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Southwark and Lambeth Integrated Care

Evaluation of the Older People's Programme

Final report

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Preface

In 2012 the Southwark and Lambeth Integrated Care (SLIC) Older People's Programme was initiated. It was wide-ranging and aimed to maximise the health and independence of older people and minimise inappropriate hospital use in times of crisis. The Older People's Programme ran for four years up to March 2016.

Formative and summative evaluations were commissioned to run in parallel to the Programme from August 2012. The evaluation was commissioned as four components:

1. The King's Fund was commissioned to look at the process of change (final report published 2015).
2. Picker Europe was commissioned to evaluate patient experience (final report published 2015).
3. RAND Europe and the University of Cambridge were commissioned to evaluate the impact on hospital utilisation (this report).
4. The London School of Economics was commissioned through RAND Europe to examine cost-effectiveness.

Subsequently, King's College London (KCL) was commissioned in 2015 to undertake a short-term evaluation of the Programme, including an assessment of its impact on hospital utilisation; their report was published in 2016.

This report presents the final findings from the evaluation of changes in hospital utilisation and length of stay among people aged 65 years and over registered with general practitioner (GP) practices in Southwark and Lambeth compared to similar populations in the rest of England (component three of the four original commissions listed above). Our findings differ from those in the KCL report and the reasons for this are discussed in our report.

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Plain English summary

Background to study: Southwark and Lambeth Integrated Care (SLIC)

Older people often need care from several different health care professionals, for example from their general practitioner (GP), specialist doctors and other staff based in hospital or in primary care. They may need additional support such as help getting dressed and washed in the morning, which is provided by social services. This separation of care across different parts of the NHS and between health and social care can result in patients experiencing gaps in their care, especially when they move from home to hospital, and vice versa. This often leads to increased costs for the NHS, for example when hospitals face difficulties in discharging patients who could be cared for at home. This can result in patients being kept in hospital for longer than they need.

The need to improve patient experience and improve the efficiency of the NHS has led to an increasing focus on 'integrated care'. Integrated care involves staff working in primary care working more closely with hospital staff and with social care services to provide the different elements of care that a person needs. Southwark and Lambeth Integrated Care (SLIC) was set up in 2012 to bring together GPs, local hospitals and local authorities (which are responsible for social care). The SLIC Older People's Programme consisted of a number of different projects. It aimed to join up services to provide more care in people's homes and to support older people to stay as well and independent as possible. The aims of the Older People's Programme were to avoid people having to go into hospital unless necessary, and to help people in hospital to return home more quickly.

What did we do?

We were asked to look at what impact the Older People's Programme had on hospital use. We looked at whether there had been any changes in how often people aged 65 years and over registered with GP practices in Southwark and Lambeth were admitted to hospital and, if they were admitted, how long they stayed in hospital. We looked at changes for six different types of hospital use:

1. Accident and emergency (A&E) attendance: Also known as emergency department and casualty.
2. Emergency admissions: When a patient's admission to hospital has not been planned in advance and has to be arranged as quickly as possible. For example, patients in the A&E department who need to be admitted to hospital for follow-on care. Patients will normally stay in hospital for at least one night.
3. Emergency admissions for ambulatory care sensitive conditions (ACSCs): These are admissions for patients with conditions where effective community care and integrated care can help prevent

the need to be admitted to hospital. An admission for an ACSC is sometimes seen as a sign of poor quality care being provided in the community.

4. Outpatient attendance: An appointment arranged in advance for a patient to see a specialist in an outpatient clinic.
5. Elective inpatient admissions: When a patient's admission to hospital has been planned in advance; for example, for cataract surgery or a hip replacement.
6. Length of stay in hospital: The number of nights a patient spends in hospital. Patients admitted and sent home from hospital on the same day have a length of stay of less than one day.

To understand whether any changes in hospital use were a result of the Older People's Programme, we compared changes in Southwark and Lambeth to changes occurring over the same time period among similar populations from GP practices in the rest of England. The results of our study tell us whether any changes in hospital use in Southwark and Lambeth were different from what would have been expected if the Programme had not been introduced.

In addition, we measured whether changes in hospital use were likely to be due to specific parts of the Programme known as holistic assessments (HAs) and integrated care management (ICM). Each HA involved looking at the patient's physical health, mental health and social care needs as well as wider social aspects of daily living (e.g. benefits and housing). Based on these assessments, some patients would be identified as needing ICM, i.e. receiving additional support for the problems identified.

What did we find?

Compared to other parts of the country, we found that older people in Southwark and Lambeth visited A&E and were admitted to hospital as an emergency more often than expected in the first two years of the Older People's Programme (2012 to 2014). However, in the next two years they attended A&E less often than we would have expected (6 per cent less by the end of the Programme). Despite this, we found no reductions in people who were actually admitted to hospital as an emergency when we compared Southwark and Lambeth practices with similar practices in England.

The number of older people attending outpatient clinics and the number of non-emergency hospital admissions of older people from Southwark and Lambeth were lower than would have expected compared with practices in other parts of England (6 per cent fewer by the end of the Programme). However, GP practices that carried out more HAs, and especially those which had undertaken more ICM, had more outpatient visits and planned admissions by their patients compared to those that carried out fewer of these interventions. This suggests that HAs and ICM might be identifying unmet needs, i.e. conditions that might benefit from hospital referral and were more likely to be picked up in patients who received these interventions.

The Older People's Programme made no difference to the length of time patients spent in hospital.

Table of contents

Figures

Tables

Executive summary

Background

The Southwark and Lambeth Integrated Care (SLIC) Older People's Programme, set up in 2012, aimed to maximise the health and independence of older people and minimise unnecessary hospital utilisation. SLIC brought together GPs, hospitals and local authorities to redesign services and provide better integrated care for people aged 65 and over. The Older People's Programme ('the Programme') consisted of many different activities, which addressed a range of aspects of health and social care.

The business case for SLIC outlined ambitious targets for the Programme including a 14 per cent reduction in emergency bed days for people aged 65 and over in the first three years of the Programme. The target was later reduced from 14 per cent to 5 per cent following slower than anticipated implementation of key aspects of the Programme and simply reducing the previous growth in admissions was regarded as an important aim. This evaluation was commissioned to run in parallel with the Programme, from August 2012 until the end of the Programme in March 2016, to examine changes in hospital use by those aged 65 and over registered with GPs in Southwark and Lambeth that followed implementation of the Programme.

Methods

We examined changes in hospital use in Southwark and Lambeth among those aged 65 and over from the Programme's inception in October 2012 to the end of SLIC in March 2016. Patterns of hospital utilisation were compared to background trends and changes in a set of matched control practices from other parts of England. Six outcome measures of hospital use by patients aged 65 and over were included in the analyses:

1. Accident and emergency (A&E) attendance.
2. Emergency hospital admissions.
3. Emergency hospital admissions for patients with admissions for ambulatory care sensitive conditions (ACSCs). These are conditions for which, emergency admission might be avoided by improved care in the community.
4. Outpatient attendance.
5. Elective hospital admissions including day case admissions.
6. Inpatient length of stay.

For each of the outcomes, we estimated overall changes in hospital use among people aged 65 and over registered with GP practices in Southwark and Lambeth from the introduction of SLIC compared to what would have expected in the absence of the Programme. Expected rates of hospital use were informed by national trends in a matched group of control practices, allowing for trends in hospital use in individual Southwark and Lambeth practice before the introduction of the Programme. In this analysis, all practices within Southwark and Lambeth were treated as if they were delivering the same intervention. As well as using practices outside Lambeth and Southwark as controls, the method of analysis measures within-practice change, which allows for practices in Lambeth and Southwark being 'special' in some way, for example, ethnic profiles that are different from other parts of the country. By analysing rates of hospital utilisation in different age and gender groups, we also allow for potential changes in the age profile of the population over the course of the study period.

A second set of analyses took account of the variation in the level of activity that occurred between practices in Southwark and Lambeth for two key elements of the Programme: holistic assessments (HAs) and integrated care management (ICM). Since some practices implemented these much more comprehensively than others, we were able to look for a 'dose-effect' to see whether the delivery of HAs and ICM appeared to have an effect on hospital utilisation.

Comparisons are made at the GP practice level and outcome data was derived from Hospital Episode Statistics (HES) from NHS Digital, which contains details of all admissions, outpatient appointments and A&E attendance at NHS hospitals in England. Data were examined for the three years prior to and the four years following the start of the Programme. We used a regression-based approach that allowed for the longitudinal and clustered nature of the data, individual practice characteristics and for the effect of the time of year (seasonality).

Findings

In the first two years of the Programme, we found an initial rise in both A&E attendance and emergency admissions over and above what would have been expected. In the subsequent two years, we found fewer A&E attendances than would have been expected from the comparison with control practices (3 per cent fewer in 2014/15 and 6 per cent fewer in 2015/16), suggesting that, over time, the Programme did achieve a reduction in A&E attendance in line with its objectives. However, we found no evidence of a fall in emergency admissions and some evidence that emergency admissions for ACSCs increased over the course of the Programme – these are conditions where good primary care should, in principle, reduce the need for admission. By the end of the programme, we found fewer outpatient attendances and elective admissions than would have been expected, by 8 per cent and 6 per cent, respectively.

The number of HAs completed was much lower than anticipated, with only 27 per cent of the relevant population having received HAs by the end of 2015. Because of the slow uptake of both HAs and ICM, we were able to separately estimate the effect of these aspects of the Programme on demand for secondary care by comparing practices that had delivered these interventions to a high percentage of their patients with practices that had not. The most striking finding here was that, despite an overall reduction in volume of elective care compared to what would have been expected across all practices in Lambeth and

Southwark, we found an increase in outpatient referrals and elective admissions associated with practices that carried out more HAs and ICM.

From this, we can draw the following conclusions. First, we are disinclined to put too much weight on the initial rises in demand for urgent care seen in the first two years of the Programme. We know that a number of elements of the Programme were slow to start and it seems likely that these rises would have been associated with factors outside the Programme, but we are not in a position to speculate on what these might have been. Subsequently, we found evidence of a fall in A&E attendance but no fall in emergency admissions.

We found significant reductions in demand for elective care, which could have been related to the innovations introduced as part of the Programme. We do not believe that these reductions are related to HAs and ICM because, in contrast, HAs and ICM appeared to increase the demand for elective care, possibly by identifying unmet need.

There was no overall impact on length of hospital stays during the period of the study.

King's College London (KCL) was commissioned in 2015 to undertake a short-term evaluation of the SLIC programme and the KCL group reported in May 2016. Their evaluation examined trends in A&E attendances, non-elective discharges and emergency bed days for people aged 65 and over to King's College Hospital and Guy's and St Thomas' Hospital, based on 44 months of data up to November 2015. The KCL evaluation found a 2 per cent increase in emergency discharges and a 0.6 per cent reduction in emergency bed days per month among patients aged 65 and over from Southwark and Lambeth compared to 23 per cent and 18 per cent increases, respectively, for patients from other clinical commissioning groups (CCGs). The authors report that the data represent a flatlining of Southwark and Lambeth hospital activity in contrast to a marked rise from elsewhere. However, the analysis reports only admissions to Southwark and Lambeth hospitals and the authors note that, 'Discussion among Southwark and Lambeth representatives suggests that patients are being routed from Kent due to local issues. We have no data with which to compare the growth in "other CCGs" with the rest of England.' This suggests that the apparent limitation of growth in admissions attributed to SLIC might have been due to a change in referral patterns from surrounding CCGs. In other words, the only comparator which the KCL group had available was one which was itself subject to change because of external factors. The authors of the KCL report themselves comment that their analyses 'have no control comparisons and as such interpretation of data is problematic and open to bias'. It is therefore difficult to infer any causal link between SLIC and the observed trends in the KCL evaluation because of the large number of confounding factors that have not been controlled for. Our analysis compared changes at the practice level in Southwark and Lambeth to a set of matched control practices and took account of trends in the outcomes for the individual practices before the Programme was introduced, controlling also for a range of practice characteristics and for seasonality. In addition, we were able to examine a dose-response based on the intensity of HAs and ICM in different practices across Southwark and Lambeth. This effectively treats all Southwark and Lambeth practices as controls for each other. In this way, our analysis overcomes many of the problems of the KCL analysis and gives a more reliable assessment of the impact of the Older People's Programme on hospital utilisation.

Conclusion

Overall, we found evidence that the SLIC Older People's Programme achieved its desired effect of reducing A&E attendance in the later years of the Programme, but no evidence of a reduction in emergency admissions for older people. In relation to outpatient attendance and elective care, we found an overall reduction in activity, but that carrying out HAs and providing ICM for those identified as 'at risk' increased secondary care utilisation in these areas, which is compatible with identifying unmet needs through these additional interventions.

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Abbreviations

A&E	Accident and emergency
ACSC	Ambulatory care sensitive condition
CCG	Clinical commissioning group
CI	Confidence interval
CIPS	Continuous inpatient spells
COPD	Chronic obstructive pulmonary disease
GP	General practitioner
HA	Holistic assessment
HES	Hospital Episode Statistics
ICM	Integrated care management
IQR	Interquartile range
KCL	King's College London
RR	Rate ratio
SLIC	Southwark and Lambeth Integrated Care

Glossary of terms

95 per cent confidence interval (95 per cent CI)	When an average (mean) value is quoted, there may be some statistical uncertainty about the figure. A 95 per cent confidence interval (CI) is constructed around the best estimate that comes from the research. It is likely that 95 per cent of the time the 'true' population value will fall within the interval. The smaller the confidence interval, the closer the estimate is likely to be to the 'true' value.
Accident and emergency (A&E) attendance	Also known as the Emergency Department and Casualty. A visit by a patient to an A&E department to receive treatment from the A&E service including paramedics, A&E nurses, diagnostic radiographers, healthcare assistants and emergency medicine doctors. Patients in A&E are either admitted to hospitals as 'emergency admissions' or are allowed to go home.
Ambulatory care sensitive conditions (ACSCs)	Conditions where effective community care and integrated care management can help prevent the need for hospitalisation. An admission for an ACSC is sometimes used as a sign of poor quality of primary and community care.
Confounding	A confounding factor is one that is associated with both the outcome and exposure of interest. A confounding factor may mask the association of interest or falsely suggest an apparent association between the outcome and exposure of interest where no real association between them exists. If confounding factors are not measured and accounted for, bias may result in the conclusion of the study.
Dose effect (dose response)	Describes how the likelihood or severity of an outcome is related to the amount or 'dose' of a exposure/intervention. In this study, this was used to compare practices that had been more successful in implementing holistic assessments and integrated case management, and those that had done very few.
Elective hospital admission	An admission to hospital has been arranged in advance, i.e. not an emergency admission and excluding maternity admission or

	transfer from another hospital.
Emergency hospital admission	An admission to hospital that is not predicted and occurs at short notice because of clinical need, i.e. it has not been arranged in advance.
Genetic matching	Matching is a statistical technique for identifying comparators or controls. This approach is often used where randomisation is not possible, for example where an intervention has already been implemented. The 'genetic algorithm' identifies a set of controls whose overall characteristics match the intervention group. Making the control and intervention groups as similar as possible reduces the risk of bias, making it more probable that any observed effect is a result of the intervention. Despite the name 'genetic matching', this technique does not originate from clinical genetics.
Holistic assessment (HAs)	HAs are undertaken by general practice professionals (e.g. GPs and other practice staff) to proactively identify the care needs of older people in Southwark and Lambeth. HAs may then lead to implementation of a range of established best practice care pathways for older people. In the early stages of the Programme, these were termed 'holistic health assessments'.
Hospital Episode Statistics (HES)	HES is a data warehouse kept by NHS Digital containing details of all admissions, outpatient appointments and A&E attendances at NHS hospitals in England.
Integrated care management (ICM)	Additional planning for patients identified at high risk following an HA, e.g. for patients at risk of admission to hospital. Subsequent care planning may then result in additional services being proactively provided, e.g. to reduce the risk of admission.
Interquartile range (IQR)	The IQR is a measure of how variable the data is. It is calculated by subtracting the 25th percentile (lower quartile) form the 75th percentile (upper quartile). Thus, the IQR contains the middle 50 per cent of the data points. A large IQR indicates that the data is very variable, while a small IQR indicates that there is relatively little variation in the data.
Length of stay	The number of nights a patient spent in hospital. Patients admitted and discharged on the same day have a length of stay of less than one day.
Outpatient attendance	Attendance for a patient to see a specialist, normally in an outpatient clinic.

Primary care	Primary care services provide the first point of contact in the healthcare system, acting as the 'front door' of the NHS. Primary care includes general practice, community pharmacy, dental and optometry (eye health) services.
p-value	The p-value is used to determine the significance of a statistical test. The p-value is a number between 0 and 1. A small p-value (typically ≤ 0.05) indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be true and not likely to be due to chance.
Rate ratio (RR)	A measure of relative difference used to compare the number of new cases of a particular disease/outcome per population at risk occurring at any given point in time.
Secondary care	Secondary care services are usually based in a hospital or outpatient clinic, though some services may be community based. Medical care is provided by a specialist. Patients are usually referred to secondary care by a GP.
Sensitivity analysis	A statistical method to determine the robustness of an assessment by examining the extent to which the results change if the assumptions underlying the analysis are changed. Consistency between the main analysis and sensitivity analysis strength the conclusions.

1. Introduction

1.1. Background

The NHS faces major challenges, which relate in part to increasing numbers of elderly patients, many of whom have multiple complex problems such as diabetes and chronic obstructive pulmonary disease (COPD). Traditional services may fail to meet the needs of these patients, with care that is fragmented between different parts of the NHS and poorly coordinated between healthcare and social care. This lack of integration may lead to unnecessary admissions to hospital and difficulties in discharging patients who are fit to be cared for in the community; and it can also lead to some care needs going unrecognised. These in turn can lead to poor outcomes for patients, poor patient experience and unnecessary NHS costs. While these problems have to some extent been evident since the early days of the NHS (Guillebaud 1956), the increasing population of very elderly patients has made them more acute in recent years. A wider range of initiatives have been introduced to address these problems including, nationally, the Integrated Care Pilots and the Integrated Care Pioneers (Department of Health and Social Care 2012; NHS England 2018). Most recently, Sustainability and Transformation Plans are explicitly expected to address cross-service and cross-sectoral collaboration (NHS England 2018).

Southwark and Lambeth Integrated Care (SLIC) was set up in 2012 as a partnership between the three local NHS Foundation Hospital Trusts (Guy's and St Thomas', South London & Maudsley and King's College), Guy's and St Thomas' Charity, Southwark and Lambeth Clinical Commissioning Groups (CCGs), Southwark and Lambeth local authorities, local primary care practices and local citizen groups (5). SLIC's vision was 'to increase the value of care we provide for the people of Southwark and Lambeth, so they can lead healthier and happier lives' (5).

The SLIC Older People's Programme ('the Programme') was planned to run for four years up to March 2016 and had a total budget of over £39 million (6). The Programme aimed to maximise older people's health and independence and, thus, minimise inappropriate hospital use in times of crisis (Southwark and Lambeth Integrated Care 2016). These outcomes were anticipated to be achieved by: (i) identifying and addressing care needs at an earlier stage to avoid crisis; (ii) providing joined up care around the needs of individuals delivered in the most appropriate setting; (iii) reducing delays to discharge from hospital to maximise independent living; and (iv) providing alternative urgent responses. As well as providing better coordination of care within the NHS, the Programme involved close working with local authorities to provide better links between health and social care.

The main elements within the Programme are summarised in Box 1.

Box 1. Summary of the main elements of the SLIC Older People's Programme

- Holistic assessments (HAs) for older people
- Integrated care management (ICM) plans for older people identified as 'at risk'
- Community-based multidisciplinary team meetings
- 'Hotline' to consultants for advice
- 'Hot clinic' to enable urgent geriatric assessment older people
- Admission avoidance through community-based enhanced rapid response services
- Improved hospital discharge procedures
- Enhanced community reablement services
- Redesigned clinical pathways including for falls and dementia

An important part of the Programme involved general practitioners (GPs) undertaking holistic assessments (HAs – initially called holistic health assessments) with patients aged 65 and over (8). Each HA included assessment of the patient's physical health, mental health and social care needs as well as wider social aspects of daily living (e.g. benefits and housing). Based on these assessments, a smaller number of patients identified as being at high risk would be eligible for integrated care management (ICM), which included proactive care plans agreed by the professional and the patient, plus support and monitoring over a longer period of time.

At the outset, the intention of the Programme was that GPs would undertake an HA with half of all of their patients aged 65 and over. However, recruitment to HAs was much lower than planned. In April 2014, the target population for HAs was changed to people aged 80 or over, and people over 65 who were either housebound or had not been seen by a GP for 15 months. We do not have information on what was actually carried out during HAs or as part of ICM.

The original SLIC business case outlined ambitious targets for the Programme; a 14 per cent reduction in emergency bed days for people aged 65 years and over, and an 18 per cent reduction in residential care home placements by 2015 (Southwark and Lambeth Integrated Care 2016). However, in the first two years of the Programme, activity was much slower than anticipated. This was in part due to a lack of engagement of GPs, who reported having insufficient capacity to take on the additional activity outlined above (6,9). The Programme was extended and in 2013 the business case was revised by SLIC. This included revised targets for reduced emergency bed days from a 14 per cent to 5 per cent reduction, though simply reducing the previous rise in admissions was seen as an important aim. The language used to describe the Programme also changed over the course of the study, with somewhat less emphasis on reducing resource utilisation and more on improving the health and well-being of the population.

1.2. Objectives

This study aimed to assess changes in hospital utilisation following implementation of HAs and ICM interventions, compared to similar populations in the rest of England. In addition to the overall impact of the Programme, we aimed to evaluate the impact of two key elements of it: HAs and ICM. A cost-effectiveness analysis will be reported separately based on the same outcome measures.

Originally, we had planned additionally to examine changes in patterns of nursing home admissions. However, it became apparent at a very early stage of the evaluation that reliable data on the nature of nursing home admissions could not be collected from any routine data source, and this aspect of the evaluation was therefore dropped with the agreement of SLIC partners.

1.3. Structure of this report

In Chapter 2 we present an overview of the methods (an extended methodology is presented in the appendix to this report). Chapter 3 presents the results of the practice-based analysis of secondary care utilisation up to the end of the Programme and Chapter 4 completes the report by drawing out the main findings and conclusions. In Appendix 1 we describe the methods in more detail. Appendix 2 is taken from our interim report and describes how well the South London SLIC practices were matched to practices in other parts of the country.

2. Methods

In this section we provide a broad overview of our approach to the evaluation (an extended description of the methods is presented in Appendix 1). The evaluation examined changes in hospital use in Southwark and Lambeth among people aged 65 and over from the Programme's inception in October 2012 to the end of SLIC in March 2016. We considered six outcome measures of hospital use for people aged 65 and over registered at a GP practice:

1. Accident and emergency (A&E) attendance.
2. Emergency hospital admissions.
3. Emergency hospital admissions for patients with admissions for ambulatory care sensitive conditions (ACSCs) recorded as one of the diagnoses on discharge (Bardsley et al. 2013). ACSCs are those for which, in principle, crises leading to emergency admission might be prevented by improved care in the community (Tian et al. 2012).
4. Outpatient attendance.
5. Elective hospital admissions of older people.
6. Inpatient length of stay.

For each outcome we estimated the same series of five statistical models. The five statistical models are summarised in Box 2, which also gives guidance on interpreting the results, and a more detailed account of the methods is provided in appendix 1. In essence, model 1 looks at overall changes in patterns of utilisation and was the main analysis that we originally intended to do. However, because of the variable implementation of HAs and ICM across practices in Southwark and Lambeth, we were able to investigate whether doing more HAs and ICM was itself associated with changes in patterns of secondary care utilisation. These are shown for each outcome in models 2 to 5 (2 and 4 for HAs, 3 and 5 for ICM).

Box 2. Summary of the five models assessing changes in rates of admission

Changes in rates of admissions over time

Model 1: shows the average practice change in the rate of hospital use on a year-by-year basis relative to what would have been expected with not being part of the SLIC Programme.[1] The model includes both practices that were and were not performing HAs/ICM. The results are presented for four financial years' (April to March) data, starting in April 2012 to March 2016.

The resulting rate ratios (RRs) can be interpreted as the average difference between practices (the relative rate of admission in intervention practices, compared to control practices). An RR of 1 indicates no change, while an RR greater than 1 represents an increase in admissions in the intervention compared to what was expected and an RR less than 1 represents a decrease in admissions in the intervention compared to what was expected.

Effect of increasing HAs and ICM (compared to control practices)

Model 2: shows the average change in the rate of hospital utilisation for the six outcomes for a 1 per cent increase in the proportion of the population aged 65 and over receiving HA. As above, this model accounts for background changes informed by national trends in our control group of practices, individual practice pre-intervention trends, seasonality and individual practice characteristics. In contrast to model 1, here we treat practices not performing HAs as having zero 'dose' of intervention, as with the control group of practices.

Model 4: shows the average change in the rate of hospital utilisation for the six outcomes for a 1 per cent increase in the proportion of the population aged 65 and over receiving ICM. As above this model accounts for background changes informed by national trends in our control group of practices, individual practice pre-intervention trends, seasonality and individual practice characteristics. In contrast to model 1, here we treat SLIC practices not undertaking ICM as having zero 'dose' of intervention, along with the control group of practices.

Effect of increasing HAs and ICM (analysis restricted to SLIC practices)

Model 3: repeats analysis of model 2 but is restricted to SLIC practices. It shows the average change in the rate of hospital utilisation for the six outcomes for a 1 per cent increase in the proportion of the population aged 65 and over receiving an HA. Background trends in this model are informed by SLIC practices only.

Model 5: the analysis repeats that of model 4 but is restricted to SLIC practices. It shows the average change the rate of hospital utilisation for the six outcomes for a 1 per cent increase in the proportion of the population aged 65 and over receiving ICM. Background trends in this model are informed by SLIC practices only.

The resulting RRS for models 2 to 5 can be interpreted as the average difference between two practices, where one is performing HAs/ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, for example, in admissions.

2.1.1. Comparison with control practices (model 1)

Model 1 considers overall changes in the rates of admission/attendance/length of stay from patients aged 65 and over registered at a practice in Southwark and Lambeth ('intervention practices') since the start of the Programme. We estimated the difference in observed hospital utilisation compared to what would have been expected had the Programme not been introduced. Expected admission/attendance/length of stay rates are informed by national trends in a set of matched control practices in other parts of England,

[1] Expected admission attendance rates are informed by national trends in our control group of practices, individual practice pre-intervention trends, seasonality and individual practice descriptors.

practice characteristics[2], pre-intervention trends in the outcomes in individual intervention practices and seasonality. Control practices were selected with the aim of obtaining a set of practices with similar characteristics to our intervention practices. Practices were matched using the so-called 'genetic' matching algorithm based on 21 characteristics including baseline admissions/attendances, the rate of change of those admissions/attendances at baseline (with the exception of A&E attendances) and a range of practice characteristics. Our original analysis plan allowed control practices to appear in the analysis data set more than once to in order to minimise differences between the control and intervention practices. However, our final analysis used practices only once. A total of 263 control practices were identified for the 94 intervention practices. Details of the matching approach are reported in Appendix 1 and the results of the matching are presented in Appendix 2 (the latter copied from out interim report). We used a regression-based approach that incorporated both the longitudinal and the clustered nature of the data, and also that we were using count data for hospital utilisation (full details are given in Appendix 1).

A key feature of the regression approach is that we are concentrating on within-practice changes (due to the use of so called random effects for practices). This means that, in effect, each practice sets its own background level and reduces concerns about practices being in Southwark and Lambeth as being special in some way, for example because of concentrations of certain ethnic groups. For the special ethnic profile to have a profound impact on our findings it would have to be the case that changes (and not just starting levels) not attributable to the SLIC Programme would have to be different over time for different ethnic groups. The doubly robust method of using matched controls and adjustment for ethnic profile further reduces any concerns in this area. It is also worth noting that by modelling rates of admissions in different age and gender groups we account for the changing age profile of practice populations over time and the changes in admissions do not reflect an aging population.

2.1.2. Effect of increasing HAs and ICM (models 2 to 5)

Given variation in the level of Programme activity between practices, we also examined the impact of two key elements of the Programme – HAs and ICM – as markers of activity in general practice. HAs and ICM are two key components within the SLIC Older People's Programme (see Box 1). Different levels of activity allowed us to estimate a specific 'dose-effect' of these two components, HAs and ICM. The dose-effect describes how the likelihood or severity of an outcome is related to the 'dose' of a particular exposure/intervention. We used the percentage of patients aged 65 and over who had received the intervention in a practice at that time point as a measure of the 'dose' of intervention being applied to that practice. This allowed us to draw inferences about changes that were specifically related to HAs or ICM, and changes that might have been caused by other interventions in the SLIC Programme.

[2] Practice characteristics included in all the models were: (i) total list size; (ii) the proportion of patients registered with the practice over the age of 65; (iii) the proportion of patients registered with the practice over the age of 80; (iv) the proportion of patients registered with the practice that were male; (v) the practice deprivation score; (vi) the proportion of the practice population who describe themselves as white; (vii) the number of GPs at the practice (excluding registrars); (viii) the number of full time equivalent GPs (a measure of workload); (ix) the mean years since qualification of GPs; (x) and the proportion of full time equivalents made up by male GPs.

In models 2 and 4 we estimated the effect of increasing HAs and ICM in comparison to our control group of practices. In these two models, practices that have had undertaken no activity are considered the same as control practices, who, by definition, have zero 'dose'. Expected admission/attendance/length of stay rates are informed by national trends in a set of matched control practices in other parts of England, practice characteristics, pre-intervention trends in the outcomes in individual intervention practices, and seasonality. The model is run separately for HAs (model 2) and ICM (model 4).

In models 3 and 5, by restricting the analysis of increasing HAs and ICM just to practices in Southwark and Lambeth, differences are estimated between those practices that have performed HAs/ICM with those practices performing fewer or none (model 3 for HAs and model 5 for ICM). Expected admission/attendance/length of stay rates for these two models are informed by practice characteristics, pre-intervention trends in the outcomes in individual intervention practices and seasonality.

All of the analyses were conducted at the GP practice level. Outcome data used for the analyses come from Hospital Episode Statistics (HES) – a centrally held data warehouse containing details of all admissions, outpatient appointments and A&E attendances at NHS hospitals in England. Initial inspection of the raw data showed that for some practices there were times where the rates of admission or attendances were very high. To examine the influence of these high rates, we carried out sensitivity analyses excluding practices with very high rates of admission or attendance or very high mean lengths of stay. None of the sensitivity analyses made a material difference to our conclusions; therefore, the detailed results are not included in the report but are available on request from the authors. A section in Appendix 1 describes the data structure, sample size and our sensitivity analyses in more detail.

3. Findings

In this section we present the results of the practice-based analysis of the outcome measures up to the end of March 2016. Since we used the extent to which practices had implemented HAs and ICM as an indicator of dose or scale of the intervention, we first show how these SLIC activities developed over the five years of the Programme (Section 3.1) before presenting changes in hospital utilisation (Section 3.2).

3.1. Activity in the Older People's Programme

At the outset, the intention of the Programme was to have performed HAs on half of the population aged 65 and over by 2015. This is equivalent to around 24,750 people receiving HAs annually (6). It can be seen in Table 1 and Figure 1 that the level of activity never reached that target. By December 2015, HAs had been performed on 26.9 per cent of people aged 65 and over, resulting in 3.5 per cent of patient aged 65 and over receiving ICM. It should be noted however that in April 2014 the eligibility criteria for HAs were narrowed to: (i) people aged 80 or over; and (ii) people aged 65 or over who were either housebound or had not been seen by a GP for 15 months. We are not aware that precise targets were set for the revised eligibility criteria. The slower than intended uptake at the start of the Programme led to an extension of our evaluation by two years as there was too little HA and ICM activity earlier on to allow a meaningful evaluation to take place.

Table 1. Total activity in the Older People's Programme by quarter, October 2012 to December 2015

Quarter		HAs			ICM		
		Number in quarter	Cumulative total	% of 65 and over*	Number in quarter	Cumulative total	% of 65 and over*
2012	Oct–Dec	65	65	0.13	18	18	0.04
2013	Jan–Mar	363	428	0.84	69	87	0.17
	Apr–Jun	671	1,099	2.15	82	169	0.33
	Jul–Sep	1,056	2,155	4.22	91	260	0.51
	Oct–Dec	1,144	3,299	6.46	60	320	0.63
2014	Jan–Mar	697	3,996	7.74	138	458	0.89
	Apr–Jun	701	4,697	9.10	99	557	1.08
	Jul–Sep	1,361	6,058	11.73	129	686	1.33
	Oct–Dec	1,158	7,216	13.98	140	826	1.60
2015	Jan–Mar	2,285	9,501	17.95	276	1,102	2.08
	Apr–Jun	1,467	10,968	20.72	206	1,308	2.47
	Jul–Sep	1,615	12,583	23.77	210	1,518	2.87
	Oct–Dec	1,630	14,213	26.85	334	1,852	3.50

*Defined as the number of HA/ICM that have occurred to date divided by the population aged 65 and over, based on practice population data obtained from NHS Digital.

Figure 1. Percentage of people aged 65 and over receiving an HA in Southwark and Lambeth from October 2012 to December 2015

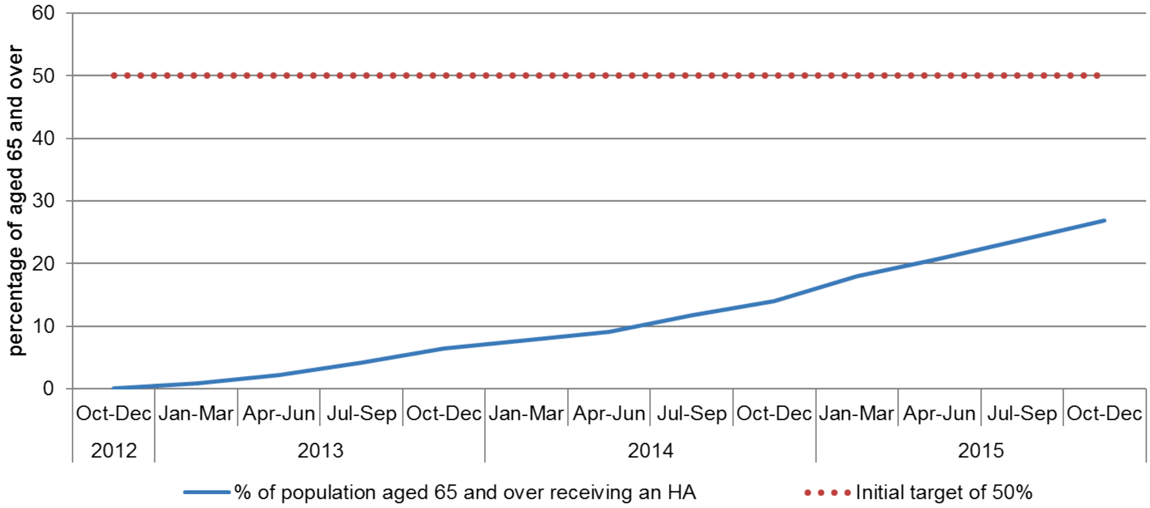
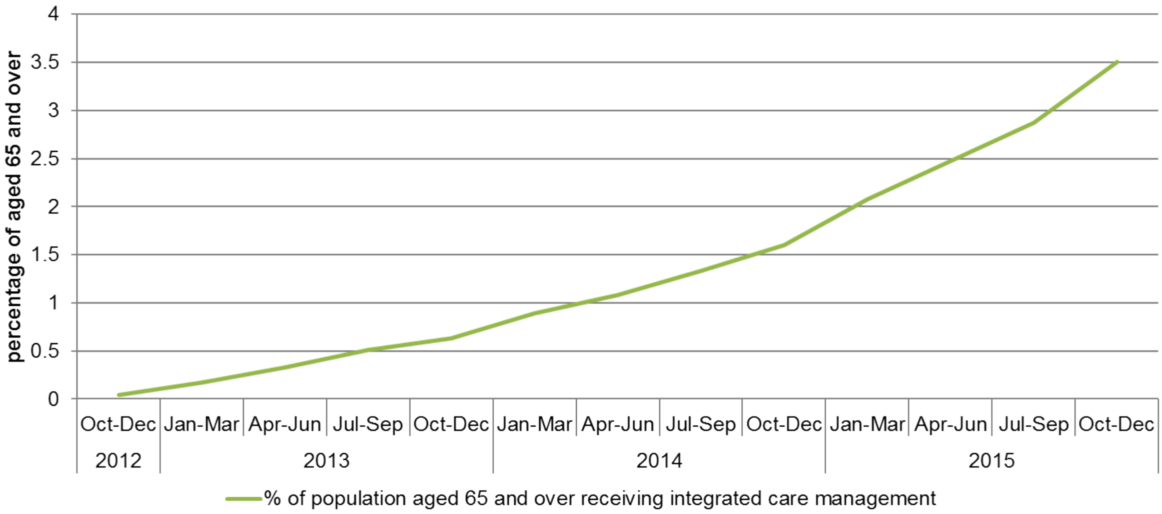


Figure 2. Percentage of people aged 65 and over receiving ICM in Southwark and Lambeth from October 2012 to December 2015



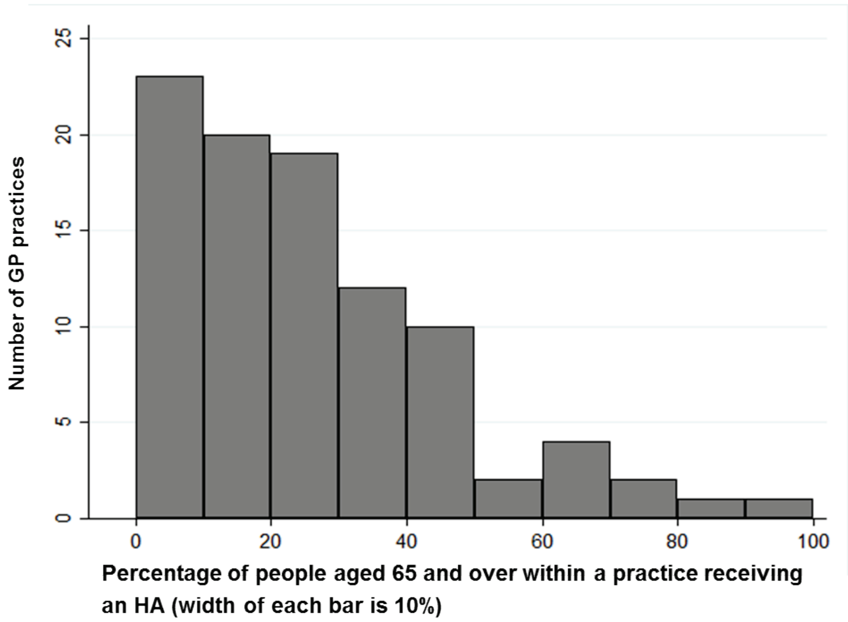
In total, 94 general practices were operating across Southwark and Lambeth at the start of the Programme in 2012. In contrast to Table 1, which looks at achievement across the whole population, Table 2 shows the average performance of individual general practices in delivering HAs and ICM. The table and Figures 3 and 4 show that there was considerable variation between practices in the level of activity. The proportion of the population aged 65 and over in a practice receiving an HA ranged from 0 in some practices to 94.1 per cent in others. Ten of the 94 practices did not complete any HAs, and only ten practices reached the target of implementing HAs on 50 per cent of patients aged 65 and over. For the majority of practices, the HA completion rates were below 30 per cent.

Table 2. Percentage of patients aged 65 and over within a practice receiving HAs and ICM by December 2015

% of over 65s*	HAs	ICM
Median	22.2	2.0
Interquartile range	12.7–36.8	0.2–4.5
Mean	26.0	3.1
Range	0–94.1	0–18.3

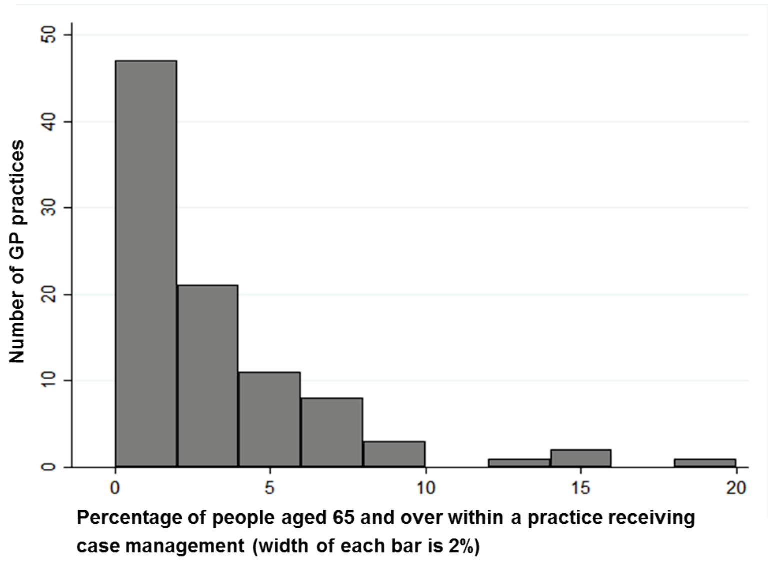
*Defined as the total number of HA/ICM activities that have occurred divided by the total population aged 65 and over for each practice. This table shows the average of practice averages (in contrast to Table 1, which shows the averages for the whole population).

Figure 3. Percentage of patients aged 65 and over within general practices receiving an HA



The proportion of the population aged 65 and over receiving ICM in practices ranged from 0 to 18.3 per cent (Figure 4). Twenty-one of the intervention practices recorded no ICM activity and half of the practices provided ICM for fewer than 2 per cent or the population aged 65 and over.

Figure 4. Percentage of patients aged 65 and over within general practices receiving ICM



3.2. Hospital utilisation

We present the changes for each of the six outcome measures of hospital use in turn below. For each outcome, we present the five models for the main analysis in a table and also summarise the key findings in the accompanying text.

3.2.1. Accident and emergency attendance (Tables 3a and 3b)

We present results from our analyses of A&E attendance in Tables 3a and 3b below.

Overall change in A&E attendance (model 1, Table 3a)

Model 1 in Table 3a presents the overall change in A&E attendance in SLIC practices compared to what would have been expected if the Programme had not been implemented.[3] Against a background trend of increasing A&E attendance among control practices, we found that the average rate of A&E attendance among SLIC practices was higher than would have been expected in the first two years of the Programme. Compared to GP practices in the rest of England, SLIC practices had rates of A&E attendance that were on average 2 per cent higher than expected in 2012/13. Over time, the rate of admissions compared to what was expected decreased such that there was no evidence of a difference in 2013/14 and from 2014/15 onwards there were fewer A&E attendance rates in Lambeth and Southwark practices than what would have been expected from the comparison with control practices (3 per cent fewer in 2014/15 and 6

[3] Expected A&E attendance is informed by national trends in the set of matched control practices in other parts of England, practice characteristics, pre-intervention trends in the A&E attendance in individual SLIC practices, and seasonality.

per cent fewer in 2015/16. Overall, these results suggest that the Programme did achieve a reduction in A&E attendance in line with its objectives.

Table 3a. A&E attendance: Comparison with control practices

Year	RR[a] (95% CI)[b]	p-value[c]	Observed rate for SLIC practices (A&E attendances per 1,000 patients per year)	Expected rate in the absence of intervention (A&E attendances per 1,000 patients per year)
2012/13	1.020 (1.002–1.038)	0.032	144	141
2013/14	1.001 (0.978–1.025)	0.931	No significant change	No significant change
2014/15	0.973 (0.946–1.002)	0.068	No significant change	No significant change
2015/16	0.944 (0.913–0.976)	0.001	144	153

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5, the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while a RR greater than 1 represents an increase, and an RR less than 1 represents a decrease in admissions. (b) The width of the confidence interval (CI) indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed attendance rate refers to the observed attendance rate in patients aged 65 and over across all SLIC practices included in the analysis. The expected rate has been calculated according to the model results and is equal to the observed rate/RR.

Effect of HA and ICM on A&E attendance (models 2 to 5, Table 3b)

We found no evidence to suggest that increasing implementation of HAs (models 2 and 3) or ICM (models 4 and 5) were associated with changes in A&E attendance (see Table 3b – all p-values for all models were well above 0.05). This finding was consistent when comparing all SLIC practices against national controls (models 2 and 4) and when comparing differences in uptake of intervention between SLIC practices only (models 3 and 5). This suggests that observed changes in A&E attendance were unrelated to how effectively practices had implemented HAs or ICM.

Table 3b. A&E attendance: Effect of HAs and ICM per 1 per cent

RR[a] (95% CI)[b]	p-value[c]	Expected change in number of A&E attendances per 10,000 HAs[d] or per 1,000 ICMs[e]
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
1.000 (0.999–1.000)	0.306	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.000 (0.999–1.001)	0.760	No significant change
Model 4 – Effect of ICM (cumulative total over four years compared to control practices)		
1.004 (0.999–1.008)	0.114	No significant change
Model 5 – Effect of ICM (cumulative total over four years – SLIC practices only)		
1.000 (0.995–1.006)	0.911	No significant change

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5, the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while a RR greater than 1 represents an increase, and an RR less than 1 represents a decrease in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) The expected change in attendances has been calculated from the model RR for 18.9 per cent of the 65 and over population receiving HAs (equivalent to 10,000 patients receiving HAs). (e) The expected change in attendances has been calculated from the model RR for 1.9 per cent of the 65 and over population receiving ICM (equivalent to 1,000 patients receiving ICM).

3.2.2. Effect on emergency hospital admissions (Tables 4a and 4b)

Overall change in emergency hospital admissions (model 1, Table 4a)

This analysis showed that the average rate of emergency admissions among SLIC practices compared to controls was around 4 per cent higher in 2012/13 and 3 per cent higher in 2013/14 than would have been expected. However, over time the difference between SLIC and comparator practices narrowed, and from 2014/15 onwards, the increase in admissions compared to what would have been expected from the comparison with controls was no longer statistically significant. There was no evidence that the Programme was associated with a reduction in emergency hospital admissions.

Table 4a. Emergency admissions: Comparison with control practices

Year	RR[a] (95% CI)[b]	p-value[c]	Observed rate for SLIC practices[d] (emergency admissions per 1,000 patients per year)	Expected rate in the absence of intervention[d] (emergency admissions per 1,000 patients per year)
2012/13	1.043 (1.019–1.067)	<0.001	77	74
2013/14	1.031 (1.001–1.062)	0.043	77	75
2014/15	1.019 (0.983–1.056)	0.301	No significant change	No significant change
2015/16	1.011 (0.971–1.052)	0.600	No significant change	No significant change

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed attendance rate refers to the observed attendance rate in patients aged 65 and over across all SLIC practices included in the analysis. The expected rate has been calculated according to the model results and is equal to the observed rate/RR.

Effect of HAs and ICM on emergency hospital admissions (models 2 to 5, Table 4b)

We found no evidence to suggest that HAs (models 2 and 3) or ICM (models 4 and 5) were associated with changes in emergency admissions. This finding is consistent when comparing all SLIC practices against national controls (models 2 and 4) and when comparing differences in uptake of intervention between SLIC practices only (models 3 and 5). This suggests that neither was there any effect of the interventions in reducing emergency admissions, nor was the initial rise observed in emergency admissions seen in model 1 in 2012–2014 related to how effectively practices had implemented HAs or ICM in those first two years.

Table 4b. Emergency admissions: Effect of HAs and ICM per 1 per cent of practice population aged 65 and over

RR[a] (95% CI)[b]	p-value[c]	Expected change in number of emergency admissions per 10,000 HAs[d] or per 1,000 ICMs[e]
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
1.000 (0.999–1.001)	0.497	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.001 (1.000–1.002)	0.201	No significant change
Model 4 – Effect of ICM (ICM, cumulative total over four years compared to control practices)		
1.004 (0.998–1.009)	0.177	No significant change
Model 5 – Effect of ICM (ICM, cumulative total over four years – SLIC practices only)		
1.005 (0.998–1.011)	0.190	No significant change

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤ 0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) The expected change in attendances has been calculated from the model RR for 18.9 per cent of the 65 and over population receiving HAs (equivalent to 10,000 patients receiving HAs). (e) The expected change in attendances has been calculated from the model RR for 1.9 per cent of the 65 and over population receiving ICM (equivalent to 1,000 patients receiving ICM).

3.2.3. Emergency admissions for ACSCs (Tables 5a and 5b)

Overall change in emergency admissions for ACSCs (model 1, Table 5a)

When assessing the possible impact of SLIC on emergency admissions for ACSCs, we found evidence that the average rate of such admissions was between 7 and 14 per cent higher than would have been expected based on pre-intervention trends and trends in control practices for all four years of the older people programme (model 1).

Table 5a. Emergency admissions for ACSCs: Comparison with control practices

Year	RR[a] (95% CI)[b]	p-value[c]	Observed rate for SLIC practices[d] (ACSC admissions per 1,000 patients per year)	Expected rate in the absence of intervention[d] (ACSC admissions per 1,000 patients per year)
2012/13	1.072 (1.026–1.120)	0.002	21	19
2013/14	1.118 (1.056–1.184)	<0.001	21	19
2014/15	1.149 (1.076–1.228)	<0.001	22	19
2015/16	1.073 (1.004–1.147)	0.037	20	19

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed attendance rate refers to the observed attendance rate in patients aged 65 and over across all SLIC practices included in the analysis. The expected rate has been calculated according to the model results and is equal to the observed rate/RR.

Effect of HAs and ICM on emergency admissions for ACSCs (models 2 to 5, Table 5b)

We found no evidence to suggest that HAs (models 2 and 3) or ICM (models 4 and 5) were associated with changes in emergency admissions for ACSCs. This finding was consistent when comparing all SLIC practices against a national control (models 2 and 4) and when comparing differences in uptake of intervention between SLIC practices only (models 3 and 5). This suggests that the overall increases in emergency admissions for ACSCs noted in SLIC practices in model 1 were not related to the implementation of HAs or ICM.

Table 5b. Emergency admissions for ACSCs: Effect of HAs and ICM

RR[a] (95% CI)[b]	p-value[c]	Expected change in number of ACSC admissions per 10,000 HAs[d] or per 1,000 ICMs[e]
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
1.001 (1.000–1.003)	0.073	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.001 (0.998–1.003)	0.516	No significant change
Model 4 – Effect of ICM (ICM, cumulative total over four years compared to control practices)		
1.008 (0.998–1.017)	0.127	No significant change
Model 5 – Effect of ICM (ICM cumulative total over four years – SLIC practices only)		
1.005 (0.992–1.017)	0.476	No significant change

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) The expected change in attendances has been calculated from the model RR for 18.9 per cent of the 65 and over population receiving HAs (equivalent to 10,000 patients receiving HAs). (e) The expected change in attendances has been calculated from the model RR for 1.9 per cent of the 65 and over population receiving ICM (equivalent to 1,000 patients receiving ICM).

3.2.4. Outpatient attendance (Tables 6a and 6b)

Overall change in outpatient attendance (model 1, Table 6a)

Compared to increasing outpatient attendance in control practices since 2012/13, the average rate of outpatient attendance from SLIC practices was lower than would have been expected based on pre-intervention trends and trends in control practices for three out of the four years of the SLIC programme (model 1). For example, in 2014/15, attendance rates were 7.9 per cent lower in SLIC practices than that would have been expected in the absence of the Programme.

Table 6a. Outpatient attendance: Comparison with control practices

Year	RR[a] (95% CI)[b]	p-value[c]	Observed rate for SLIC practices[d] (outpatient attendances per 1,000 patients aged 65 and over per year)	Expected rate in the absence of intervention[d] (outpatient attendances per 1,000 patients aged 65 and over per year)
2012/13	0.961 (0.954–0.968)	<0.001	1093	1137
2013/14	1.004 (0.995–1.014)	0.375	NS	NS
2014/15	0.973 (0.961–0.985)	<0.001	1213	1247
2015/16	0.921 (0.908–0.935)	<0.001	1220	1324

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed attendance rate refers to the observed attendance rate in patients aged 65 and over across all SLIC practices included in the analysis. The expected rate has been calculated according to the model results and is equal to the observed rate/RR.

Effect of HAs and ICM on outpatient attendance (models 2 to 5, Table 6b)

In contrast to the changes seen in model 1, we found evidence that ICM led to an increase in the rate of outpatient attendance. For every 1 per cent of the 65 and over practice population for whom ICM was implemented we estimate outpatient attendances across all 65 and older patients increased by around 0.3 per cent when compared to what would have expected based on national controls and pre-intervention trends (model 4) and around 0.8 per cent when comparing differences in uptake of intervention between SLIC practices only (model 5). This is equivalent to an increase of 1,491 and 4,172 outpatient attendances per year when 1,000 patients receive ICM. For HAs, there was evidence of an increase in the rate of outpatient attendance when comparing differences in uptake of HAs within SLIC practices only (model 3) but not in the comparison with controls (model 2). An increase in outpatient attendance following HAs and ICM would be expected if these activities had identified conditions that would be likely to benefit from specialist referral, i.e. identified unmet need.

Table 6b. Effect of HAs and ICM

RR[a] (95% CI)[b]	p-value[c]	Expected change in number of outpatient attendances per 10,000 HAs[d] or per 1,000 ICMs[e]
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
1.000 (1.000–1.000)	0.557	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.002 (1.001–1.002)	<0.001	9,149
Model 4 – Effect of ICM (ICM, cumulative total over four years compared to control practices)		
1.003 (1.001–1.005)	<0.001	1,491
Model 5 – Effect of ICM (ICM, cumulative total over four years – SLIC practices only)		
1.008 (1.006–1.010)	<0.001	4,172

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while a RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) The expected change in attendances has been calculated from the model RR for 18.9 per cent of the 65 and over population receiving HAs (equivalent to 10,000 patients receiving HAs). (e) The expected change in attendances has been calculated from the model RR for 1.9 per cent of the 65 and over population receiving ICM (equivalent to 1,000 patients receiving ICM).

The reason that models 4 and 5 differ in their estimates of the numbers of additional outpatient slots used is that the comparison with control practices may also reflect a more general effect of the Programme (which reduced elective admissions overall). This effect would not have been seen in model 5 which just looks are data within Lambeth and Southwark practices.

3.2.5. Elective inpatient admissions (Tables 7a and 7b)

Overall change in elective admissions (model 1, Table 7a)

Over time the annual rate of elective admissions to hospital from SLIC practices decreased compared to what would have been expected based on pre-intervention and national trends (model 1). For example, in 2014/15 there was a 4 per cent decrease in the rate of elective admissions compared to what would have been expected and in 2015/16 there was a 6 per cent decrease.

Table 7a. Elective admissions: Comparison with control practices

Year	RR[a] (95% CI)[b]	p-value[c]	Observed rate for SLIC practices[d] (elective admissions per 1,000 patients aged 65 and over per year)	Expected rate in the absence of intervention[d] (elective admissions per 1,000 patients aged 65 and over per year)
2012/13	1.001 (0.982–1.020)	0.945	No significant change	No significant change
2013/14	0.990 (0.965–1.016)	0.454	No significant change	No significant change
2014/15	0.955 (0.924–0.987)	0.005	156	164
2015/16	0.938 (0.902–0.975)	0.001	153	164

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the p<0.05 level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed attendance rate refers to the observed attendance rate in patients aged 65 and over across all SLIC practices included in the analysis. The expected rate has been calculated according to the model results and is equal to the observed rate/RR.

Effect of HAs and ICM on elective admissions (models 2 to 5, Table 7b)

In contrast to overall changes, there was evidence to suggest that when comparing SLIC practices with one another, both HAs and ICM led to an increase in the average rate of elective admissions. For models examining changes within SLIC practices, a 1 per cent in increase in the proportion of the population over 65 receiving an HA was associated with a 0.1 to 0.4 per cent increase in elective admissions, and a 1 per cent increase in ICM was associated with a 1 to 2 per cent increase in elective admissions. This is equivalent to an extra 2,400 admissions when performing 10,000 HAs, or an extra 1,500 admissions when 1,000 patients received ICM. These results suggest that the overall fall in elective admissions from SLIC practices was not due to the implementation of HAs and ICM – i.e. that it was due to some other factor in the policy/practice environment that was not captured in our analysis. In contrast, an increase in elective admissions following HAs and ICM might be expected if these activities identified conditions that would be likely to benefit from inpatient treatment.

Table 7b. Elective admissions: Effect of HAs and ICM

RR[a] (95% CI)[b]	p-value[c]	Expected change in number of elective admissions per 10,000 HAs[d] or per 1,000 ICMs[e]
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
1.001 (1.000–1.001)	0.165	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.004 (1.003–1.005)	<0.0001	2,399
Model 4 – Effect of ICM (cumulative total over four years compared to control practices)		
1.012 (1.007–1.016)	<0.001	735
Model 5 – Effect of ICM (cumulative total over four years – SLIC practices only)		
1.024 (1.018–1.030)	<0.0001	1,501

NOTE: (a) RRs for model 1 represent the relative change in the rate of admission compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in admissions. (b) The width of the CI indicates the level of uncertainty associated with the RR estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) The expected change in attendances has been calculated from the model RR for 18.9 per cent of the 65 and over population receiving HAs (equivalent to 10,000 patients receiving HAs). (e) The expected change in attendances has been calculated from the model RR for 1.9 per cent of the 65 and over population receiving ICM (equivalent to 1,000 patients receiving ICM).

3.2.6. Length of stay for all inpatient admissions (Tables 8a and 8b)

Overall change in length of stay, emergency and elective admissions combined (model 1, Table 8a)

Against background trends of decreasing length of stay among control practices, there was a 7 per cent increase in overall length of stay for patients from SLIC practice in the first year of the Programme compared to what would be expected based on pre-intervention and trends in control practices. Following the first year there was no statistical difference in length of stay compared to what would have been expected from the comparison with control practices.

Table 8a. Length of stay for all inpatient admissions: Comparison with control practices

Year	RR for length of stay[a] (95% CI)[b]	p-value[c]	Observed mean length of stay for SLIC practices[d] (in days)	Expected mean length of stay in the absence of SLIC intervention[d] (in days)
2012/13	1.073 (1.014–1.134)	0.014	28	26
2013/14	1.009 (0.942–1.081)	0.797	No significant change	No significant change
2014/15	1.004 (0.932–1.083)	0.907	No significant change	No significant change
2015/16	1.011 (0.937–1.090)	0.776	NS	No significant change

NOTE: (a) RRs for model 1 represent the relative change in length of stay compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in length of stay. (b) The width of the CI indicates the level of uncertainty associated with the estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect. (d) Observed length of stay refers to the observed length of stay in patients aged 65 and over across all SLIC practices included in the analysis.

Effect of HAs and ICM on length of stay, emergency and elective admissions combined (models 2 to 5, Table 8b)

There was no evidence to suggest that HAs (models 2 and 3) or ICM (models 4 and 5) were associated with any change in length of stay. This finding is consistent when comparing all SLIC practices against national controls (models 2 and 4) and when comparing differences in uptake of intervention between SLIC practices only (models 3 and 5).

Table 8b. Length of stay for all inpatient admissions: Effect of HAs and ICM

RR for length of stay[a] (95% CI)[b]	p-value[c]	Expected change in length of stay per 10,000 HAs or per 1,000 ICMs
Model 2 – Effect of HAs (cumulative total over four years compared to control practices)		
0.999 (0.997–1.001)	0.467	No significant change
Model 3 – Effect of HAs (cumulative total over four years – SLIC practices only)		
1.000 (0.997–1.002)	0.754	No significant change
Model 4 – Effect of ICM (cumulative total over four years compared to control practices)		
0.995 (0.983–1.007)	0.420	No significant change
Model 5 – Effect of ICM (cumulative total over four years – SLIC practices only)		
0.996 (0.981–1.012)	0.657	No significant change

NOTE: (a) RRs for model 1 represent the relative change in length of stay compared to what would have been expected in the absence of SLIC activity. In models 2 to 5 the RRs represent the average relative difference between two practices, where one is performing HAs or ICM on 1 per cent more of its patients aged 65 and over than the other. An RR of 1 indicates no change, while an RR greater than 1 represents an increase, and an RR less than 1 represents a decrease, in length of stay. (b) The width of the CI indicates the level of uncertainty associated with the estimate, i.e. the wider the interval the greater the level of uncertainty. For a result to be significant at the $p<0.05$ level, the CI must not cross 1. (c) A p-value of less than ≤0.05 indicates that there is strong evidence that any observed difference between the intervention and control groups is likely to be a true effect.

4. Discussion

4.1. Summary of findings

We found an initial rise in both A&E attendance and emergency admissions to hospital over and above what would have been expected in the first two years of the Programme. In the subsequent two years, we found fewer A&E attendances than would have been expected from the comparison with control practices (3 per cent fewer in 2014/15 and 6 per cent fewer in 2015/16), suggesting that, over time, the Programme did achieve a reduction in A&E attendance in line with its objectives. However, we found no evidence of a fall in emergency admissions and some evidence that emergency admissions for ACSCs increased over the course of the Programme – these are conditions where good primary care should, in principle, reduce the need for admission. By the end of the programme, we found fewer outpatient attendances and elective admissions than would have been expected, by 8 per cent and 6 per cent, respectively.

The number of HAs completed was much lower than anticipated, with only 27 per cent of the relevant population having received HAs by the end of 2015. Because of the slow uptake of both HAs and ICM, we were able to separately estimate the effect of these aspects of the Programme on demand for secondary care by comparing practices which had delivered these interventions to a high percentage of their patients with practices that had not. The most striking finding here was, despite an overall reduction in volume of elective care compared to what would have been expected across all practices in Lambeth and Southwark, we found an increase in outpatient referrals and elective admissions associated with practices that carried out more HAs and ICM.

From this, we can draw the following conclusions. First, we are disinclined to put too much weight on the initial rises in demand for urgent care seen in the first two years of the Programme. We know that a number of elements of the Programme were slow to start and it seems likely that these rises would have been associated with factors outside the Programme, but we are not in a position to speculate on what these might have been. Subsequently, we found evidence of a fall in A&E attendance but no fall in emergency admissions.

We found significant reductions in demand for elective care, which could have been related to the innovations introduced as part of the Programme. We do not believe that these reductions related to HAs and ICM as in contrast, HAs and ICM appeared to increase the demand for elective care, possibly by identifying unmet need.

There was no overall impact on length of hospital stays during the period of the study.

4.2. Relationship of our findings to previous work

The fragmentation of services and lack of coordination between different parts of the NHS and between health and social care is a major problem. Therefore, interventions designed to improve these are logical places to start when seeking to improve the effectiveness and efficiency of care. However, evaluations of programmes with these aims often yield disappointing findings; for example, a recent systematic review and meta-analysis of 36 studies of case management for adults with long term conditions in primary care reported that case management had a small positive effect on patient satisfaction but was not effective in reducing primary or secondary care utilisation or costs of care(12). Identifying unmet need is one of the reasons why coordinated care interventions are much more likely to improve care than to save money (Powell Davies et al. 2008).

There are many reasons for this, including interventions being too short for the substantial organisational and cultural changes needed to take place. We have previously identified factors that are likely to enable and be barriers to these types of change in health and social care (Ling et al. 2012). They are also described for SLIC in the King's Fund evaluation where the authors discuss workforce issues in partner organisations and in the core team, information technology issues and financial arrangements around pooled budgets (9).

The lack of change in length of stay is perhaps surprising bearing in mind the use of significant SLIC resources to enable patients to be discharged more rapidly to the community and the evidence that interventions to promote early discharge are often effective in reducing length of stay (15). Nevertheless, this and other business objectives need to be seen against a challenging background of demographic changes with increasing numbers of older people in the population.

4.3. Comparison with report from King's College London

King's College London (KCL) was commissioned in 2015 to undertake a short-term evaluation of the SLIC programme and the KCL group reported in May 2016 (6). Their evaluation examined trends in A&E attendances, non-elective discharges and emergency bed days for people aged 65 and over to King's College Hospital and Guy's and St Thomas' Hospital, based on 44 months of data up to November 2015. The KCL evaluation found a 2 per cent increase in emergency discharges and a 0.6 per cent reduction in emergency bed days per month among patients aged 65 and over from Southwark and Lambeth compared to 23 per cent and 18 per cent increase, respectively, for patients from other CCGs. The authors report that the data represent a flat-lining of Southwark and Lambeth hospital activity in contrast to a marked rise from elsewhere. However, the analysis reports only admissions to Southwark and Lambeth hospitals and the authors note that 'Discussion among Southwark and Lambeth representatives suggests that patients are being routed from Kent due to local issues. We have no data with which to compare the growth in 'other CCGs' with the rest of England.' This suggests that the apparent limitation of growth in admissions attributed to SLIC might have been due to a change in referral patterns from surrounding CCGs. In other words, the only comparator that the KCL group had available was one which was itself subject to change because of external factors. The authors of the report themselves comment that their analyses 'have no control comparisons and as such interpretation of data is problematic and open to bias'. It is therefore difficult to infer any causal link between SLIC and the observed trends in the KCL evaluation because of the large number of confounding factors that have not been controlled for.

Our analysis compared changes at the practice level in Southwark and Lambeth to a set of matched control practices, and the analysis took account of trends in the outcomes for the individual practices before the Programme was introduced, controlling also for a range of practice characteristics and for seasonality. In addition, we were able to examine a dose-response based on the intensity of HAs and ICM in different practices across Southwark and Lambeth. This effectively treats all Southwark and Lambeth practices as controls for each other. In this way, our analysis overcomes many of the problems of the KCL analysis and gives a more reliable assessment of the impact of the Older People's Programme on hospital utilisation.

4.4. Strengths and limitations of the study

There are however a number of limitations to our study. The principal one is being unable to relate the changes we found to the wide range of initiatives undertaken by SLIC, some of which we understand were much more rapidly implemented than others. In addition, this type of observational analysis is always potentially confounded by factors outside the control of those running the scheme or the ability of the evaluators to allow for. For example, Kent CCGs sending more patients to Lambeth and Southwark hospitals was something we only discovered by reading the KCL report (though this should not have affected our analysis as ours was based on all admissions from Southwark and Lambeth practices rather than admissions to a particular hospital). While it is standard to allow for confounders by using external controls, this in itself caused problems as so many areas of the country have some sort of initiative to better co-ordinate care. While we deliberately avoided some areas with well-known similar schemes when selecting controls (e.g. North West London), problems inevitably remain in identifying matched controls. Furthermore, during the initial stages of analysis, we realised that maintaining a well-matched cohort of practices throughout the evaluation period was impossible due to practices closing and data becoming unreliable around the time of practices closing. For this reason, we did not include multiple copies of control practices in our analyses and so the matching of practices would not have been as good as first intended. However, as we were looking at within practice changes using random effects models, using a broadly similar set of practices and further adjusting for the practice characteristics that were included in the matching process, we expect our models to be robust to any systematic differences between control practices and SLIC practices (with the exception of the Programme itself, which was the focus of the evaluation).

To the extent that the results show that some of the expectations of the Programme that related to hospital utilisation were not being met, this is in part because some of the interventions were slow to get going (e.g. HAs), while some other planned interventions could not be implemented at all. An example was the original plan to move to a new contracting model for outcomes-based commissioning, which had not been implemented by 2016/17. Another example was in reablement services, where the contract for reablement was suspended in one of the two boroughs for a time. Therefore, in interpreting the findings, it is important to understand which of the original plans (e.g. as shown in Box 1) were actually implemented and to what timescale. Full information on this was not available to us and would be needed to draw adequate conclusions about whether the interventions 'worked' or not.

SLIC was different from some previous interventions of this type both in the scale of what was planned and also in the wide range of agencies involved. However, we noted that it is often difficult to attribute change to one particular intervention or set of interventions when change, for example from national policy directives, is ubiquitous. The scale of ambition of SLIC was also both a strength and a weakness of the Programme. Previous work suggests that intervening only with patients at the highest risk of admission is unlikely to have a great impact on overall rates of admission(16). It was therefore ambitious to aim to carry out HAs on half of the elderly population and it rapidly became clear that the initial target was too ambitious, as delivery of HAs by practices was slow in the first two years.

In addition to assessing impact on hospital utilisation, it would have been beneficial to analyse changes in admissions to residential and nursing homes. Admissions could plausibly decrease if older people in Lambeth and Southwark retained greater independence as a result of the interventions; but equally, admissions to residential and nursing homes might increase either because of efforts to reduce hospital inpatient lengths of stay, or because of efforts to find more appropriate placement for people who might otherwise be admitted to hospital. We had originally planned to conduct a before and after comparison of residential and nursing home admissions and reasons for admissions but, as agreed with the SLIC Evaluation Steering Group, this proved impossible from the data that was available to us (something that highlights the weakness of current data in this sector). However, even this analysis would have been difficult to interpret had we been able to carry it out, as the two local authorities involved in SLIC already had extensive programmes in place to reduce nursing home admissions by maintaining people's independence at home. We note that the KCL evaluation reports a reduction of 44 per cent in care home placements between 2012/13 and 2014/15.

We also note two issues relating to the data itself. First, it took many months to get the relevant permissions from NHS Digital to analyse the HES data. This is now a common problem for both researchers and managers and relates to tighter regulations on using NHS patient data introduced over the last 3–5 years. This meant that our original plan to feedback data at three to six-month intervals proved impossible, though this also became less important as the Programme was slow to start. The implications of this for future service evaluations is that rapid access to NHS data cannot be assumed. For the data itself, it is possible that coding practices may have improved as a result of staff being involved in the Older People's Programme, though it is unlikely that this would have affected our major outcomes such as hospital admission.

4.5. Conclusion

Overall, we found evidence that the SLIC Older People's Programme achieved its desired effect of reducing A&E attendance in the later years of the programme, but no evidence of a reduction in emergency admissions for older people. In relation to outpatient attendance and elective care, we found an overall reduction in activity following the implementation of the Programme, but that carrying out HAs and providing ICM for those identified as 'at risk' increased secondary care utilisation in these areas, which is compatible with identifying unmet needs through these additional interventions.

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Appendix 1. Further details of statistical methods

This appendix lays out the technical details of our analysis. We consider four measures of secondary care use: A&E attendances, emergency admissions, outpatient attendances and elective admissions. The same methodology is applied to all four outcome measures. For each outcome, we consider overall changes in the rates of admission within Southwark and Lambeth since the introduction of the Older People's Programme relative to what would have been expected, based on what happened in areas of the country that did not implement such a Programme. The counterfactual scenario was not explicitly calculated but implicitly built into the regression models and was based on practice-specific pre-intervention levels and trends, changes seen in control practices over time, seasonality and a range of practice characteristics. All our analyses were completed using longitudinal Poisson regression modelling of practice admission/attendance rates.

Matching

The analysis makes use of a set of matched practices. The selection of these practices is described in full in our baseline report (see extract in Appendix 2 for full details). Practices were matched using the so-called 'genetic' matching algorithm (17), on baseline admissions/attendances and the rate of change of those admissions/attendances at baseline (with the exception of A&E attendances). The matching also included total list size, the proportion of patients registered with the practice over the age of 65, the proportion of patients registered with the practice over the age of 80, the proportion of patients registered with the practice that were male, the mean years since qualification of GPs, the number of patients per full-time equivalent GP (a measure of workload), and the proportion of full-time equivalents made up by male GPs, practice deprivation score and the proportion of the practice population that describe themselves as white.

The matching was done to obtain five control practices per intervention practice; however, this was done with replacement, meaning that one control practice could appear more than once in the comparison set. A total of 263 control practices were identified for to the 94 intervention practices. Our original plan was to perform two sets of analyses. The first would include multiple copies of the data for those practices appearing in the matching set more than once. The purpose for doing this was to make the comparison set overall as close to the set of intervention practices as possible and reduce bias. The second set of analyses would only include each of the matched practices once. The reason for this was to avoid any exaggeration of statistical significance due to the artificially enhanced sample size. Unfortunately, a number of practices in our analysis data set closed during the period of study, so maintaining an ideally matched overall sample throughout the period was not possible. For this reason, we have only conducted the analysis including single copies of control practices. Because we used mixed effects regressions, our findings can be interpreted as within-practice changes; therefore, between-practice differences, which remain unchanged over time, should not confound our observed associations. Furthermore, we adjust for all factors included in the matching process to improve robustness to such confounding.

Data

Data on hospital utilisation is taken from HES – a centrally held data warehouse containing details of all admissions, outpatient appointments and A&E attendances at NHS hospitals in England. Here we make use of three separate datasets: admitted patient care, accident and emergency, and outpatients. While the outpatients and accident and emergency datasets require little preliminary processing, the admitted patient care data does. The admitted patient care data is delimited at the level of the consultant-led episode. Given that a patient may receive care from more than one consultant's team during their spell in hospital, it is important to link these episodes of care together to determine the total number of admissions and the overall length of stay. We use the algorithm developed by the Centre for Health Economics, University of York, to define continuous inpatient spells (CIPS), which also recognise that patients may be transferred between hospitals in any one admission. Once the CIPS are constructed, they are flagged according to whether the admission was elective or an emergency.

Once data pre-processing is complete, admissions or attendances of each type are aggregated for each quarter from April 2009 in groups defined by general practice of patient, age of patient (in five-year bands from 65 upwards, up to 85 years old and one group for 85 years and older) and gender of patient. This gives 10 strata per practice at each time point. Data is restricted to those 65 years of age and older and to April 2009 onwards.

In order to model the rates of admissions, we need to know the denominator populations to which these admissions refer. These are calculated from the number of patients registered with the practice in the appropriate age by gender strata. The data on practice population are recorded in April each year. These denominators are then applied to each quarter in the calendar year. We excluded data from practices in years in which their practice code did not appear in the denominator data, even when attendances or admissions were attributed to patients at the practice. Further, we excluded the data from practices in the year preceding that where the practice did not appear, in order to exclude practices where mergers or closures may have occurred during the year of analysis. Although such exclusions introduced missing data, the model framework used (a longitudinal mixed-effects model) is robust to missing data over time under the assumption that the data are missing at random conditional on the covariates in the model (18).

Analysis

We made use of a series of five models for each of the outcomes of interest to probe the effect of the intervention. The basic structure of each model is the same, differing only in the way in which we operationalise the intervention in the models. We first describe the general model in the absence of the intervention and then describe how the intervention is captured.

General model

The models used are mixed-effect Poisson models, where the outcome is the number of admissions or attendances in each practice by age group and gender strata. In order to model rates rather than counts, an offset equal to the population denominator for that stratum (see Data section above) is applied in the model. Being a longitudinal model, there are multiple observations for each practice by age group and gender stratum (i.e. one for each quarter of data used). As such, we consider the data to be clustered by practice and this is captured using a random intercept.

The models contain strata level categorical fixed effects for age group and gender. They also contain a number of practice-level continuous fixed effects describing the practice. These are: the total list size, the proportion of patients registered with the practice 65 and over, the proportion of patients registered with the practice 80 and over, the proportion of patients registered with the practice that were male, the practice deprivation score, the proportion of the practice population describe themselves as white, the number of GPs at the practice (excluding registrars), the number of full-time equivalent GPs, the mean years since qualification of GPs, and the proportion of full-time equivalents made up by male GPs. We also include an indicator for SLIC practices in case there remain any systematic differences between them and the control practices.

Background change in the model is captured using four fixed effects and two random effects. Firstly, a categorical indicator variable is used for each quarter of the year to capture seasonality. This protects against the confounding effect of interventions starting in a particular season and erroneously attributing the seasonal change to the intervention. A quarterly time variable was created, which is the number of quarters from January 2000, and was included as both a squared and quadratic terms. Including these three variables as continuous fixed effects allows for the background trend over time to be increasing or decreasing and for this trend to be non-linear. Further, the time variable is included as random effect to allow the modelled trends over time in admissions to be differential by practice.

Operationalising the intervention

Model 1

In this model, a categorical variable is included that takes a value of 0 for all observations prior to the start of SLIC and for control practices at all time points. For SLIC practices, it takes the value of the number of years since the start of the intervention, i.e. 1 in 2012/13, 2 in 2013/14, etc. The resulting RRs show on average the relative rate of admission in intervention practices compared to what would have been expected had the effect of the intervention been absent. This RR represents the average difference over a financial year. The model treats all GP practices within the SLIC catchment area as receiving the intervention (i.e. includes both practices that are and are not performing HAs/ICM).

Model 2

Recognising that not all practices are performing the intervention at the same level, we decided to perform a dose-response analysis. In order to do this, we calculated the cumulative number of HAs that had been performed for each practice at each quarter. This was then divided by the number of over 65 year olds registered at that practice. While in theory patients may have received more than one HA, we interpret this number as the proportion of over 65 year olds who have received an HA. This variable is, by definition, zero for non-SLIC practices and pre-intervention. Including this variable in our model captures this dose-response effect. The resulting RR is the average change in the rate of admissions or attendances for a 1 per cent increase in the proportion of the population over 65 receiving HA.

Model 3

As above but restricting the model only to SLIC practices. By doing this, the SLIC practices act as their own control, comparing SLIC practices with high volumes of intervention with those with low volumes. Background trends in this model are informed by SLIC practices only.

Model 4 and 5

Models 4 and 5 repeat 2 and 3, but replace HAs with ICM.

Data structure, sample size and sensitivity analysis

All of the analyses were conducted at the GP practice level. Outcome data used for the analyses come from HES. Our dataset consists of 357 practices, including 94 practices in Southwark and Lambeth, and covers the time period from the three years prior to, and four years following, the start of the Programme (second quarter of 2009 to first quarter of 2016). For each GP practice, we know the number of admissions and attendances in each five-year age band (five age groups) for each gender and for each quarter over the seven years (28 quarters). We refer to each of these as a 'stratum'; for example, the number of admissions or attendances for women in the age group 65 to 69 years old during the first quarter of 2015 in a specific GP practice. In total, the data set consisted of 98,081 strata for hospital admissions/attendance, corresponding to a population of between 194,337 and 215,447 at any one time period (the actual population changed over time). In analyses of admissions and A&E attendance, which were restricted to SLIC practices, the dataset included 25,702 strata corresponding to populations of between 50,356 and 53,869 in any one time period. When considering inpatient length of stay 87,338 strata were included in the model corresponding to between 35,410 and 45,816 admissions in any one quarter. Inpatient length of stay models restricted to SLIC practices included populations of between 10,542 and 12,596 in any one time period.

Initial inspection of the raw data showed that for some practices there were times where the rates of admission or attendances were very high in one or more of the strata. To examine the influence of these high rates, we carried out sensitivity analyses that excluded data where very high admission/attendance rates or mean lengths of stay were seen (excluding individual strata with more than one admission per person per quarter for A&E attendance and inpatient emergency admissions, more than three admissions per person per quarter for inpatient elective admissions, or more than four admissions per person per quarter for outpatient appointments). In the inpatient length of stay analysis, we excluded mean lengths of stay longer than one year. These sensitivity analyses excluded up to a maximum of 108 patients at risk for A&E admissions, 926 for outpatient appointments, 77 for elective admission and 21 for emergency admissions (these are maximum numbers per quarter; the number of exclusions varies by quarter). For inpatient length of stay, a maximum of 160 admissions were excluded in a given quarter. None of the sensitivity analyses made a material difference to our conclusions, therefore the detailed results are not included in the report but are available on request from the authors.

Appendix 2. Extract from RAND Europe's interim report: Baseline analysis of hospital utilisation and initial matching

The following text is taken from our interim report 'Baseline analysis of hospital utilisation and initial matching' prepared for the SLIC steering committee. The document was not formally published.

Aims

The aims of the baseline analysis were two-fold:

1. To quantify the hospital utilisation profile of practices in the Southwark and Lambeth Older People's Programme, prior to the major interventions, compared to practices in the rest of England. This includes a comparison of changes over time.
2. To perform an initial matching exercise to assess its performance and feasibility in producing a set of matched controls.

Methods

We consider five measures of secondary care use: (i) emergency admissions; (ii) elective admissions; (iii) emergency admissions for ACSCs; (iv) outpatient attendances; and (v) A&E attendances. For each of these measures, we use annual data for the four years starting on 1 April 2007. For each GP practice in the country, we have the number of admissions and attendances in each five-year age band by gender.

Given that this is count data, Poisson regression is more suitable than linear models, so we used that approach along with random effects at the practice level to allow for overdispersion. Each outcome is modelled separately, considering only patients aged 65 years and above. Each contains fixed effects for patients' age and gender, as well as a fixed linear term for year (time). The models also include a random intercept for each practice, which allows the baseline rate of admissions to vary between practices, and a random slope for year allowing the rate of change over time to vary between practices. Such models (balanced mixed models) have the useful property of being unbiased in the presence of data missing at random.

From these models we extract an estimate of the age and gender adjusted rates of admissions and attendances among over 65 year olds for each practice in England for 2010/11. We also extract an estimate of the adjusted rate of change over time. Due to the large number of admissions, the statistical uncertainty on these rates is small compared to the variation between practices and, as such, the estimates can be considered statistically reliable. A second set of models include flags for intervention practices along with an interaction between intervention practice and year to formally test if adjusted admission rates and trends are different, on average, to the country as a whole.

The age and gender profile of each practice in the country, as of December 2012, was obtained from the Health and Social Care Information Centre. From this data set we derived four variables: (i) the total list size; (ii) the proportion of patients registered with the practice over the age of 65; (iii) the proportion of patients registered with the practice over the age of 80; (iv) and the proportion of patients registered with the practice that were male.

Information about each GP in the country was obtained from the NHS Digital and related to GP census data as at 30 September 2012. From this data we derived the following variables: (i) the headcount of GPs (excluding registrars); (ii) the number of full-time equivalent GPs (excluding registrars); (iii) the mean years since qualification; (iv) the number of patients per full-time equivalent (a measure of workload); (v) and the proportion of full-time equivalents made up by male GPs.

Finally, we make use of two further pieces of information. Firstly, a deprivation score based on the Index of Multiple Deprivation[4] was obtained from the Association of Public Health Observatories (19,20). Here, Lower Super Output Area[5] level deprivation data is applied proportionally to the practice populations. Secondly, we use a measure of what proportion of the practice population describe themselves as white to approximate population ethnic diversity, although we appreciate that this is a very simplistic measure. This data was derived by us from the 2009/10 GP patient survey. Although the data is likely to be biased due to differential non-response, it is expected that the bias should be fairly consistent between practices and thus this will be suitable data to for comparing and categorising practices with.

We use all of the above variables, with three exceptions, to obtain a matched set of control practices. The matching is done using the genetic matching algorithm to obtain a ratio of five controls for every intervention practice (17). The matching is done with replacement, meaning that control practices can appear more than once in the comparison data set. This approach is generally thought to result in the least biased comparisons and was agreed upon in the Evaluation Steering Group meeting on 11 October 2013. Variables excluded from the matching process are GP headcount, number of full-time equivalents and the rate of change of A&E admissions. The first two were omitted because by including practice list size and patients per full time equivalent, there was already information regarding practice size and workload, and including further variables in the matching algorithm resulted in a very slow process. The rate of change of A&E admissions was excluded as many of the pre-2010/11 numbers appear to be artifactually low, resulting in apparently large increases in some practices (see Results below). We suspect this reflects poor or non-existent A&E data for some hospitals in the early years. It was confirmed at the Evaluation

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[4] The Index of Multiple Deprivation is an area-based measure that combines a number of indicators chosen to combine a range of economic, social and housing issues into a single deprivation score for each small area in England.

[5] A Lower Super Output Areas are small geographic areas defined by the Office for National Statistics and typically cover populations of around 1,500 people.

Steering Group meeting on 11 October 2013 that there were likely to have been improvements in A&E coding in recent years and this will be explored.

For the matching and distribution comparisons, we only consider practices with a list size of 1,000 patients or more. This excludes small practices that are often unusual in some way. For the purposes of this analysis, intervention practices are those identified as being in either Southwark PCT or Lambeth PCT in the 30 September 2012 GP census data.

Results

Baseline utilisation – Admissions

Table 9 shows the results of the regression modelling comparing intervention practices with those in the rest of England. Figures 5 to 9 show the distribution of adjusted admission rates for intervention practices relative to the national average (geometric mean) in 2010/11. The distribution for England as a whole is also shown. We see that emergency admissions, outpatient attendances and A&E attendances are typically higher in intervention practices than in the picture seen across England. In the case of emergency admissions, the intervention practices, on average, have an age and gender adjusted rate of admission for over 65 year olds 18 per cent higher than the rest of the country. The equivalent figures for outpatient attendance rates and A&E attendance rates are 47 per cent and 92 per cent higher, respectively. Contrastingly, the rates of elective admissions and admissions for ACSCs are lower than those seen nationally (11 per cent and 85 per cent less, respectively).

Table 9. Results of regression modelling comparing intervention practices with those in the rest of England

	RR (95% CI)*	
	Rate of admissions/attendances 2010/11†	Annual rate of change in admissions/attendances‡
Emergency admissions	1.18 (1.10, 1.26)	0.95 (0.93, 0.97)
Elective admissions	0.89 (0.84, 0.94)	0.96 (0.94, 0.98)
Emergency admissions for ACSCs	0.15 (0.07, 0.32)	1.40 (1.10, 1.78)◊
Outpatient attendances	1.47 (1.38, 1.56)	0.97 (0.95, 0.98)
A&E attendances	1.92 (1.76, 2.08)	1.58 (1.47, 1.69)

* p<0.001 for all except ◊ where p=0.007

† These RRs can be interpreted as the age and gender adjusted ratios of the rate of admissions/attendances for over 65 year olds in intervention practices compared to practices in the rest of England. For example, the age and gender adjusted rate of emergency admissions for over 65 year olds in intervention practices is 1.18 times higher (or 18 per cent higher) than the rest of England.

‡ These RRs can be interpreted as the age and gender adjusted ratios of the rate of change admissions/attendance rates for over 65 year olds in intervention practices compared to practices in the rest of England. For example, the age and gender adjusted rate of admissions for over 65 year olds in intervention practices is changing by 0.95 times the rate of change (or 5 per cent slower) seen in the rest of England.

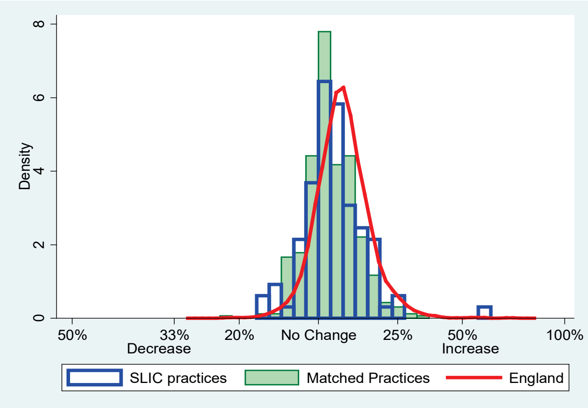

Figure 5. Age adjusted emergency admission rate for over 65 year olds, 2010/11

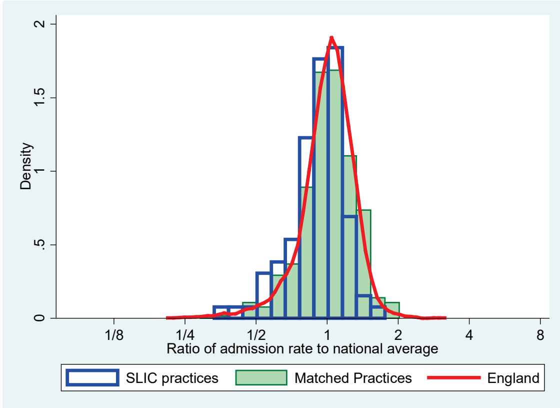

Figure 6. Age adjusted elective admission rate for over 65 year olds, 2010/11

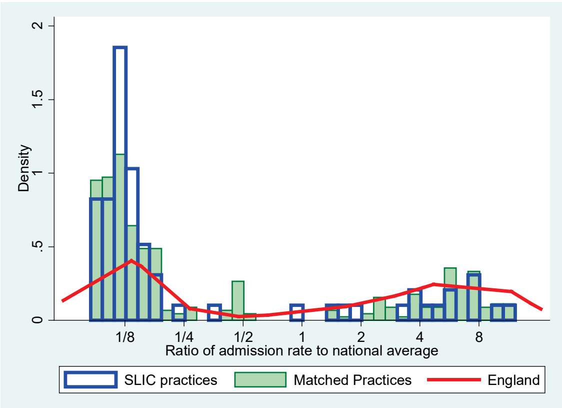

Figure 7. Age adjusted emergency admission rate: ACSC admissions for over 65 year olds, 2010/11

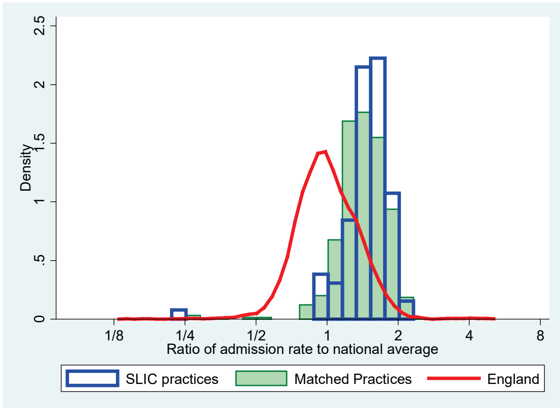

Figure 8. Age adjusted outpatient attendance rate for over 65 year olds, 2010/11

Figures 10 to 14 show the distribution of the annual rate of change of admissions. Results from the models estimating the average difference in the rate of change are also shown in Table 15. As might be expected, most practices across the country are seeing increases in elective and emergency admissions year on year. However, while this is also true in Lambeth and Southwark, there is a tendency for the increase over time to be smaller than average (5 per cent and 4 per cent smaller, respectively). A similar picture is seen for outpatient attendances, although the difference between intervention practices and the rest of the country is less obvious (3 per cent difference in the rate of change). In the case of admissions for ACSCs we see, for both England as a whole and the intervention practices, a very strong peak in increasing admission rates at about an additional 60 per cent per year, and a very wide range of annual changes from over 80 per cent decrease to over 700 per cent increase. How much these changes are real and how much they reflect artefactual coding changes is unclear at the moment but warrants some further investigation. A number of coding audits have been conducted in the boroughs and these will be discussed with the SLIC team to see whether they are helpful. The Evaluation Steering Group confirmed that they felt there would have been significant improvements in coding in recent years. Figure 14 illustrates the distribution of annual changes for A&E attendances. Here we see a national peak close to zero, but a large number of practices with estimated increases of a few hundred per cent. Inspection of the data for a number of these practices reveals that these often occur when very few (or even zero) attendances are recorded in early years leading to apparently huge relative increases over time. We suspect that in all likelihood these very low attendance rates are as a result of poor coding in some hospitals, perhaps where the age of patients was not submitted with the HES data. The Southwark and Lambeth practices generally lie in this range. For this reason, we did not use this as a matching variable.

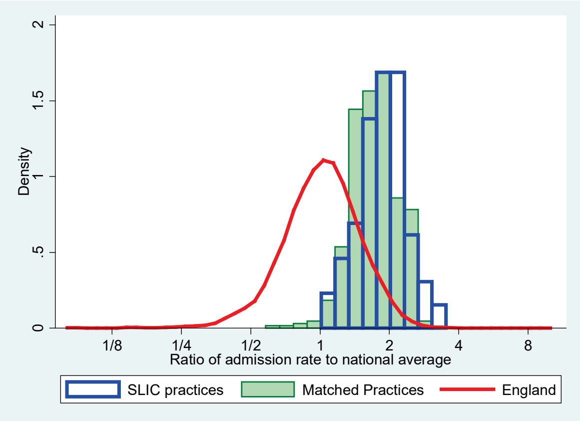

Figure 9. Age adjusted A&E attendance rate for over 65 year olds, 2010/11

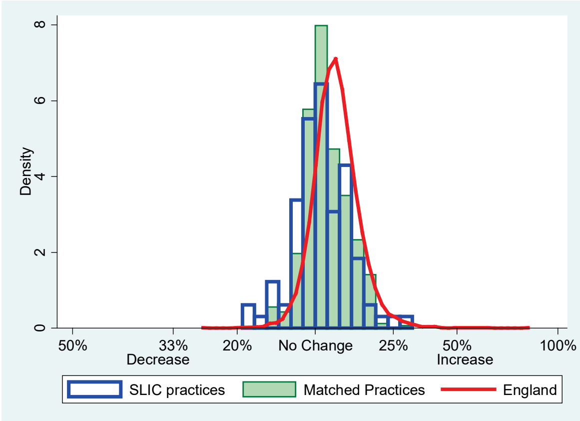

Figure 10. Age adjusted annual relative change in emergency admission rate for over 65 year olds

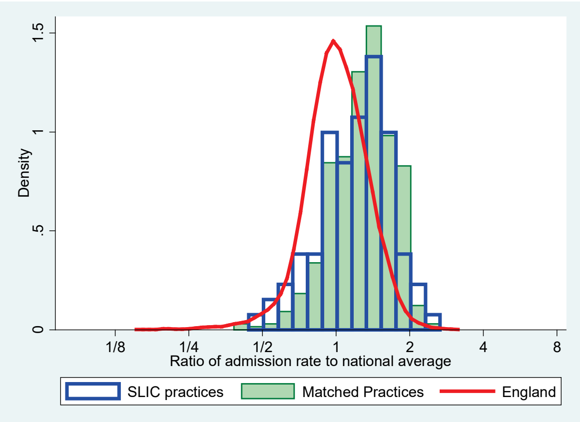

Figure 11. Age adjusted annual relative change in elective admission rate for over 65 year olds

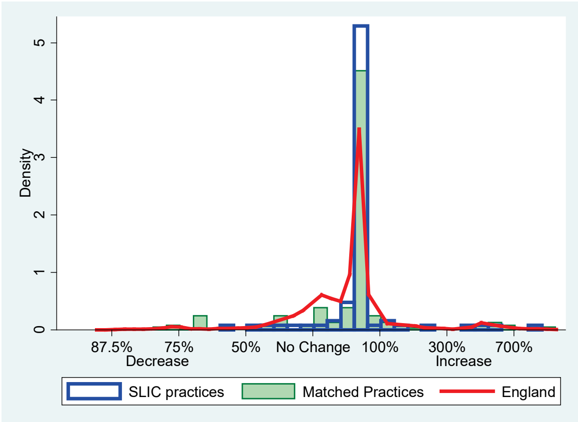

Figure 12. Age adjusted annual relative change in emergency admission rate and ACSC admissions for over 65 year olds

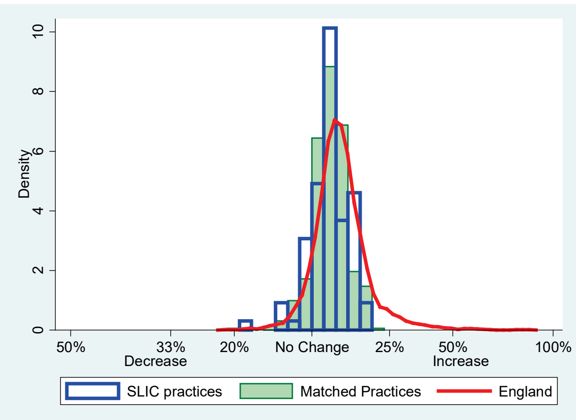

Figure 13. Age adjusted annual relative change in outpatient attendance rate for over 65 year olds

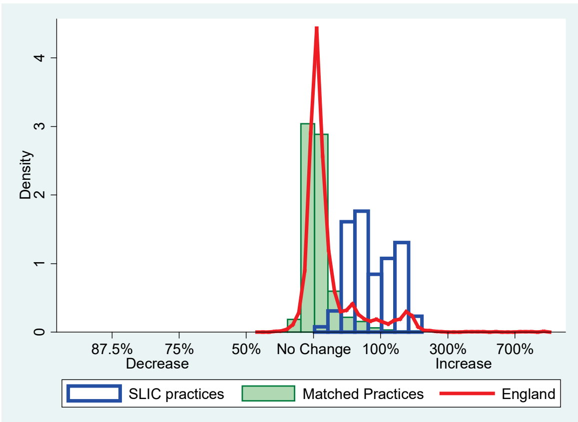

Figure 14. Age adjusted annual relative change in A&E attendance rate for over 65 year olds

Also shown in Figures 5 to 14 are the distributions for the matched control practices. In most cases, the matching seems to have done a reasonably good job. The obvious exception to this is the A&E attendance rate of change. However, given we did not match on this in the end and conclude that many of the estimates are artefactual rather than real, this is of no real concern.

Figures 15 to 23 show the distributions of the other variables that were matched for intervention practices, matched practices and England as a whole. The variables showing substantial departures from the national profile are the percentage of patients who are over 65, over 85 and white, and the practice deprivation score. We see that intervention practices tend to have fewer old patients compared to England, but are located in more deprived areas on average (i.e. their IMD score is higher). We see that, in general, the matching has done a reasonable job of reproducing the distribution of matching variables in the intervention practices, even for those variables where substantial departures are seen from the national distribution. However, some small, and statistically significant, deviations remain.

As another way of assessing matching quality, we also compare distributions for variables not included in the matching process. Figures 24 and 25 show the distributions for the two variables we did not include in the matching algorithm. For both variables, the intervention practices were fairly typical of the distribution seen nationally and the match practices maintain this similarity even though these variables were not matched on.

In the matching process, we matched to 94 intervention practices. The matching was done with a ratio of 5:1 giving 470 intervention practices. Of these, 164 (35 per cent) are practices that were selected only once. A further 122 (26 per cent) are practices that were selected twice (61 practices each appearing twice, giving 122 control practices). The remaining 184 (39 per cent) of control practices are made up of practices that appear three or more times. There are four practices that appear ten times or more. The full distribution of repeated practice selection is shown in Table 10.

Table 10. Distributions of repeatedly selected practices that form the set of matched controls

Appearances	Number of practices n (%)	Resulting number of practices in matched controls n (%)
1	164 (62.4%)	164 (34.9%)
2	61 (23.2%)	122 (26.0%)
3	15 (5.7%)	45 (9.6%)
4	7 (2.7%)	28 (6.0%)
5	8 (3.0%)	40 (8.5%)
6	2 (0.8%)	12 (2.6%)
7	2 (0.8%)	14 (3.0%)
10	2 (0.8%)	20 (4.3%)
11	1 (0.4%)	11 (2.3%)
14	1 (0.4%)	14 (3.0%)

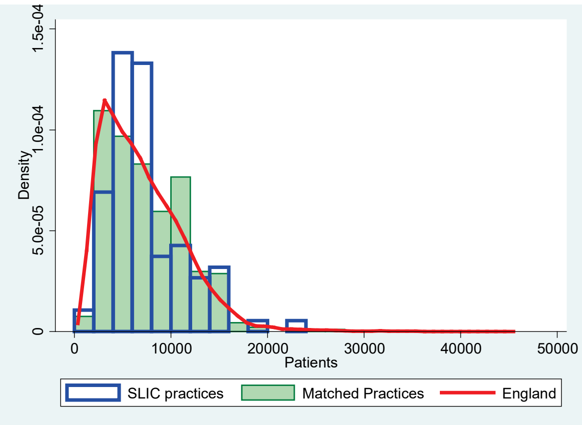

Figure 15. Practice list size

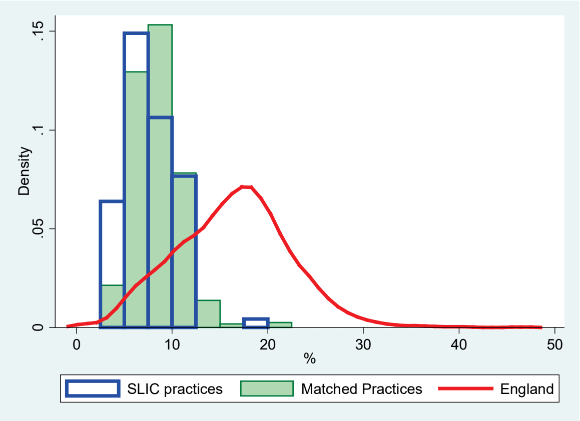

Figure 16. Percentage of practice population over the age of 65

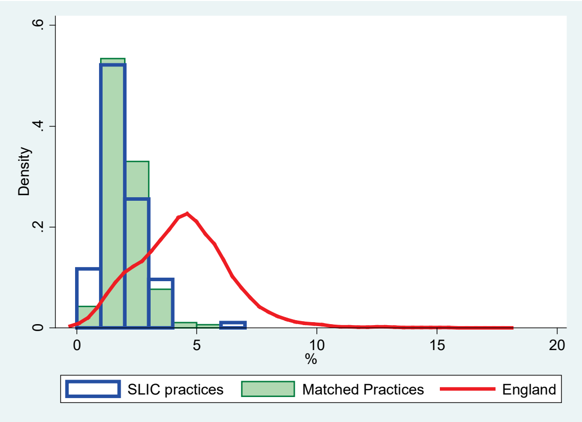

Figure 17. Percentage of practice population over the age of 80

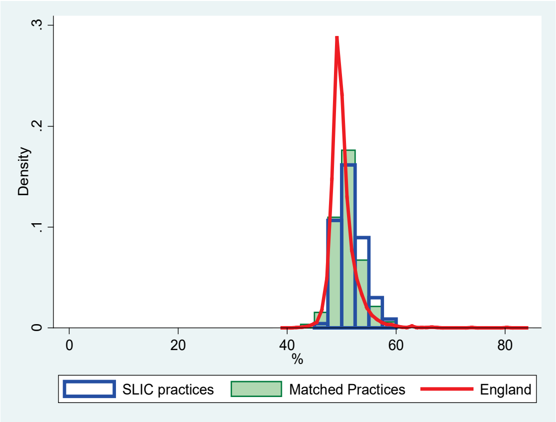

Figure 18. Percentage of practice population who are male

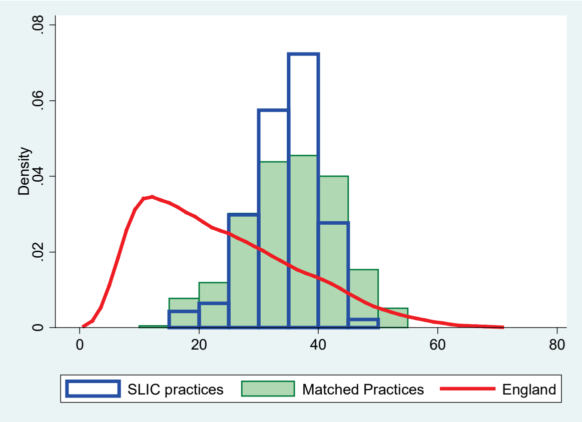

Figure 19. Practice deprivation score

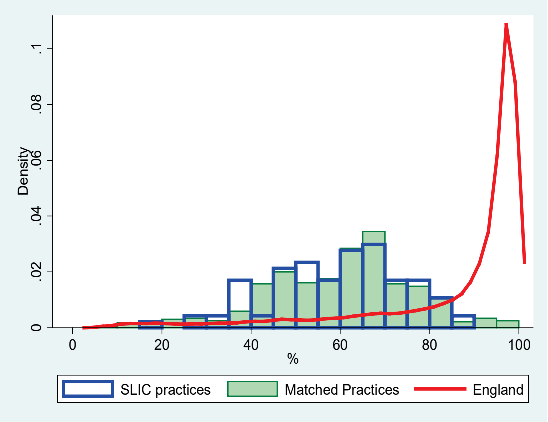

Figure 20. Percentage of practice population who describe themselves as white

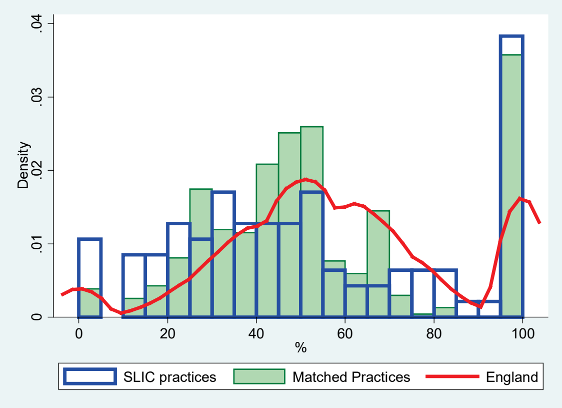

Figure 21. Percentage of full-time equivalents made up of male GPs

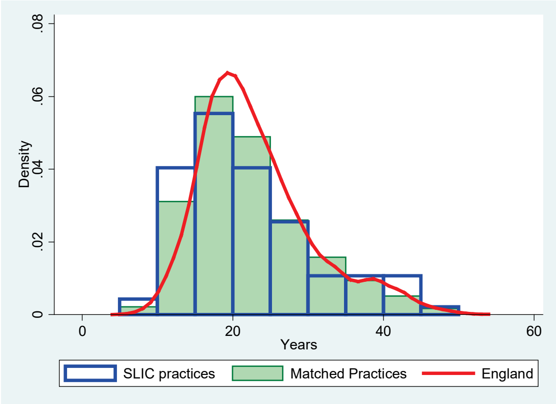

Figure 22. Mean years since qualification of GPs

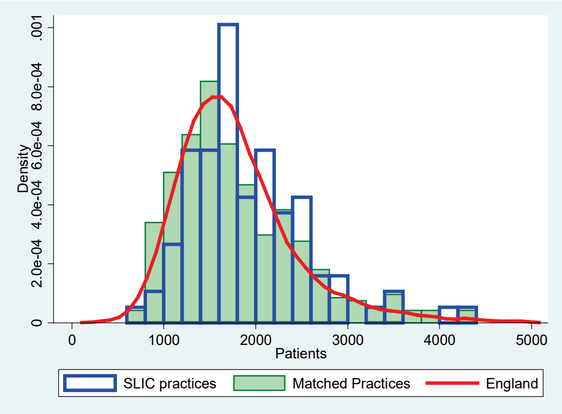

Figure 23. Patients per full-time equivalent

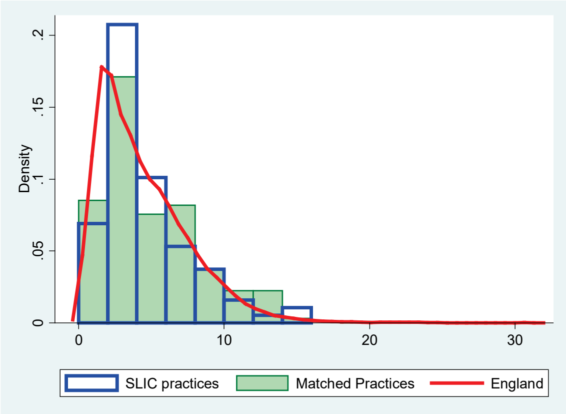

Figure 24. Headcount of GPs

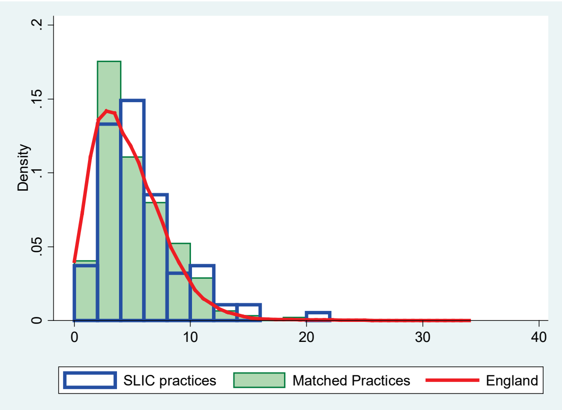

Figure 25. Full-time equivalents