to other researchers. In order to ensure that the results were not skewed by patients in their final year of life (who would contribute less than a full year of exposure), these patients were excluded in a sensitivity analysis, although this was not found to alter the study findings.

Limitations to this analysis should be noted. This analysis does not capture all costs associated with health care in England and only incorporates costs related to primary care and secondary care. Costs associated with community care (including some maternity services), specialist mental health care services, specialised drugs and social care are not available for inclusion in this analysis. Social care is a particularly important area to consider, as scarcity of public funding over recent years has led to an increase in delayed discharges from hospitals, which in turn impacts on hospitals' bed availability, length of stay, and financial performance.[39] Funding reform of the social care system is anticipated and greater investment could help to facilitate more care delivery in the community.[40]

No attempt was made to determine whether costs of care were appropriate for a given level of patient need. Therefore, these figures cannot be used to evaluate equity within the system with regards to care delivered to different subgroups. Costs are presented from a single financial year, which offers a snapshot of the use of health care resources by different groups of patients. Longitudinal studies over multiple years would help to understand how costs vary over time for individuals as well as trends in the concentration of spending, which might help to identify further opportunities and time points for intervention. For the purposes of this research, patients were dichotomised into a high-cost, high-need group (the top 5%) and all other patients (the bottom 95%). This is a binary simplification of the cost distribution across patients, but it allowed us to disaggregate findings by other variables and uncover interesting insights. Finally, previous studies have comprehensively investigated the impact of end-of-life care on costs and have found that health care costs increase in the last years of life.[27,28] The analysis was restricted to a simple sensitivity analysis. The findings were broadly consistent with previous studies, in that costs were higher in those patients in their last year of life. However, further investigation would be required to understand the impact of end of life on the distribution of utilisation and costs across primary and secondary care.

Further work is also needed to understand the extent to which these costs (particularly those attributable to inpatient hospital settings) are avoidable and how strategies and interventions might be used to sustainably manage these costs. An international review found limited evidence that interventions to manage high-cost, high-need patients (primarily based on outpatient care management and care coordination) have had an impact on clinical outcomes or cost savings.[41] Where evaluated, such interventions in the UK have also have been found to have had limited success.[32]

Conclusion

This working paper shows the concentration and distribution of costs across primary and secondary services for a nationally representative sample of patients in England. The results highlight potential areas where efforts could be made to reduce costs or improve efficiency. Other researchers may find the methods presented in this paper useful when attempting to cost a full range of health care activity.

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Appendix

Appendix 1: Primary care: consultation types and roles

Consultations relating to specific practice, visit and telephone consultation codes ('constype') were included. Practice consultation codes included:

- clinic (1)
- follow-up/routine visits (3)
- night visit, practice (6)
- out of hours, practice (7)
- surgery consultation (9)
- acute visit (11)
- emergency consultation (18), and
- initial post discharge review (48).

Consultations involving a visit included:

- home visit (27)
- hotel visit (28)
- nursing home visit (30)
- residential home visit (31)
- twilight visit (32), and
- night visit (50).

Telephone consultations included:

- telephone call from a patient (10)
- telephone call to a patient (21)
- triage (33), and
- telephone consultation (55).

Consultations relating to specific GP, nurse and other clinician role codes ('role') were included. GP roles included:

- senior partner (1)
- partner (2)
- assistant (3)
- associate (4)
- locum (7)

- GP registrar (8)
- sole practitioner (10)
- salaried partner (47)
- GP retainer (50), and
- other students (53).

Nurse roles included:

- practice nurse (11), and
- other nursing & midwifery (54).

Other clinician roles included:

- physiotherapist (26), and
- other health care professional (33).

Appendix 2: Ambulatory care sensitive admissions

Table 1: List of ICD10 codes used to identify ambulatory care sensitive admissions[24]

Condition	ICD-10 code
Angina	I20, I24.0, I24.8–24.9
Aspiration	J69.0, J69.8
Asthma	J45–46
Cellulitis	L03–04, L08, L88, L98.0, L98.3
Congestive heart failure	I11.0, I50, J81
Constipation	K59.0
Convulsions/epilepsy	G40–41, R56, O15
COPD	J41–44, J47
Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9
Dental conditions	A69.0, K02–06, K08, K09.8, K09.9, K12–13
Diabetes complications	E10.0–10.8, E11.0–11.8, E12.0–12.8, E13.0–13.8, E14.0–14.8
Ear, nose and throat infections	H66–67, J02–03, J06, J31.2
Gangrene	R02
Gastro-oesophageal reflux disease	K21
Hypertension	I10, I11.9
Iron deficiency anaemia	D50.1, D50.8–50.9
Influenza	J10–11
Nutritional deficiencies	E40–43, E55, E64.3
Pelvic inflammatory disease	N70, N73–74
Perforated/bleeding ulcers	K25.0–25.2, K25.4–25.6, K26.0–26.2, K26.4–26.6, K27.0–27.2, K27.4–27.6, K28.0–28.2, K28.4–28.6
Pneumonia and other acute lower respiratory tract infections	J13–14, J15.3–15.4, J15.7, J15.9, J16.8, J18.1, J18.8, J20–20.2, J20.8, J20.9, J22
Tuberculosis and other vaccine preventable	A15–16, A19, A35–37, A80, B05–06, B16.1, B16.9, B18.0–18.1, B26, G00.0, M01.4
Urinary tract infections/pyelonephritis	N10–12, N13.6, N39.0