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# Social gradients in health and social care costs: Analysis of linked electronic health records in Kent, UK



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## ABSTRACT

**Objectives:** Research into the socio-economic patterning of health and social care costs in the UK has so far been limited to examining only particular aspects of healthcare. In this study, we explore the social gradients in overall healthcare and social care costs, as well as in the disaggregated costs by cost category.

**Study design:** We calculated the social gradient in health and social care costs by cost category using a linked electronic health record data set for Kent, a county in South East England. We performed a cross-sectional analysis on a sample of 323,401 residents in Kent older than 55 years to assess the impact of neighbourhood deprivation on mean annual per capita costs in 2016/17.

**Methods:** Patient-level costs were estimated from activity data for the financial year 2016/17 and were extracted alongside key patient characteristics. Mean costs were calculated for each area deprivation quintile based on the index of multiple deprivation of the neighbourhood (lower super output area) in which the patient lived. Cost subcategories were analysed across primary care, secondary care, social care, community care and mental health.

**Results:** The mean annual per capita cost increased with deprivation across each deprivation quintile, with a cost of £1205 in the most affluent quintile, compared with £1623 in the most deprived quintile, a 35% cost increase. Social gradients were found across all cost subcategories.

**Conclusions:** Health inequalities in the population older than 55 years in Kent are associated with health and social care costs of £109m, equivalent to 15% of the estimated total expenditure in this age group. Such significant costs suggest that appropriate interventions to reduce socio-economic inequalities have the potential to substantially improve population health and, depending on how much investment they require, may even result in cost savings.

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## Introduction

Health inequalities have been described as ‘*the systematic differences in the health of people occupying unequal positions in society*’, for example, due to differences in income, education, occupation, material resources and social status.<sup>1</sup> Reducing these inequalities has become a key policy objective both in the UK<sup>2</sup> and internationally,<sup>3</sup> but despite this, health inequalities remain persistent and progress in reducing them has been a challenge.<sup>4,5</sup>

Despite the vast literature demonstrating the existence of health inequalities, there has been less research into their impact on healthcare costs in England. A recent study of national hospital data by Asaria et al.<sup>6</sup> found that inpatient costs in England in 2011/12 were 31% higher for patients in the most deprived quintile than for those in the most affluent quintile and estimated that the total annual cost associated with this inequality was £4.8bn. Another study of inpatient hospital costs by Kelly et al.<sup>7</sup> found a 35% difference in costs between the most and least deprived quintiles, in patients older than 65 years. A study by Charlton et al.<sup>8</sup> on primary care data in the UK found that deprivation was associated with greater morbidity and increased healthcare costs. No studies were found exploring this relationship on services outside of secondary care and primary care.

There has also been research on the relationship between deprivation and healthcare utilisation, from which the impacts on costs can be reasonably inferred. Reviews of the literature by Dixon et al.,<sup>9</sup> Goddard and Smith<sup>10</sup> and Cookson et al.<sup>11</sup> conclude that deprived groups tend to consume more healthcare due to greater health needs. However, these inequities vary by service: in general, poorer populations tend to use more general practitioner (GP) services, relative to need, than affluent groups but are less likely to be referred on for specialist elective care. Uptake of health promotion and preventative services was also found to be lower in areas of high deprivation.<sup>10,11</sup>

In multiple studies, deprivation has been found to be a strong predictor of accident and emergency (A&E) attendance and hospital admission.<sup>12–15</sup> The studies' authors suggest many possible reasons for this: increased need for healthcare, less capability for self-care, lack of awareness or understanding of the most appropriate health services and lower uptake of preventative services. This demonstrates the importance of looking at impacts between different services because they may be linked: lower use of preventative services may lead to higher use of emergency services. For example, one study showed that deprived populations had higher A&E attendance but lower use of the National Health Service (NHS) telephone line, ‘NHS Direct’.<sup>16</sup> Goddard and Smith's<sup>10</sup> review describes the difficulties in capturing the impacts of deprivation across the wide range of complementary and substitute services involved in long-term care, such as social care, due to the complexity of different providers involved and differing funding streams. At present, social care in the UK is funded from local authority budgets rather than via the NHS.

Given the policy goals of the NHS to better integrate care between these different sectors,<sup>17</sup> it would be informative to

assess the system-wide association between deprivation and costs. We found no literature on the socio-economic patterning of social care or community care costs. However, given that it is well established that there is a higher prevalence of multimorbidity and chronic long-term conditions in deprived populations,<sup>18–20</sup> we would expect this to be reflected in higher community care and social care costs in deprived groups. Similarly, there was also no literature on the association between deprivation and the cost of mental health services. Again, we know that the prevalence of mental health conditions is associated with deprivation,<sup>18,20,21</sup> and so we would also expect a social gradient in mental health expenditure with higher costs for those living in more deprived areas.

The difficulties in analysing system-wide impacts can be overcome through the analysis of linked electronic health records. The Kent Integrated Dataset (KID) is a ‘whole-population’ database, developed by Kent's local authority public health team since 2014, which links patient-level data across primary, secondary, community, mental health and social care while anonymising personal data.<sup>22</sup> The database includes data for all residents of Kent and from most of the healthcare and social care providers in the area, linked by means of the patients' NHS number as a common identifier.

This study evaluates the association between socio-economic deprivation and annual per capita costs of health and social care in Kent. Previous studies at a patient level have tended to focus on a particular type of cost, such as hospital costs or primary care costs. The more comprehensive nature of this study and the disaggregated analysis by cost category is important because there may be differential impacts of deprivation across care settings, and impacts on one part of the system may be compensated for by impacts on other parts of the system.

## Methods

Patient data were extracted from the KID using Microsoft SQL Server. Age is known to be a key determinant of healthcare expenditure, with older people more likely to utilise healthcare and social care services. Because of this, the study was restricted to people older than 55 years, as a group with high care costs overall. Therefore, the inclusion criteria were people older than 55 years and currently alive, with a registered address in Kent, as of 1st May 2017. From this population list (502,675), some were excluded because of gaps in cost data: 85 of 238 GP practices in Kent were not flowing activity data into the KID during the study period, and we therefore excluded patients registered to these practices. This resulted in a study sample of 323,401, which is 63% of the total population older than 55 years.

The English Index of Multiple Deprivation (IMD) was used as an area-based measure of deprivation, by quintile, for each patient based on lower super output area (LSOA) of residence. LSOAs are a standardised geographical unit for reporting small area statistics whereby each LSOA has around 1500 residents that are relatively socially homogenous. There are 32,844 LSOAs in England and 902 in Kent. Kent is a large county in South East England, with 1.6 million residents from a wide spectrum of social backgrounds; certain areas in Kent

feature among the most deprived and the most affluent in the country. Areas of deprivation tend to be concentrated around urban centres and in particular the eastern coastal towns, whereas areas of affluence are often found in the more rural parts of the county.

Healthcare costs for each patient in the financial year 2016/17 were estimated from utilisation activity, taken from providers across primary care, secondary care, community care, social care and mental health services. Unit costs in the database were calculated in various ways across these sectors of care.<sup>23</sup> Primary care unit care costs were taken from the Personal Social Services Research Unit (PSSRU) manual of reference costs.<sup>24</sup> Secondary care unit care costs were taken from the national tariff price for that activity. For community care and mental care, which are commissioned by block contracts, unit costs were taken as the mean costs of activity; calculated by dividing the total sum of the contract by the throughput of activity. Social care costs were taken from Kent County Council's 'SWIFT' database which includes monthly billed invoices for each person receiving social care services. The database attempts to include all costs across health and social care in Kent, although there are some gaps, as described in Appendix 1.

Mean total costs were calculated for each deprivation quintile using IBM SPSS version 23. Generalised linear model (GLM) regression was also performed to assess the role of age and gender as potential confounders, although this was found to have little impact on the relationship between mean costs and deprivation quintile (Appendix 2). Mean costs were also calculated across the cost subcategories. For each cost category, the total costs in the Kent population associated with deprivation were calculated using the formula:

$$\sum_{i=1}^4 (P_{Qi} * (C_{Qi} - C_{Q5}))$$

where

- P = population size
- C = mean cost
- Qi = deprivation quintile 'i'
- Q5 = most affluent quintile
- $\sum$  = sum for deprivation quintiles 1 to 4.

This gives, for each cost category, the hypothetical reduction in healthcare and social care costs in Kent if the social

gradient in costs was eliminated, that is, if the whole population older than 55 years had the same mean per capita costs as those living in the most affluent quintile of LSOAs.

## Results

The study sample was 323,401 (Table 1). This compares to a whole population of 512,120 people in Kent older than 55 years and follows exclusion of patients registered to GP practices not flowing data to the KID. The sample was highly representative of the overall population of Kent, with very similar mean age, gender split and distribution among the deprivation quintiles.

Costs increased with each deprivation quintile, with mean annual cost of £1623 for people living in the most deprived quintile compared with £1205 in the most affluent quintile. This difference of £418 represents a 35% increase in per capita costs between the least and most deprived quintiles (Table 2).

A social gradient is observed across all cost categories (Fig. 1). Secondary care costs, as the largest component of per capita costs, increased by £141 between the least and most deprived quintiles, an increase of 27% (Table 2). Social care costs increased by £121 (47%), and primary care costs increased by £74 (26%). Mental health and community care are smaller components of overall per capita costs, but the cost increases (£44 and £37, respectively) represent steep social gradients (66% and 54%, respectively).

Overall, the cost variation by deprivation is associated with about £111m of additional costs across Kent, representing 15% of the total healthcare and social care costs in the Kent population older than 55 years (Table 3). In absolute terms, the largest of these additional costs by cost category are in secondary care and social care (£37m and £39m, respectively). When looked at in relative terms, larger proportions of the overall costs in social care, community care and mental health are associated with deprivation (23%, 22% and 27%, respectively) than with secondary care (12%) and primary care (8%) (Table 3).

## Discussion

The annual mean per capita cost was £1629 in the most deprived quintile compared with £1211 in the least deprived quintile. There was a clear social gradient in mean costs

**Table 1 – Study population.**

Characteristic		Study sample	Kent population (older than 55 years)
Population size		323,401	512,120
Age	Mean age	68.9 years	69.0 years
Gender	Male	152,773 (47.2%)	241,652 (47.2%)
	Female	170,628 (52.8%)	270,468 (52.8%)
Deprivation	Q1 – most deprived	29,646 (9.2%)	53,414 (10.4%)
	Q2	52,721 (16.3%)	82,405 (16.1%)
	Q3	77,186 (23.9%)	128,380 (25.1%)
	Q4	87,397 (27.0%)	138,546 (27.1%)
	Q5 – least deprived	76,448 (23.6%)	109,375 (21.4%)



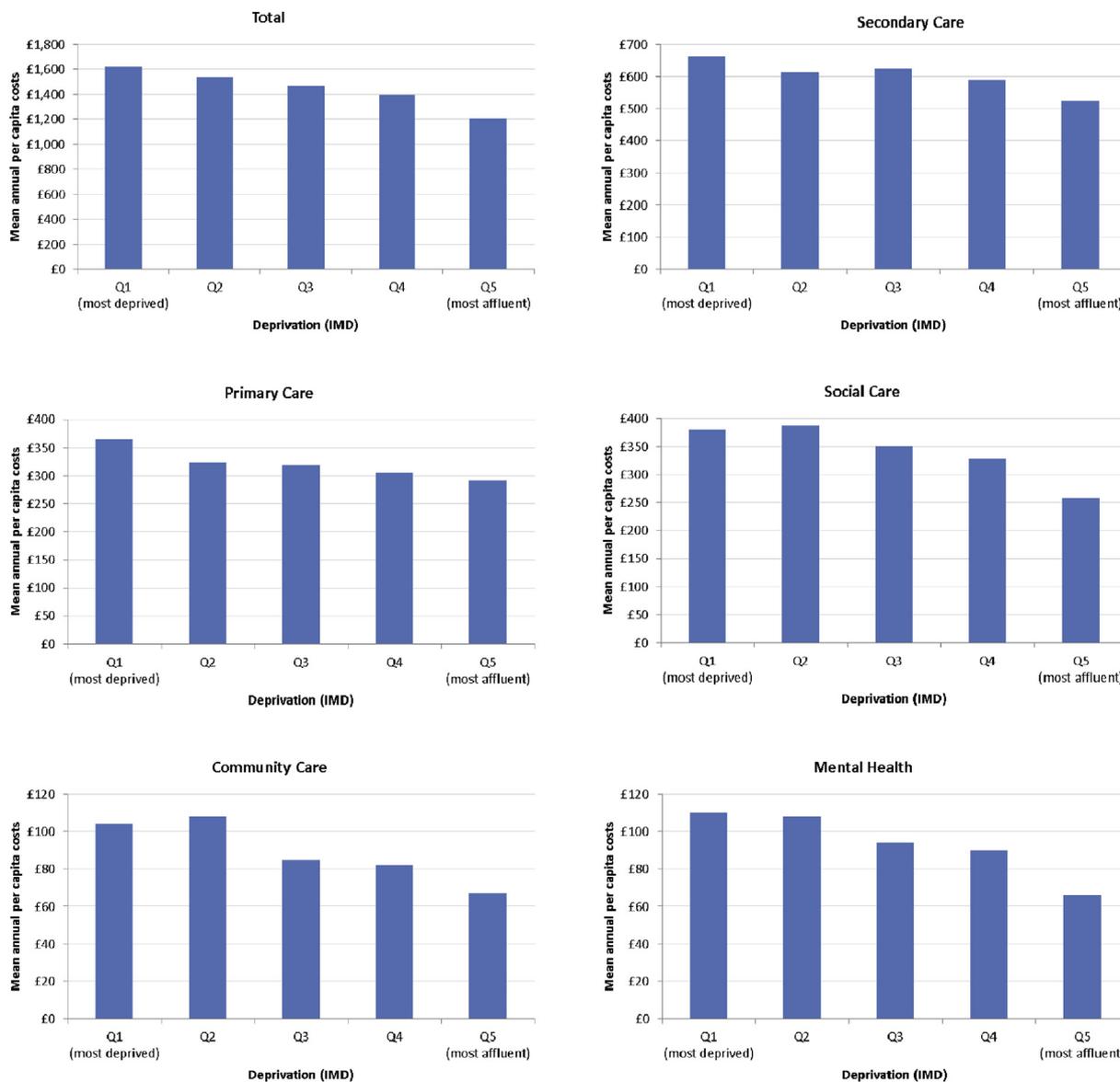


Fig. 1 – Mean annual per capita costs by deprivation quintile for each sector of care. IMD, Index of Multiple Deprivation.

sectors, which distinguishes this analysis from existing literature on the topic.

The main limitation of this study is that use of an area-based measure of deprivation risks the ecological fallacy; just because someone lives in a deprived area does not mean they themselves are deprived, and vice versa. However, individual measures of deprivation cannot be easily linked to routine health service data. Furthermore, this is a cross-

sectional analysis, in which deprivation status is based on the area in which someone is currently living. This is a snapshot measure, which does not account for the fact that people may have recently moved house into or out of deprived areas. Another factor that could not be analysed from the routine data available was patient utilisation of private healthcare services, which would act as a substitute for NHS care. Roughly 11% of the UK population has some form of

Table 3 – Costs attributable to deprivation in the Kent population older than 55 years.

Cost category	Secondary care	Social care	Primary care	Community care	Mental health	Total
Costs associated with deprivation	£36.9m	£38.7m	£12.3m	£9.7m	£12.6m	£110.8m
Total costs	£305.m	£171.m	£161.3m	£44.1m	£46.5m	£727.9m
Proportion of costs associated with deprivation	12.1%	22.6%	7.6%	22.1%	27.1%	15.2%

health insurance,<sup>26</sup> and because more affluent populations are more likely to have insurance, this study's findings of lower NHS costs in affluent groups may in part be a reflection of this. On the other hand, only patients registered to a GP are included in the analysis. This means that vulnerable groups who are less likely to be registered in primary care (such as asylum-seekers, ex-offenders and the homeless) may be under-represented, despite the fact that these groups have high health needs.<sup>27</sup> This might therefore lead to an underestimate of the costs associated with deprivation.

The findings of this study suggest that socio-economic inequalities are associated with around 15% of overall healthcare and social care costs in those older than 55 years in Kent, ranging from 7.6% for overall primary care costs to 27.1% for overall mental care costs. If the Kent population is representative of the national picture and if the relationship applies to other age groups and costs more broadly, this would mean that inequalities are associated with £674m of the £8.88bn spent in primary care,<sup>28</sup> £2.63bn of the £9.72bn spent on mental health<sup>29</sup> and £8.64bn of the £71.4bn spent in secondary care.<sup>30</sup>

While reducing inequalities in health is often seen as a moral imperative, the results of this study indicate that it may also result in significant cost savings on healthcare and social care systems. However, this would depend on the level of public expenditure required to reduce health inequalities (assuming that effective interventions exist), and fully eliminating social gradients is probably unrealistic. Nonetheless, the findings suggest that health resources could be better redistributed to address health inequalities; preventative interventions targeted towards populations in deprived areas might reduce the onset of ill-health in these groups, leading to savings to both the NHS and local authorities. Other upstream interventions that address the social determinants of health should be explored to tackle the primary causes of deprivation in the first place. Public health professionals could use the results of this study to make a stronger economic case for policy action to reduce inequalities in health.

## Author statements

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### Ethical approval

This study was approved by London School of Hygiene and Tropical Medicine MSc Research Ethics Committee, and also Kent County Council.

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None declared.

### Competing interests

None declared.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2019.02.007>.