

Population Level Commissioning for the Future



Implementing capitated budgets within long term conditions for people with complex needs

LTC Year of Care Commissioning Programme

The Long Term Conditions (LTC) Year of Care Commissioning programme aims to transform the quality of care for people with complex care needs.

People with multiple long term conditions need personalised care that enables them to live as well as possible for as long as possible. They need all their health and care services to be joined-up.

Personalised, integrated services can achieve better outcomes, a better quality of life, and a more efficient use of health and care resources. However, NHS funding systems have traditionally focused on isolated episodes of activity, rather than longer-term packages of care planned proactively around the needs of the individual.

The internationally groundbreaking programme is supporting commissioners and providers to develop and implement funding models so that an annual budget for individuals with complex care needs can be used to commission tailored, joined-up packages of care.

Implementing capitated budgets

The programme, which began in 2012, has been working with early implementer sites to develop, test and refine tools and techniques for identifying groups of patients with complex care needs and calculating the costs of their care.

Early implementers are also modelling the effects of different tariffs and patient cohorts, trialling new pathways of care and new datasets, and exploring workforce implications. A number of 'fast followers' are implementing the shared learning as it develops.

About this document

Population Level Commissioning for the Future

This paper presents analysis of a Kent 'whole population' dataset, linking whole population demographics with activity and cost data for the population from acute, community, mental health and social care providers. The data helps commissioners to understand the impact of different selection methods for people with 'very complex' health and social care needs, particularly in relation to the development of a LTC year of care currency.

This document should be seen alongside the 'Recovery, Rehabilitation and Reablement – step-by-step guide' which describes how providers can carry out the audit in their own organisation.

Other documents and learning materials

This document is part of a suite of learning materials being produced by the LTC Year of Care Commissioning Programme to support the spread and adoption of capitated budgets for people with complex care needs.

For all the latest available documents, please visit:

www.nhs.uk/ltyoc

CONTENTS

Summary	4
Results	5
- The case for multimorbidity - replication of the multimorbidity in Scotland research results - Multimorbidity and the cost of healthcare - Multimorbidity and the pattern of services delivered to patients - Selecting patients with complex health and social care needs - Trends in costs for selected patients - Stability of patient cohorts	
Implications for the Long Term Conditions Year of Care Commissioning Programme	23
- Introduction - Comparison of risk score and multimorbidity for population stratification - Next steps for analysis	
Methods	26
- A&E data - Admitted patient care data - Outpatient data - Mental health data - Community contact data - Community inpatient data - Social care data - Assigning risk scores to people - Assigning LTCs to inpatient activity - Comparison of risk score and multimorbidity populations - Deaths in hospital - Adjustments for trends - Data processing	
Acknowledgements	31

SUMMARY

This paper presents analysis undertaken during 2012 of a Kent 'whole population' dataset, linking whole population demographics with activity and cost data for the population from acute, community, mental health and social care providers, over a four year period.

This is a working document, it is an interim report after 2 years of a 4 year programme. The authors are aware that more work is required to improve the selection and adjustment of data to ensure the analysis is robust. A section is included near the end of the report that describes some of the additional analysis that we expect to produce.

Despite the developing nature of this analysis, we can conclude our results the following - all of which confirm analysis described elsewhere (see footnotes throughout this paper):

- Multimorbidity is strongly related to age
- Multimorbidity is more common than single morbidity
- People with more physical morbidities are also more likely to have a mental health morbidity
- Total health and social care costs are strongly related to risk score and multimorbidity
- Multimorbidity appears to be more strongly related than age to total health and social care costs
- Acute non-elective costs contribute most to the increased cost for people with multimorbidity.

Further conclusions can be made that:

- Non-elective costs contribute much less to the increased cost for people with mental health multimorbidity
- Selecting people with 'very complex' health and social care needs is possible, using either risk score or multimorbidity population segmentation methods, but these methods select different (although similar) groups of people:
 - Only 36% of people were common to groups selected using the 2 methods
 - The multimorbidity methods selected a generally older person cohort
 - Both methods selected people who required at least 1 health and social care service each year over the 4 year period
- Both the risk score or multimorbidity population segmentation methods show a 'crisis curve', where people move into and then out of a period of higher health and social care need
- Following the crisis curve, the health and social care needs of patients change, such that nearly 50% of services were delivered by non-acute providers (compared with 2/3 of cost before the crisis curve)
- People move into and out of the 'very complex' health and social care need, person cohort rapidly, with only 20% of people remaining in this cohort from 1 year to the next.

This data helps to understand the impact of different selection methods for people with 'very complex' health and social care needs, particularly in relation to the Long Term Conditions Year of Care currency being developed by the Long Term Conditions Year of Care Commissioning programme. The analysis strongly supports research from elsewhere, and builds upon this evidence. Further information is provided later on in this report describing additional analysis that is expected to be carried out.

RESULTS

The case for multimorbidity - replication of the multimorbidity in Scotland research results

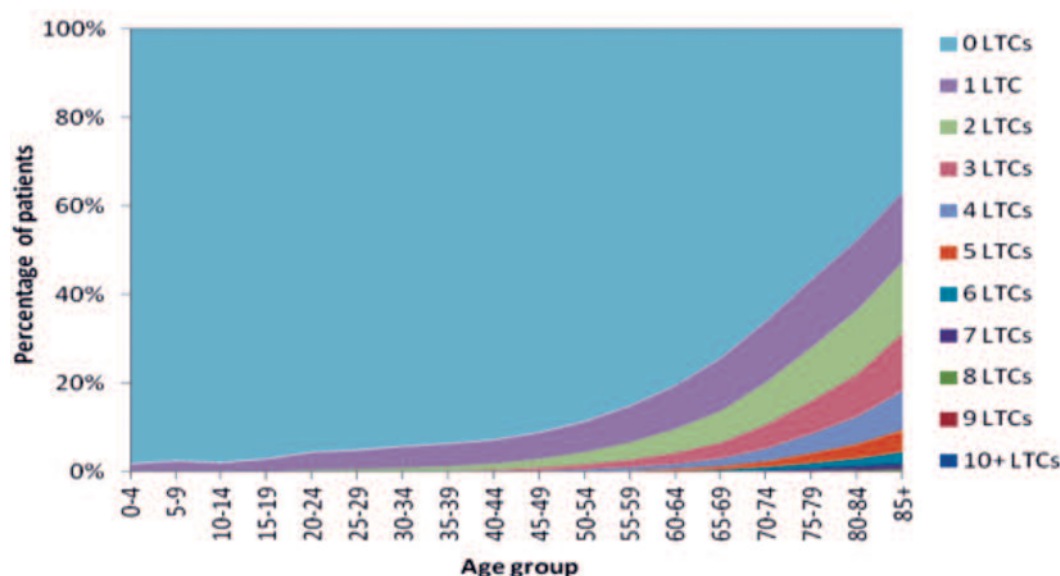
In a series of papers¹, the Scottish School of Primary Care's multimorbidity research programme, demonstrated that patients with multimorbidity were more common than patients with single morbidity. The Long Term Conditions Year of Care Commissioning programme was based on the premise that an integrated care model for patients with multimorbidity, was more effective and efficient than an approach that provides the person with separate services for each single morbidity². This section aims to replicate the results from the Scottish research programme.

A key finding from the Scottish study found that older patients tended to have more long term conditions (LTCs). It stated a startling 90% of patients aged 75 years or over, from the whole population had at least one LTC, with 50% of this age group having 3 or more LTCs. The data from Kent is similar but less startling. For the 75 years and over age group it found 50% had at least one LTC, with approximately 20% having 3 or more LTCs (Fig. 1).

The main reasons for the differences between the results are:

- The Scottish study identified 40 LTCs, whereas the Kent study only identified 20 LTCs
- The Scottish study identified LTCs from a wide range of data sources, in particular GP clinical records, whilst the Kent study only identified LTCs using ICD10 codes for patients admitted to hospital.

Figure 1 - The number of long-term conditions by age group for the Kent population



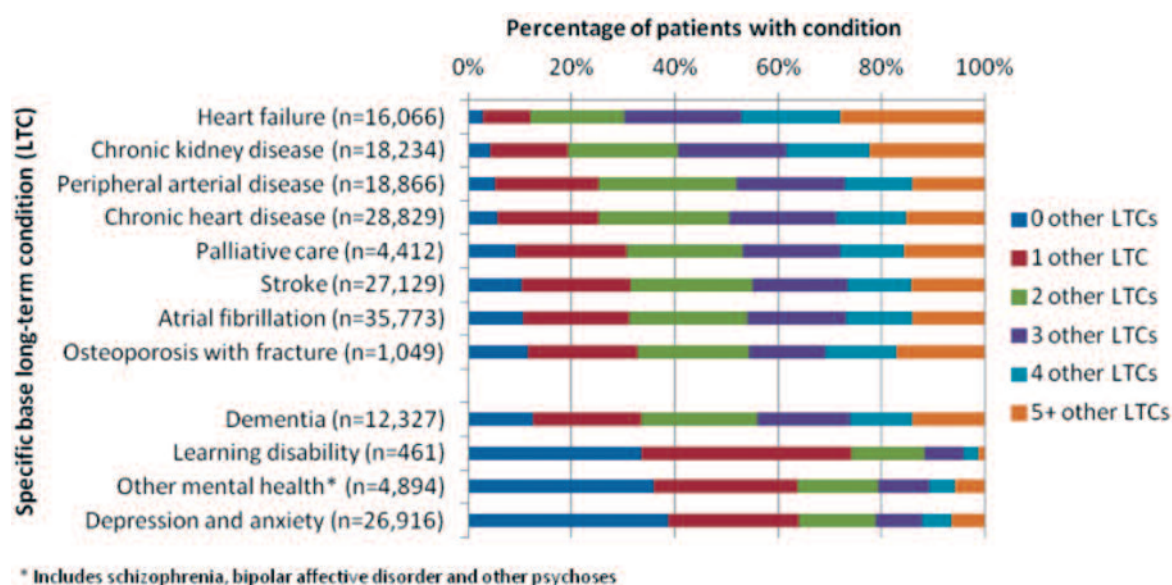
¹For example: Mercer S, Guthrie B, Wyke S, O'Brien R, Watt G, Barnett K. Multimorbidity in Scotland. The Scottish School of Primary Care's multimorbidity research programme. Universities of Glasgow and Dundee. Presentation. Long Term Conditions in Scotland Final Report. <http://www.isdscotland.org/isd/5658.html> (2008) Mapping multimorbidity in a large cross-sectional database: implications for healthcare, research and medical education. The Lancet (D-11-08270R1) Supplementary file S1: Definitions of multimorbidity. Payne RA, Abel GA, Guthrie B, Mercer SW (2013) The effect of physical multimorbidity, mental health conditions and socioeconomic deprivation on unplanned admissions to hospital: a retrospective cohort study. CMAJ 2013. DOI:10.1503/cmaj.121239.

²QIPP Long Term Conditions: Supporting the local implementation of the Year of Care Funding Model for people with long term conditions. Department of Health Gateway Reference 17415, April 2012.

A second major finding of the Scottish study was that if a person had one LTC, they were likely to have at least one other LTC, and there is perhaps some predictability about the other condition(s) that a person is likely to have.

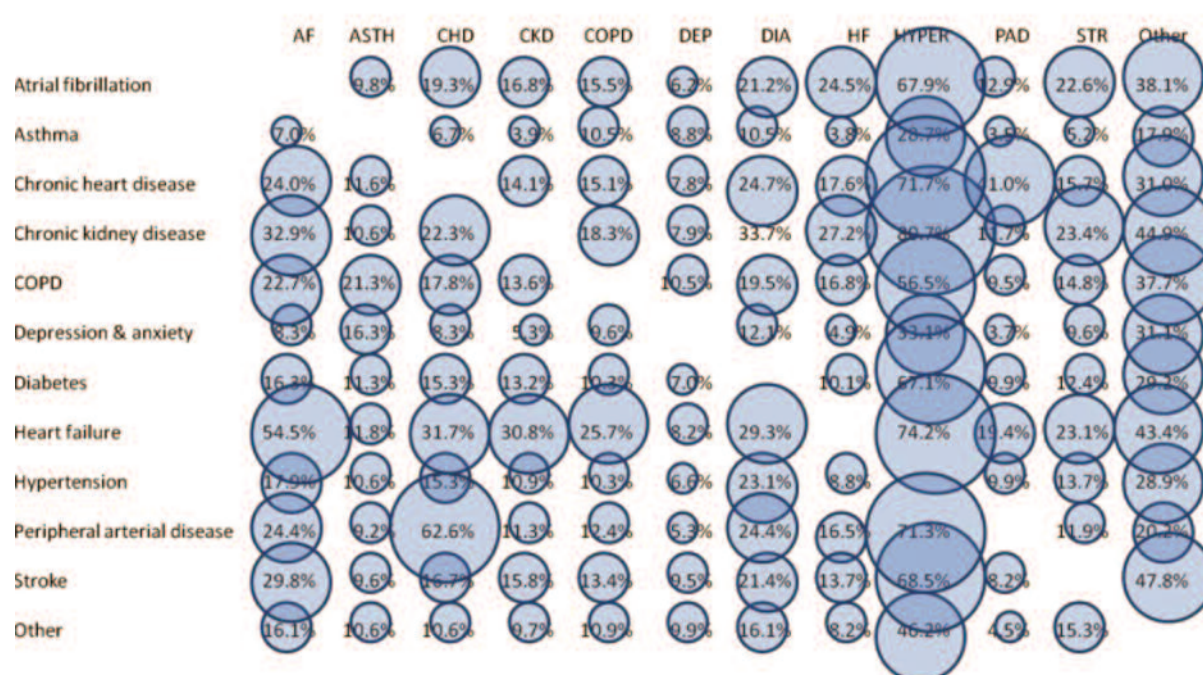
The Kent data shows that, for example, over 95% of people with heart failure have 1 or more other LTC and nearly 30% of people with heart failure have 5 or more other LTCs (Fig. 2). The data shown here is for the 8 physical LTCs and 4 mental health LTCs for which patients displayed greatest multimorbidity.

Figure 2- The percentage of the Kent population who have a specific base long-term condition (LTC) who also have other LTCs (selected physical and mental health LTCs only - those where patients demonstrate the greatest multi-morbidity)



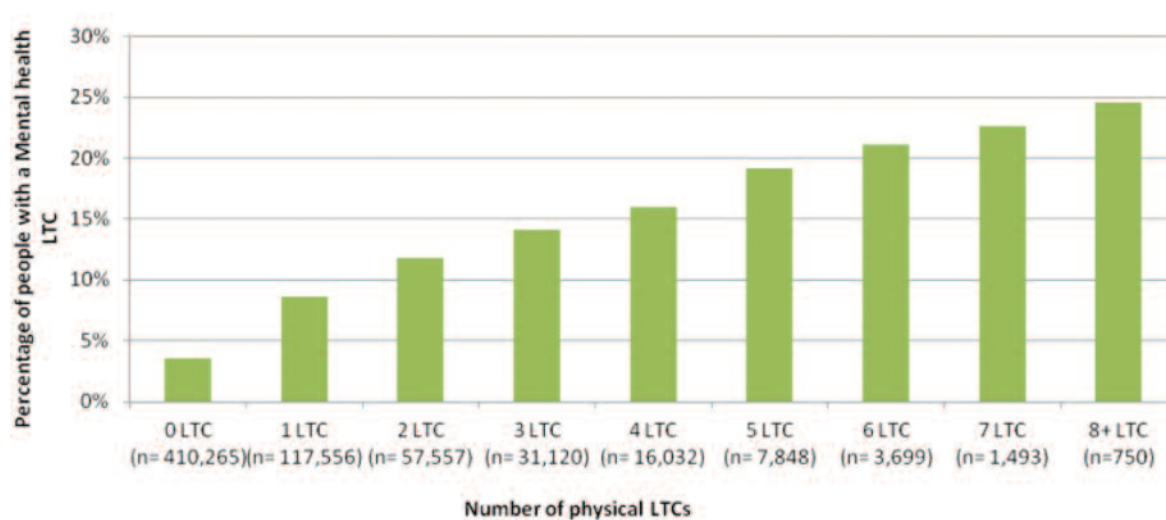
Furthermore, the types of 'other' LTCs a person might have are influenced by the initial LTC (Fig. 3). For example, reading from the right-hand side, if a person has atrial fibrillation, they have a 9.8% likelihood of also having asthma, as well as a 67.9% likelihood of having hypertension.

Figure 3 - The percentage of people with a specific LTC (left-hand of figure) who also have another specific LTCs (selected LTCs only - those where patients demonstrate the greatest multimorbidity)



The results from the Scottish study were not restricted to physical LTCs. The Kent study, replicating the Scottish work, illustrates that people with greater physical multimorbidity are more likely to also have a mental health LTC (Fig. 4).

Figure 4 - The percentage of people with an increasing number of physical LTCs who have a mental health LTCs



Multimorbidity and the cost of healthcare

It is well known that there is a strong relationship between age and the cost of healthcare - the average cost of care for older people is greater than the average cost for younger people. A number of studies also describe a relationship between the number of morbidities or LTCs and the total average cost of healthcare³. There is increasing evidence suggesting that the relationship between age and healthcare is confounded by multimorbidity - that is, it is not the increase in age per se that results in greater healthcare costs but the increase in multimorbidity (as we see in Figure 1, also increases with age)⁴. Figures 5 and 6, illustrate these relationships in the Kent whole population data.

The blue line in Figure 5 indicates that older people in the whole of the Kent population require greater health and social care resources. Figure 6 indicates that people with greater multimorbidity (the number of LTCs) also require greater resources to meet their health and social care needs. The red columns in Figure 5 indicate that, if you select a group of patients with multi-morbidity (in this case people with 2 or more LTCs), the relationship between age and health and social care costs disappears.

³For example:
Lehnert T, et. al. (2011) Review: Health care utilization and costs of elderly persons with multiple chronic conditions. *Med Care Res Rev* 68:387-420.
Kadam UT, Uttley J, Jones PW, Iqbar Z. (2013) Chronic disease multimorbidity transitions across healthcare interface and associated costs: a clinical-linkage database study. *BMJ Open* 3: e003109. doi:10.1136/bmjopen-2013-003109.

⁴For example:
Nagl A, Witte J, Hodek JM, Greiner W. (2012) Relationship between multimorbidity and direct healthcare costs in an advanced elderly population. *Z Gerontol Geriatr* 45: 146-154.
Kasteridis P, Street A, Dolman M, Gallier L, Hudson K, Martin J, Wyter I. (2014) The importance of multimorbidity in explaining utilisation and costs across health and social care settings: evidence from South Somerset's Symphony Project. *CHE Research Paper* 96:1-52.

These data tend to suggest that younger people with multimorbidity require greater resources to meet their health and social care needs than older people. But this result needs more investigation - the numbers of children with multimorbidity are small. It may be the case that younger people with multimorbidity have more resource-requiring conditions. In the Kent population, over half of the children with 2+ LTCs had a mental health condition, and over half had epilepsy.

These results suggest that, when selecting the group of people with greatest need for health and social care resources, multimorbidity is perhaps a better selection criterion than age.

Figure 5 - The relationship between age and average annual cost per person for two different patient cohorts (Note: numbers of people with 2+ LTCs in the younger age groups were small (all less than 0.25% of the sample population) - 0-4 yrs age group = 41 people; 5-9 yrs = 96 people; 10-14 yrs = 135 people; 15-19 yrs = 323 people. In contrast, 85+ yrs age group = 27,761 people).

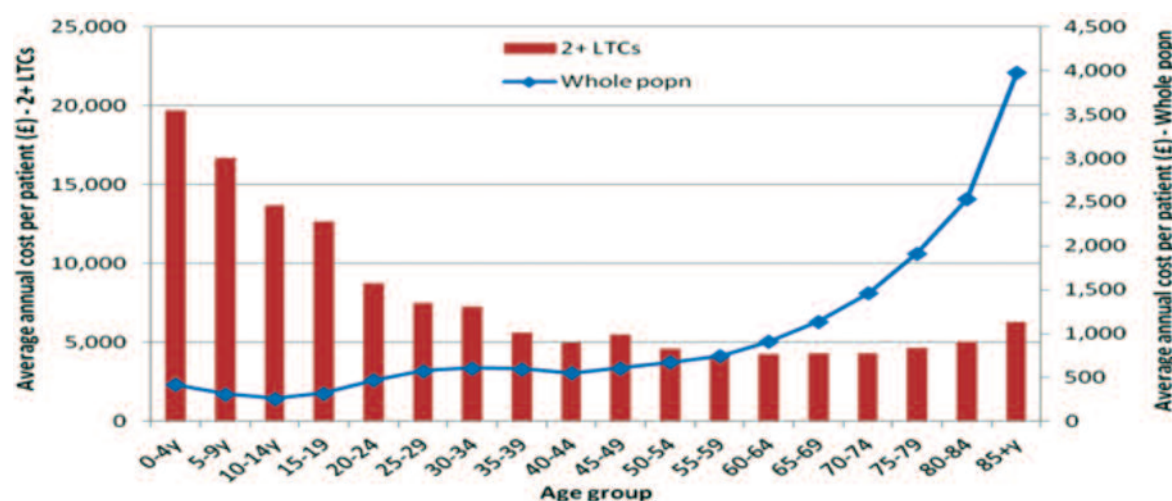
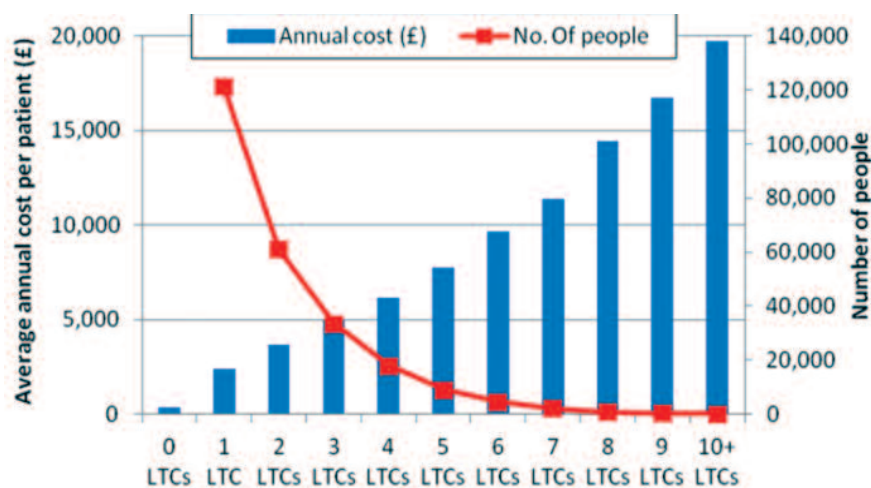


Figure 6 - The relationship between multimorbidity and average annual cost per patient

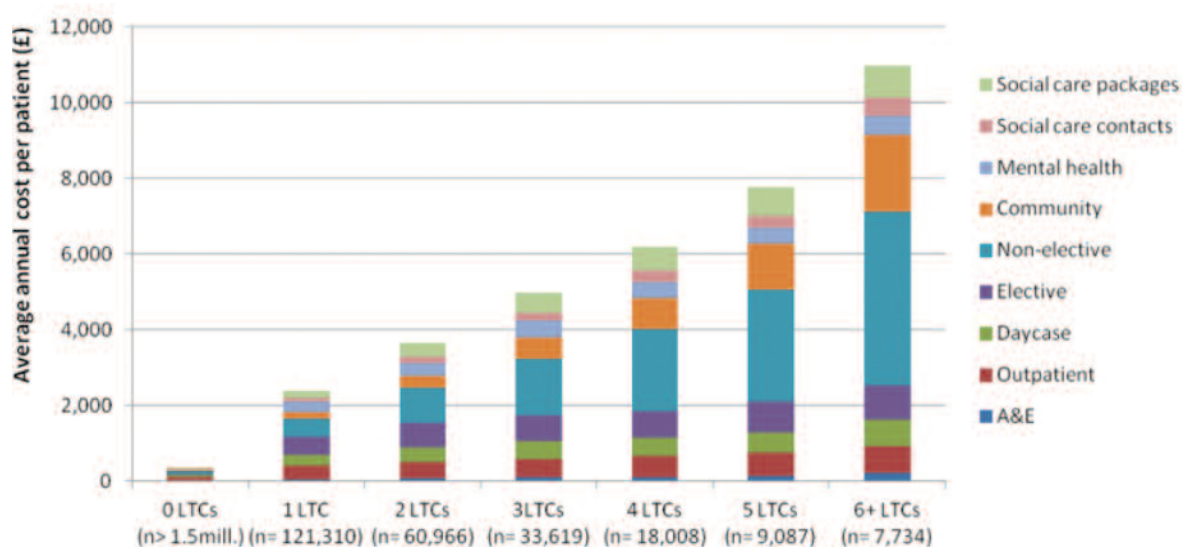


Multimorbidity and the pattern of services delivered to patients

The Somerset study⁴ found that the pattern of services delivered to patients varied by LTC and by the number of LTCs. For example, patients with asthma as one of their LTCs tended to receive a large percentage of their care in an acute inpatient setting; whereas patients with dementia as one of their LTCs tended to receive a large percentage of their care in mental health, community and social care settings. Also, the percentage of acute inpatient care for patients with asthma as one of their LTCs tended to increase as multimorbidity (the number of LTCs) increased.

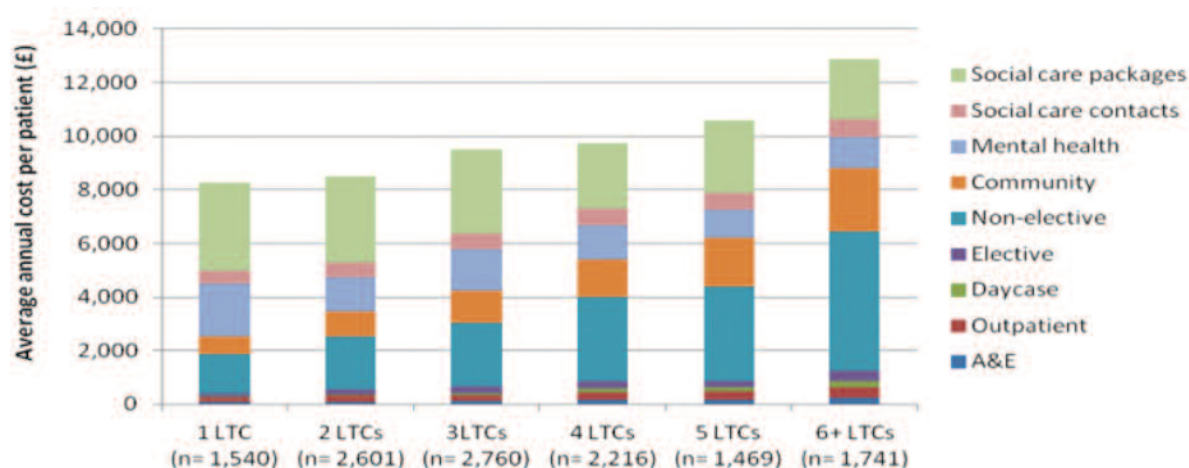
The Kent population analysis, the increase in health and social care costs for patients with greater multimorbidity (Fig. 6) tended to be driven mostly by acute non-elective costs and community costs (Fig. 7).

Figure 7 - Pattern of services received by patients with increasing multimorbidity



If dementia was selected as one of the LTCs (to mirror the analysis from the Somerset study⁴, then the pattern of delivered services is different to that in Figure 7, but the change in this pattern with multimorbidity is much the same (Fig. 8). This result is perhaps not surprising. This pattern of service could be interpreted as, 'patients with dementia need a certain level of mental health and social care support; but with greater multimorbidity (mostly resulting from an increase in the number of physical morbidities), patients require a greater level of support in acute non-elective and community settings.'

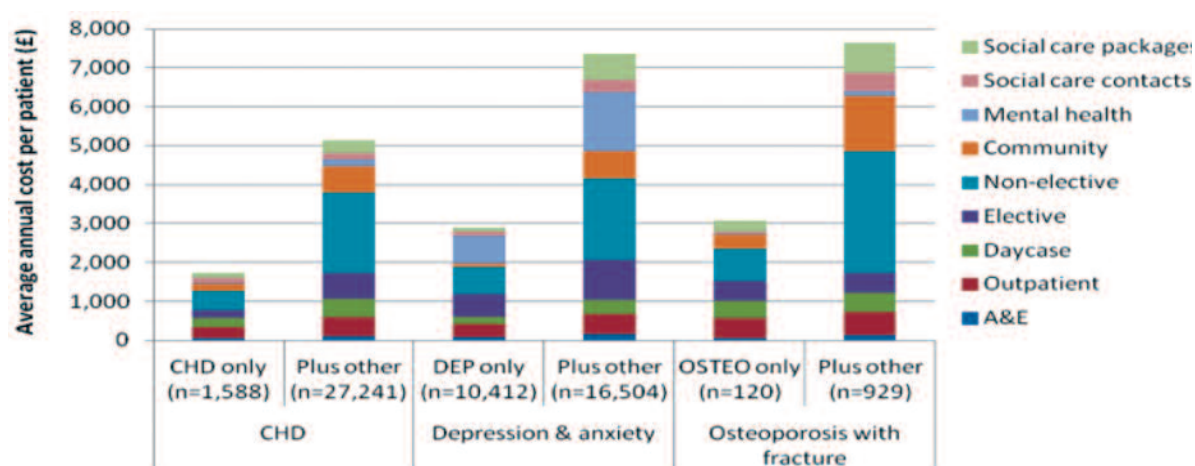
Figure 8 - Pattern of services received by patients with increasing multimorbidity where one of the LTCs is dementia



Looking at this in a slightly different way, Figure 9 compares the patterns of services delivered to patients with 3 different LTCs. These data suggest:

- The average annual cost per patient varies with LTC, and the pattern of services received by patients varies with LTC
- The change in average annual cost and pattern of services received also varies with LTC, but the general feature of increasing multimorbidity is an increase in acute non-elective and community costs.

Figure 9 - Pattern of services received by patients - one LTC with additional morbidities (Note: these 3 LTCs were chosen only to give a spread of examples)



- Require overall greater health and social care input (approximately £2,000 to £24,000 annual cost per patient, compared with £2,000 to £11,000 annual cost per patient in Figure 7).
- The bulk of this care is received in a mental health setting
- The increase in costs with greater mental health multimorbidity results from greater mental health costs, with smaller increases in acute inpatient and social care costs.

Average annual cost per patient (£)

LTC Category	n	A&E	Outpatient	Daycase	Elective	Non-elective	Community	Mental health	Social care contacts	Social care packages
0 LTCs	>1.7mill.	~500	~100	~100	~100	~100	~100	~100	~100	~100
1 LTC	38,133	~1,000	~500	~500	~1,500	~2,000	~1,000	~2,000	~500	~1,000
2 LTCs	3,057	~500	~500	~500	~2,500	~3,000	~1,500	~6,000	~1,000	~2,000
3 LTCs	117	~500	~500	~500	~2,500	~3,000	~1,000	~10,000	~2,000	~4,000

Selecting patients with complex health and social care needs

One of the basic building blocks of the Long Term Conditions Year of Care Commissioning programme² is to select a group of people whose health and social care would be suitable for management, using an integrated care model and funding through a Year of Care currency. The concept is not new. Kaiser Permanente have a population segmentation pyramid based on 'risk score' (Fig. 11), and the Scottish multimorbidity study¹ suggest a modification to this pyramid based on multimorbidity (Fig. 12). These 'pyramids' have been used to illustrate that there are a group of patients with complex health and social care needs that require much professional intervention.

Figure 11 - Kaiser Permanente population segmentation pyramid

(image from <http://www.minney.org/health-care-costing-and-kaiser-pyramid>)

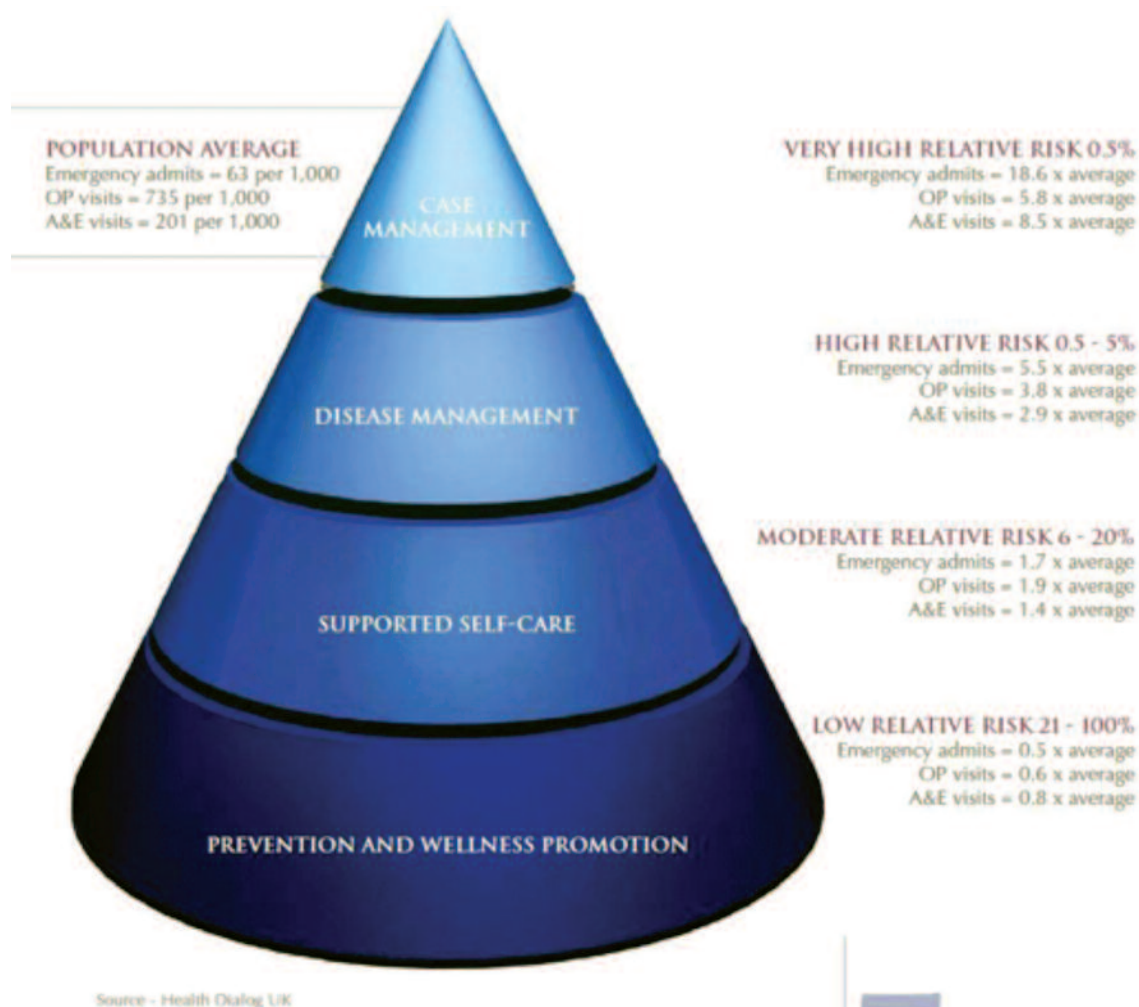
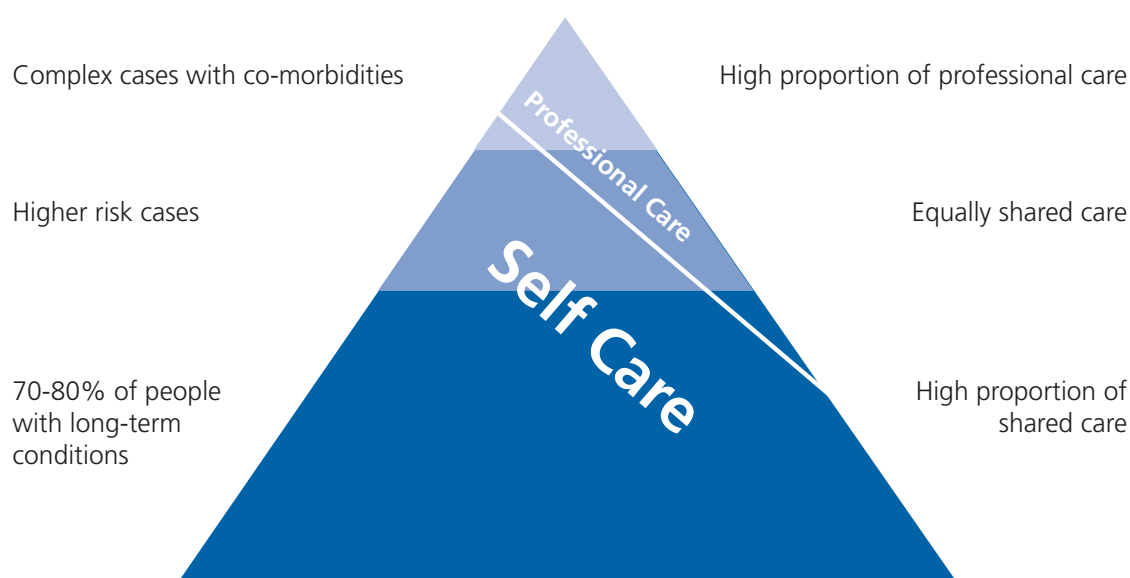


Figure 12 - Scottish multimorbidity population segmentation pyramid (equate to top three bands in the Kaiser Permanente pyramid) (image from Long Term Conditions in Scotland Final Report¹)



Rather than the risk score and multimorbidity methods for selecting patients with 'complex' needs, the Long Term Conditions Year of Care Commissioning programme Early Implementer teams initially tested an alternative approach, using the Decision Support Tool (DST) developed for NHS continuing care⁵. This method for selecting patients was rejected for two reasons. The DST was difficult to apply consistently both within a local economy by different assessors and between different local economies, and there was no strong relationship between DST scores and total health and social care cost.

In 2013 the programme tested the two other suggested methods, risk scores (scores for each patient calculated by an algorithm in a proprietary IT software package, where risk usually is risk of emergency admission to acute care within the next 12 months) and multimorbidity. Here, two groups of patients with 'very complex' health and social care needs were compared, one selected by risk score ('Band 1' patients, with risk score values in the top 0.5% for the Kent population - see Methods for fully description) and the other selected by multimorbidity (patients with 5 or more LTCs, this selected 0.3% of the total Kent population).

Comparison of the two groups of patients with 'very complex' health and social care needs indicated that these selection methods identify different groups of patients - only 36% of the patients are common to both groups (Figs. 13a and 13b). The patient groups are not too dissimilar. Over 90% of patients selected using multimorbidity had risk scores within the top 5% for the population, and approximately 75% of patients selected using risk scores had 2 or more LTCs.

⁵ Decision support tool for NHS continuing care, November 2012. Department of Health, Gateway Reference 18416

Neither selection method was substantially better than the other at selecting patients with mental health LTCs. Of patients selected by either method, approximately 35% of patients had a mental health LTC.

Figure 13a - Patients selected as 'very complex' using risk score, split by multimorbidity

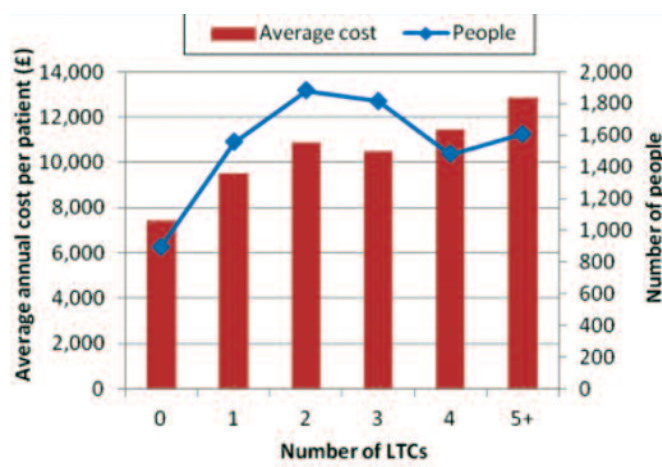
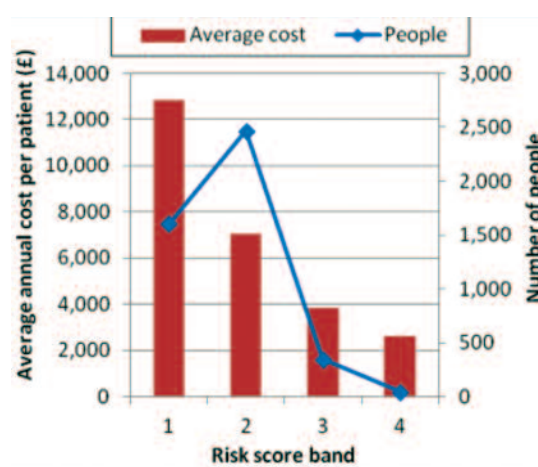
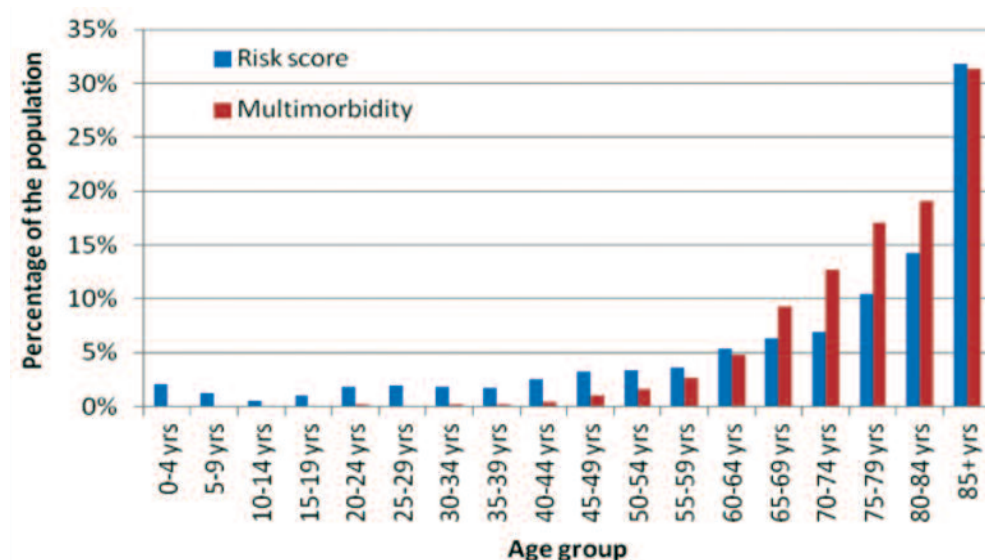


Figure 13b - Patients selected as 'very complex' using multimorbidity, split by risk score band (band 1 = top 0% - 0.5% risk scores for popn, band 2 = 0.5% - 5%, band 3 = 5% - 20%, band 4 = lowest 80% risk score for popn)



These two groups of patients differ in the age profile of selected people. Using multimorbidity to select patients selects a generally older population cohort (nearly 90% of multimorbidity selected people who were over 65 years, compared with 70% of risk score selected people over 65 years; Fig. 14).

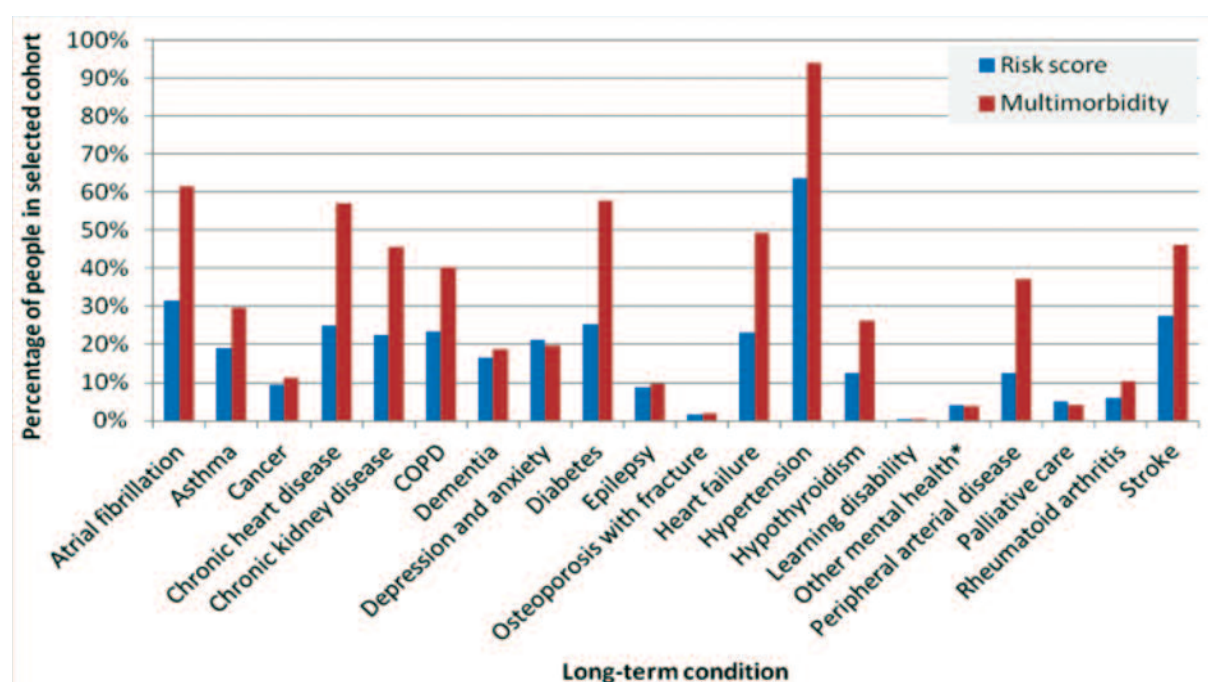
Figure 14 - Comparison of the age profile of selected patients with 'very complex' health and social care needs



The people selected using the two methods were relatively similar in disease profile (Fig. 15). Perhaps the only consistent differences were:

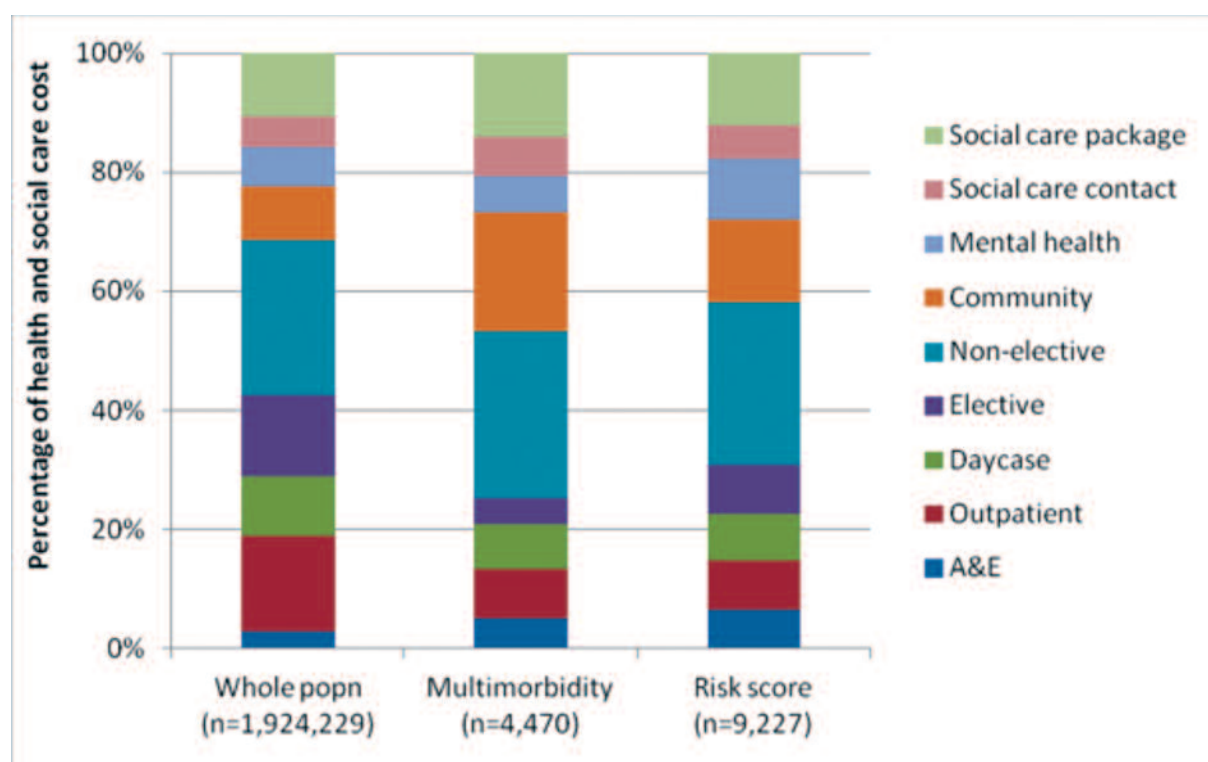
- Multimorbidity perhaps selected a greater percentage of patients with the most common physical conditions (e.g. atrial fibrillation, asthma, chronic heart disease, chronic kidney disease, COPD, diabetes, heart failure, hypothyroidism, peripheral arterial disease and stroke)

Figure 15 - Comparison of the disease profile of selected patients with 'very complex' health and social care needs



Patients selected with 'very complex' needs by risk score or multimorbidity tend to receive a greater percentage of care in community, mental health and social care settings (Fig. 16).

Figure 16 - Comparison of the pattern of services (by cost) delivered to selected patients with 'very complex' health & social care needs



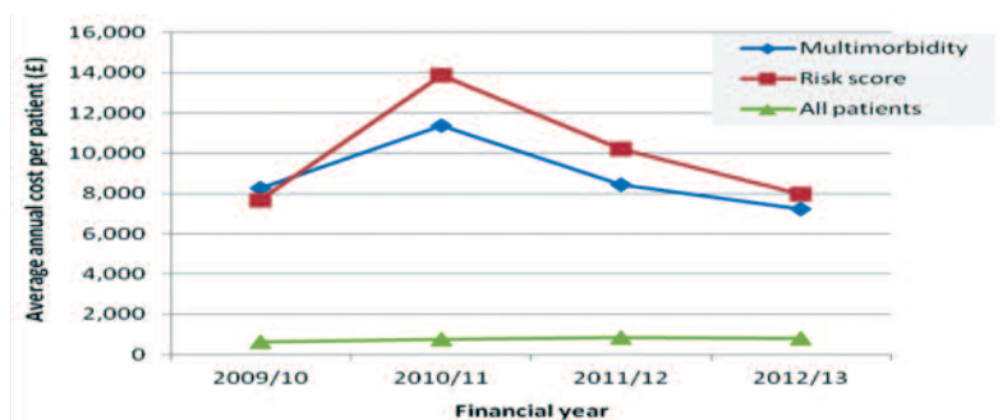
Trends in costs for selected patients

The Kent Early Implementer team describe a crisis curve as where people with complex needs enter a short phase of high resource usage, followed by a period of lower resource usage. This crisis curve is evident in Figure 17. In the Kent data set, a crisis curve is also evident for people with complex needs selected using the multimorbidity criteria used in this paper (Fig. 17), although to a lesser extent than for risk score selected patients.

It is noticeable that, although risk score population segmentation IT tools are expected to predict future resource usage, the resource usage in the year after risk score calculation is generally lower than in the calculation year. This requires further investigation.

Figure 17 - Trend in total health & social care costs

(Note: (1) Risk score - people with risk score in the top 0.5% for population at April 2011; (2) Multimorbidity - people with 5+ LTCs during the years 2009/10 or 2010/11; (3) Costs were adjusted and standardised between years as described in methods), page 19)



The trend in the pattern of service delivered to patients with 'very complex' needs is not different to what might have been expected from previous results. The crisis curve results mainly from an increase in non-elective costs, with the non-elective costs then decreasing in the following years (Figs. 18a, 18b, and Figs. 19a, 19b).

Figure 18a - Trend in pattern of service for patients selected as 'very complex' using risk score

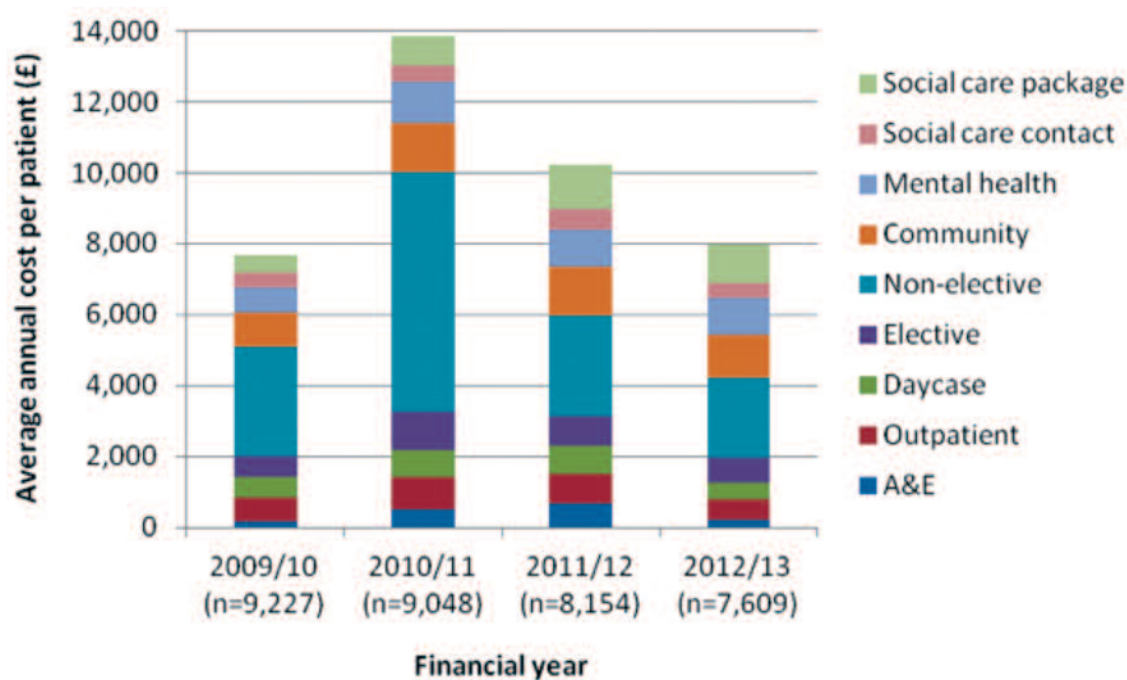
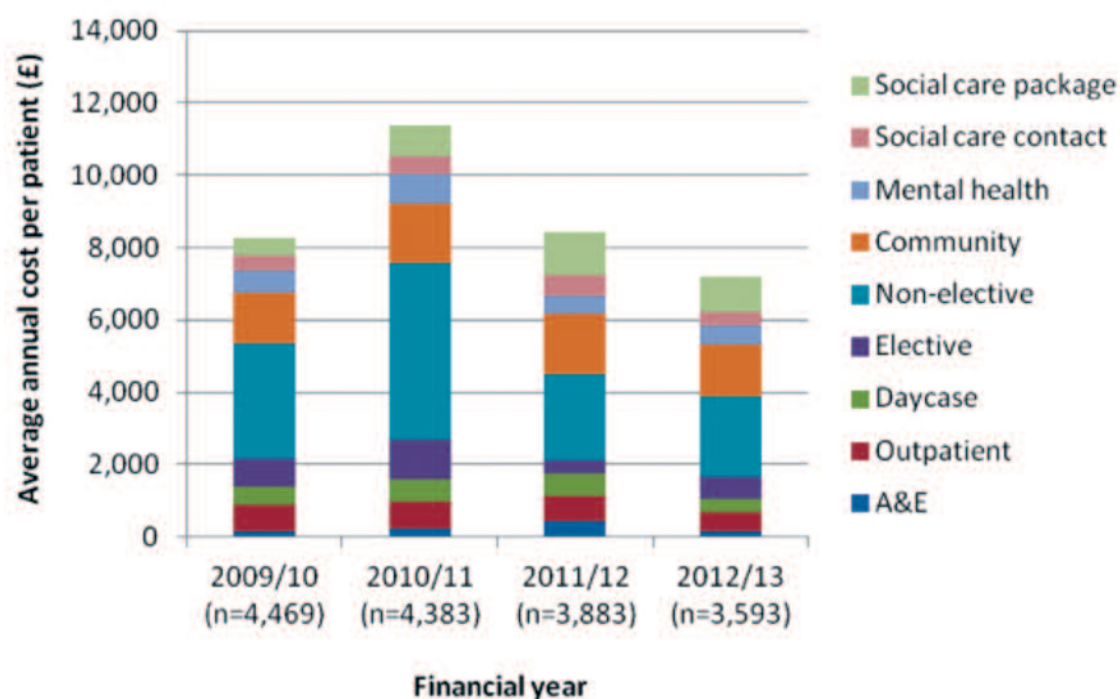


Figure 18b - Trend in pattern of service for patients selected as 'very complex' using multimorbidity



Note: (1) Only people in the Kent April 2011 population master file were included here; (2) Risk score - people with risk score in the top 0.5% for population at April 2011; (3) Multimorbidity - people with 5+ LTCs identified during the years 2009/10 or 2010/11; (4) Costs were adjusted and standardised between years as described in methods, page 19)

Perhaps more interesting is the comparison before and after the crisis curve. There is a clear shift from acute care to non-acute care, such that 1 year before the crisis curve over 2/3 of the total health and social care cost is in the acute sector, but 2 years after the crisis curve almost 50% of the cost of the health and social care patients received was in the non-acute sector (Fig. 19). This results from a steady increase in the percentage of care delivered in community and social care over the four year period and the sharp decrease in non-elective care costs in the years after the crisis curves.

More work is required to understand this change. While there was no formal change in service for these patients (i.e. these patients were not specifically targeted and there was no formal holistic integrated care service plan delivered to these patients), the data suggest that there was an 'informal' change in services delivered to some of these patients as patients became 'known' to community and social care providers.

Figure 19a - Trend in pattern of service for patients selected as 'very complex' using risk score

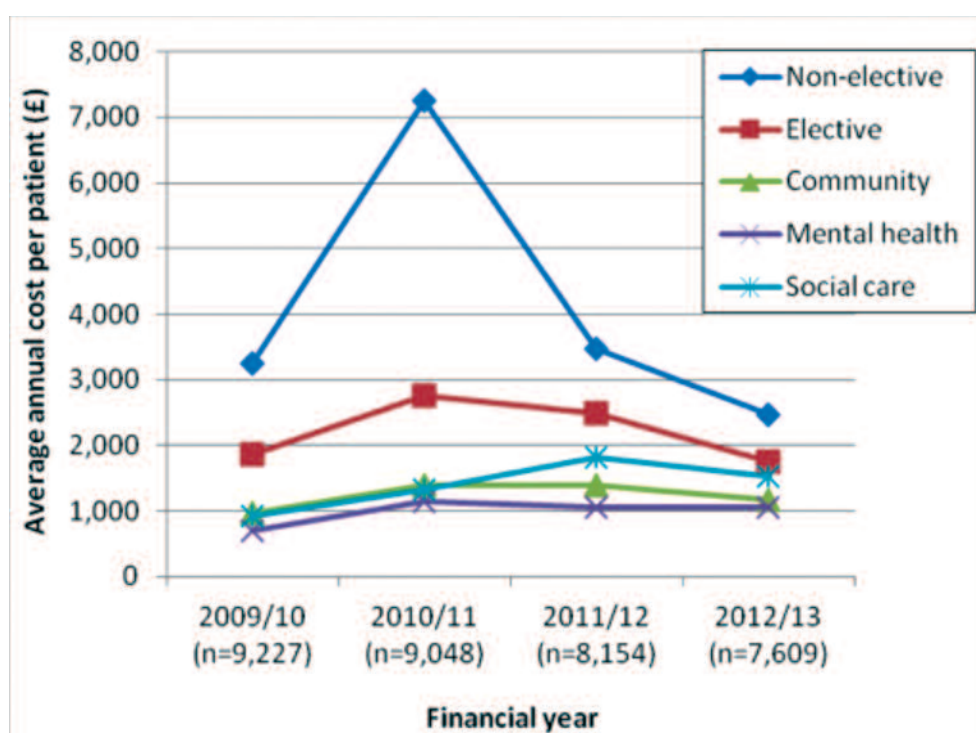
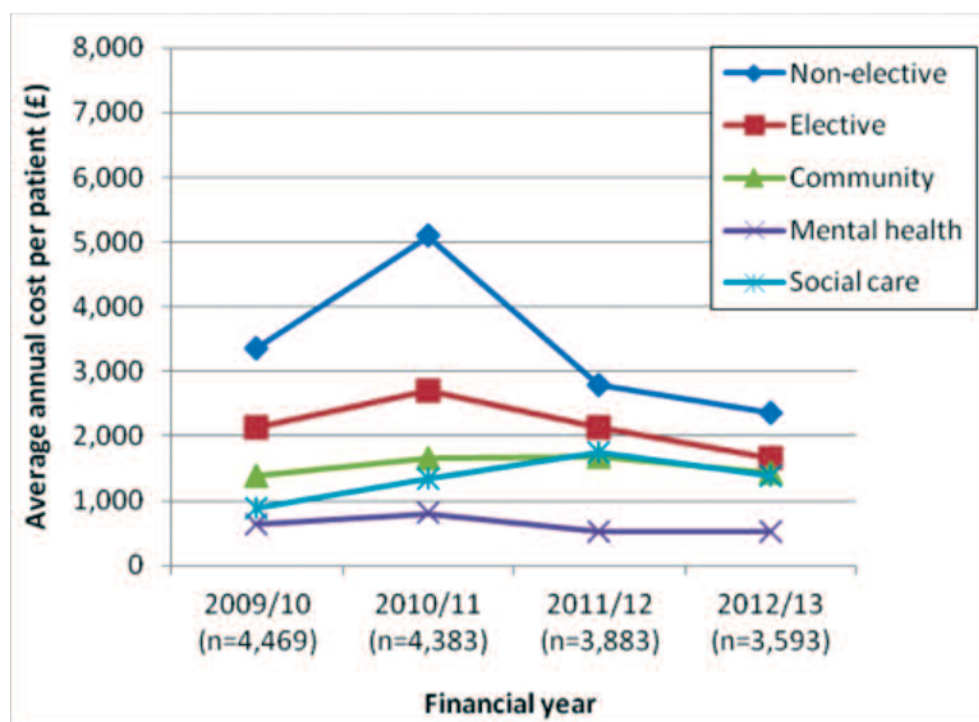


Figure 19b - Trend in pattern of service for patients selected as 'very complex' using multimorbidity



(Note: (1) Risk score - people with risk score in the top 0.05% for population at April 2011; (2) Multimorbidity - people with 5+ LTCs identified during the years 2009/10 or 2010/11; (3) Costs were adjusted and standardised between years as described in methods, page 19)

Stability of patient cohorts

The selection of patients using risk score or multimorbidity is based on the expectation that patients will continue to have 'very complex' health and social care needs for a reasonable length of time. Here, the assumption is tested by investigating the movement of patients out of the 'very complex' band.

Using risk scores, approximately 30% of patients move out of the 'very complex' band within 1 month and approximately 50% had moved out of this band within 5 months (Fig. 21a). After one year, 80% of patients have moved out of the 'very complex' band - this is true of both of the method for selecting these patients (Figs. 21a and 21b).

Figure 20a - Movement of patients out of risk score band 1

(top 0.5% of risk scores for the population)

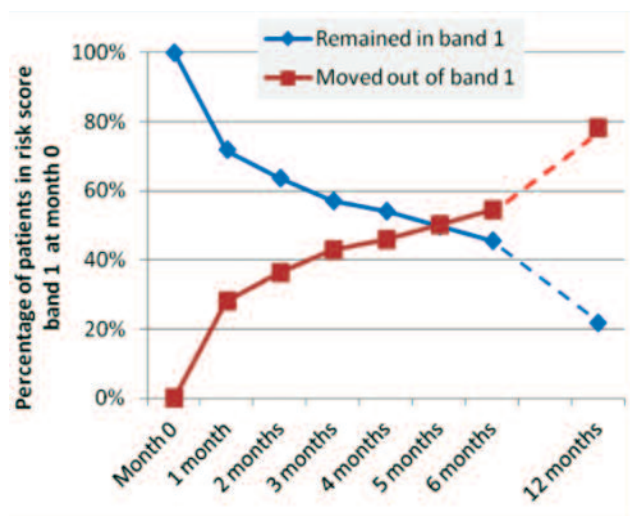
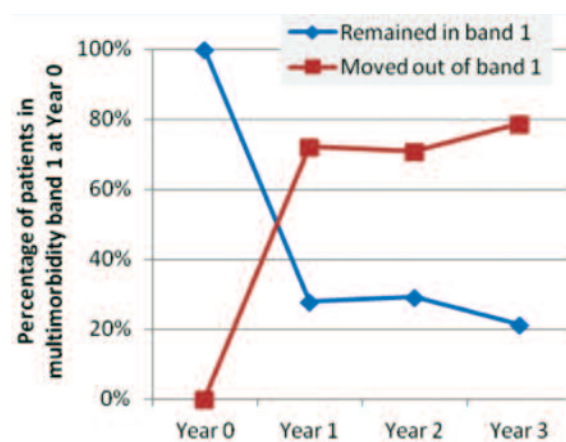


Figure 20b - Movement of patients out of multimorbidity band 1

(patients with 5+ LTCs)



IMPLICATIONS FOR THE LONG TERM CONDITIONS YEAR OF CARE COMMISSIONING PROGRAMME

Introduction

The main purpose for this initial analysis was to compare population stratification methods and to help define selection methods for people with 'very complex' health and social care needs.

Three methods of population stratification are mentioned in this paper:

- Risk stratification method described by the Kaiser Permanente pyramid
- Multimorbidity method described by the Scottish multimorbidity research programme
- DST method tested by the LTC Year of Care Commissioning programme Early Implementer teams.

Much of the analysis in this paper describes differences in the patient groups selected by the risk stratification and multimorbidity methods. However, there are many sub-methods within these two main methods. For example, each risk stratification IT tool has:

1. A different algorithm for calculating risk
2. Many of the tools calculate a different type of risk (e.g. 'risk of emergency admission in the next 12 months', 'risk of greatest total healthcare expenditure in the next 12 months')
3. Often the IT tool uses different input data sources for its calculation.

Similarly, there are different methods for calculating multimorbidity - the Scottish multimorbidity research programme¹ identified 40 LTCs mainly from Primary Care data, the Somerset work⁴ identified 49 LTCs using a wide variety of data sources (although again mainly from primary care). The work identified 20 LTCs using only hospital admission records.

The LTC Year of Care Commissioning programme would like to compare results from these multimorbidity studies with results where multimorbidity was identified using the Quality and Outcomes Framework (QOF) clinical indicators, (as this has the potential to be a nationally standardised selection method for multimorbidity based on existing data), but this was not possible with the Kent data.

One of the main conclusions from this paper (supporting previous evidence), is that risk score or multimorbidity alone appears to be useful population stratification methods. Two other complicating factors that have been considered to contribute to high health and social care cost - age and socio-economic status - have been found in other studies (Scottish¹ and Somerset studies⁴), to only contribute in a small way to the health and social care cost in comparison with multimorbidity.

Comparison of risk score and multimorbidity for population stratification

The data presented here suggests that either the risk score or multimorbidity could be suitable for selecting patients for a LTC Year of Care currency. Despite only 36% of people being common to groups selected by either method, both methods select patients who have high health and social care resource usage (Fig. 17). The current service delivered to both groups is similar (Figs. 16 and 18) and the trend in costs over 4 years is also similar (Fig. 17).

There are problems with both methods, mainly:

- As described above, there is not yet a single defined method that could be used nationally for either of these population stratification methods
- Both methods are retrospective to some extent - they select people who have greater health and social care resource usage in the year prior to measurement, than will have in the year following measurement (e.g. Fig. 17)
- People tend to move into and out of the 'very complex' category relatively quickly.

For these reasons, there is a need to continue searching for selection methods that suits the LTC Year of Care Commissioning programme's purposes.

Next steps for analysis

In terms of the selection of a group of people suitable for the LTC Year of Care currency, more work is needed on:

- As previously described, refinement of current selection methods and testing of alternative methods for selecting and, appropriate group of patients, including testing the use of QOF indicators and/or primary care 'read codes'
- Analysing the suitability of selection methods for identifying patients that others have suggested may not be appropriately identified by the methods tested so far; for example, frail elderly, patients with osteoarthritis, patients with mental health conditions as their main health and social care need. This analysis will be conducted in collaboration with other national programmes (e.g. Arthritis UK and NHS England frail elderly work, Mental health PbR currencies and tariffs).
- Understanding whether particular groups of patients should be excluded from a 'multimorbidity' capitated budget. There have been suggestions that patients with very high health and social care costs (for example, patients with learning and physical disability or patients in residential care whose annual care is likely to be greater than £50,000) should not be included within a capitated budget because their costs would add large financial variability (and hence financial risk) into the capitated budget. Clearly, exclusion from the financial mechanism would not mean that these patients would be excluded from the receipt of integrated services managed using an integrated care plan.

- Better adjustment for mortality in the data is required
- Understanding the similarities and differences between the selection methods – i.e. how many of the same patients are selected by the different methods and why? Following this, based on this extra analysis, should the programme be recommending that health and social care economies should be using more than one method for selecting patients?
- Understanding of the patients with high costs that are not being selected by the methods? Should we be selecting these patients? How can we tweak the methods to select these patients?
- Understanding the crisis curve, and in particular, how could you select patients moving into the crisis curve rather than once they are in crisis?
- Understanding of how and why patients move into and out of the patient cohort. This has a big implication on both: how long patients remain in the capitated budget, and the patients who are selected (e.g. do we want to select two types of patients – one method for patients suitable for short-term intervention where services are directed towards avoiding the crisis curve, and another method for patients suitable for long term intervention where services are directed towards supporting patients with long term care needs?).

The whole population analysis should help with other aspects of the LTC Year of Care Commissioning programme, for example:

- Testing what services should be included with the LTC Year of Care currency. For example, much elective acute care received by patients with multimorbidity is unlikely to be relevant to their overall health and social care need
- Testing whether the LTC Year of Care currency could be logically split into categories (e.g. high, medium, low health and social care resource usage). There are suggestions that the 'pairs' analysis (where a particular combination of conditions might attract a different local tariff than another combination of conditions⁶; e.g. Fig. 9), or the assessment of including one or more mental health LTCs (Figs. 8 and 10) could be used for this purpose
- Testing the movement of patients between multimorbidity categories (e.g. Fig. 20), with a view to developing a standard method for adjusting the patient cohort on a monthly or quarterly basis.

One aim for the LTC Year of Care Commissioning programme is to provide comparative analysis - to confirm that the conclusions from analysis of one whole population dataset could be confirmed by analysis of other whole population datasets.

Finally, one of the main purposes for this analysis is to provide evidence to support the development of a Framework for a Year of Care currency for people with complex health and social care requirements, and to inform the long-term pricing strategy for health and social care.

⁶Kadam UT, Uttley J, Jones PW, Iqbar Z. (2013) Chronic disease multimorbidity transitions across healthcare interface and associated costs: a clinical-linkage database study. *BMJ Open* 3: e003109. doi:10.1136/bmjopen-2013-003109.

METHODS

A large number of adjustments were made to the data in an attempt to categorise the data in a consistent way. These adjustments are listed here for reference.

A&E data

Total A&E activity and costs were low for 2010/11, but the unit cost seemed reasonable. Therefore, activity and costs were increased by a factor of 24/11 to match the overall cost and activity to other years.

Contract Year	SumOfTariff Total Payment	Attendances	Unit Cost
2009 - 2010	29,093,776	333,344	87.28
2010 - 2011 (before adjustment)	15,551,363	165,487	93.97
2011 - 2012	37,314,672	384,663	97.01
2012 - 2013	48,772,534	468,973	104.00

Admitted patient care data

'Well baby' spells as described in PbR guidance were excluded (using Treatment Function Code (TFC) and HRG code criteria).

2009/10 Admitted Patient Care (APC) spells had no cost values, and some spells in other years had no cost values (presumably these would normally have local tariffs). Average unit cost values were assigned where costs were blank. Average unit cost values for each year calculated using both TFC and POD (point of delivery) were assigned first, then averages for each year calculated using POD only were assigned if values remained blank. All costs for 2009/10 were based on average units cost calculated from 2010/11 data.

Outpatient data

Average unit costs calculated using TFC (first and follow-up attendances) or HRG (outpatient procedures) were assigned to any record with no cost. Average unit costs were calculated combining data from all years, but excluding any records with £0 and excluding any unit cost category (TFC or HRG) where less than 10 records were used for the calculation. Where records remained without a cost, average unit costs at the POD level were assigned.

Mental health data

No mental health data was available for 2012/13. No adjustment was made for this (although see adjustments for trends).

Community contact data

No costs were assigned to community contact activity records in the data we received.

Two mapping tables were created for community contact records to match (1) the service description or (2) the activity type to a limited list of service and sub-service descriptors. This limited list of services was then further mapped to cost categories. The cost categories from this whole population dataset were matched to the cost categories created from the costing dataset that had been separately provided by Kent Early Implementer team. The costs categories grouped together many service categories that in the costing dataset had similar unit prices. In this way, a small set of unit costs at the cost category level could be used to assign costs to all community contacts in the whole population dataset.

Cost Category	Unit Cost (£)
Therapy	101
Nursing	101
Community Team	130
Telephone	23
Other	59

Community inpatient data

No community inpatient data was available for 2009/10 or 2010/11. No adjustment was made for this (although see adjustments for trends).

No costs were assigned to community inpatient activity records in the data that was received.

In a similar way to above, a unit price for occupied bed days from the costing dataset (£278.47) was used to assign costs to community inpatient occupied bed days.

Social care data

Any social care record without a pseudonymised patient identifier that could be matched to one from the healthcare records was excluded.

The social care cost data seemed poor (or the descriptors for the activity were poor). The following changes were made:

- Costs were initially removed from any activity where the costs seemed unreasonable for the type of activity described. For example, any cost <£10 for activity described as hour or session, any cost <£25 for activity described as day or week, any cost <£250 for activity described as residential per week. Average unit costs were assigned to these records as described in the paragraph below.
- Some descriptions appeared to change from one year to the next, and so some descriptions with small numbers of records were changed to match a similar service with more records

Average unit costs by service description and unit type were calculated from data from all years (excluding records with no cost, and excluding any direct payment records). These average unit costs were assigned to all records with no cost value.

Assigning risk scores to people

In Kent, a local version of the King's Fund tool (combined predictive model) was developed, tested and rolled out by the Kent & Medway Health Informatics Service in mid 2012. The tool was applied to a historical Kent & Medway registered population of approx. 1.8 million, at a point in time ie. April 2011, and risk scores were generated (between 0 -100) based on each citizen's use of hospital services in the preceding 2 years. Risk scores for the whole population were arbitrarily divided and reported in 4 risk bands based on the Kaiser Permanente Pyramid – Band 1 being the top 0.5% population with the highest risk scores and Band 4 (remaining 80% population having the lowest scores).

Assigning LTCs to inpatient activity

ICD10 (diagnosis codes) from inpatient acute, community and mental health data were used to assign LTCs to patients. ICD10 codes in any position were used.

The technique used attempted to mimic the QOF clinical indicator LTC set (20 LTCs; see table below), using ICD10 codes rather than primary care read codes. Where possible, ICD10 codes from the Scottish multimorbidity study were used⁷, elsewhere ICD10 group descriptions were used to select relevant ICD10 codes for the remaining QOF clinical indicator descriptions.

The ICD10 to QOF clinical indicator LTC mapping tables are available on request.

⁷ Long Term Conditions in Scotland Final Report. <http://www.isdscotland.org/isd/5658.html>

Physical LTCs

Atrial fibrillation

Asthma

Cancer

Chronic heart disease

Chronic kidney disease

COPD

Diabetes

Epilepsy

Osteoporosis with fracture

Heart failure

Hypertension

Hypothyroidism

Peripheral arterial disease

Palliative Care

Rheumatology

Stroke

Mental health LTCs

Dementia

Depression and anxiety

Learning disability

Other mental health (includes schizophrenia, bipolar affective disorder and other psychoses)

Comparison of risk score and multimorbidity populations

Comparisons between the patient cohorts used the April 2010 population as a basis. The patient cohorts were selected using: (1) April 2011 risk scores; or (2) multimorbidity (using LTCs assigned to inpatient activity as described above) during the financial years 2009/10 and 2010/11.

Deaths in hospital

In an attempt to ensure that trend data (from year-to-year) were not affected by patients who died (a particular problem when selecting patients with 'very complex' care need and highest resource use), the study used the discharge destination and discharge method data-fields in APC and community inpatient datasets, to identify patients who died, and the year of death. These data indicate that deaths in hospital were poorly recorded in the financial years 2009/10 and 2010/11 by Kent providers.

	2009/10	2010/11	2011/12	2012/13
Deaths in hospital	7	509	8,034	7,813

Adjustments for trends

There was a substantial increase in the total cost of health and social care over the four years as represented in the data, particularly in non-elective and community costs (see table below). Only part of this difference was for activity increases, and part was for improvements in data quality. The following adjustments were made in an attempt to standardise values between years for trend comparisons:

- 2011/12 mental health values were replicated in 2012/13
- The actual annual change in costs at an activity type level for particular groups of patients were standardised by the whole population actual annual change, to ensure that trends in cost values for the particular group were 'real' trends rather than trends experienced by the whole population. To describe this in a different way, the whole population trend (annual change) in costs was subtracted from the trend (annual change) in costs for each selected population sample to remove any impact of the overall whole population trend (annual change) in costs on the trend for the selected population sample.
- Where trends in costs per patient values were analysed, the number of patients in any one year took into account the deaths in hospital that occurred in the previous year. No other changes in the base population could be adjusted.
- The base population (master patient table) was available for two snapshot dates, April 2011 and April 2012. All trend analysis was restricted to patients in the master patient table in April 2011.

Raw whole population trend in costs by activity type over 4 years

Activity type	2009/10 (cost £,000)	2012/13 (cost £,000)	4 year Difference	4 year % Difference
Acute-A&E	30,302	49,925	19,623	64.8%
Acute-Outpatient	213,335	274,560	61,224	28.7%
Acute-Daycase	116,915	135,437	18,523	15.8%
Acute-Elective	146,079	175,020	28,941	19.8%
Acute-Non-elective	287,463	492,344	204,881	71.3%
Community-contacts	89,192	149,792	60,600	67.9%
Mental health*	114,518	105,704	-8,813	-7.7%
SC-contact	58,367	79,138	20,772	35.6%
SC-package	157,945	179,397	21,452	13.6%
Total	1,214,115	1,641,317	427,203	35.2%

Data processing

The data arrived in many datasets with varying formats. Data was combined into two main tables: a master patient table with a pseudonymised patient identifier for each patient; and an activity table that included all activity from all sources combined. The master patient table contained a small number of patient demographic variables, the calculated LTCs, and risk scores.

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