Progress in Using the Electronic Health Record to Improve Primary Care:
the impact of a Clinical Effectiveness Group in east London.

John Robson[1], Kambiz Boomla[1], Sally A Hull[1]

[1] Centre for Primary Care and Public Health, Queen Mary University of London, 58 Turner Street, London E1 2AB

Corresponding author

Sally A Hull
Centre for Primary Care and Public Health
Queen Mary University of London
58 Turner Street
London E1 2AB

Tel: 020 7882 2538

s.a.hull@qmul.ac.uk

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Abstract

Improvement science has been transformed by the electronic health record (EHR) making it possible to share data for patient and population benefit across primary and secondary care organisations, with further linkage to public health, social services, and national registries. Health data analysis is an enabling technology for systems of improvement, promoting behavioural change in professionals and social change and innovation in organisations for patient and citizen benefit. The ability to learn from every patient contact and provide appropriate organisational responses to population needs has been termed a learning health system. The development of IT enabled learning health systems is a journey on which health services have only recently begun.

This report describes the impact trajectory over three decades of the Clinical Effectiveness Group (CEG), a quality improvement (QI) organisation serving a population of 2 million in east London. The core aims include delivering improvements to primary care disease management and reducing health inequalities. Commissioning support, public health and research linkage are further derivatives enabled from the curated EHR. CEG has built capacity for real-time monitoring of services from all inner east London GP practices, with support for QI programmes helping to transform service delivery across the primary/secondary interface. The clinical performance of these localities now rank top in national and some international performance metrics. CEG also supports new initiatives to deliver an integrated EHR platform for all primary, secondary and other health and social data sources to provide both direct clinical care and data for secondary uses. This agenda is aligned with national strategy in the NHS England Forward View and the Wachter Report both of which highlight the synergistic gains from aligning improved data uses, quality improvement and health data science.

BACKGROUND

The seminal work in the 1970s by Geoffrey Rose on population based strategies for prevention (1) and Julian Tudor Hart on evidence based anticipatory care (2, 3) had a profound influence on primary care and were actively supported by the Royal College of General Practitioners.

In 1985 in the east London borough of Tower Hamlets, five GP practices collaborated as the Healthy Eastenders Project to support a basic electronic health record (EHR) system, employing nurses for preventive activities and providing comparative audits of their care. By 1992, with the first wave of general practice computerisation, a single EHR system, Egton Medical Information Systems (EMIS), was deployed across all practices in Tower Hamlets with the neighbouring boroughs of City and Hackney and Newham following closely. The CEG began to form a supportive network for implementing and evaluating work on preventive care across the locality.(4) The early system required 'floppy-discs' to extract data using Morbidity Information Query and Export Syntax (MIQUEST) with manual transport, usually by bicycle, to the CEG office to collate information from each practice. Although cumbersome, the results were transformative. For the first time practices could see their own performance and share comparable information with their peers. (4-6)

In the early days, the theoretical framework used by the CEG team to translate evidence based innovation into routine clinical practice was necessarily pragmatic. With increasing experience two complementary strategies framing the process of change.

The first included elements of change management described by Kotter.(7) These include: building the case for change, forming a coalition which includes both clinicians and managers, empowering others to act on the programme by the provision of education, comparative performance data and quality improvement tools, creating early wins for the programme and consolidating the new approach into work as usual to ensure sustainability. An early example of this approach was engaging all practices to code self-reported ethnicity in the early 1990s. Working in an area where 50% of registered patients are from ethnic minority groups, the importance of understanding inequalities in access to health services and clinical management by ethnicity was clear to all - but practices needed tools and support to do the work. Embedding ethnicity recording into new patient checks and chronic disease management data entry templates provided a simple tool, and population ethnicity recording

rose rapidly to over 80%.(8, 9) This was consolidated by local commissioners providing financial support for health advocacy and translation services where they were most needed.

The second theoretical approach draws on Michie's behaviour change wheel. (10) Interventions are characterised and linked to a core behaviour framework which includes:

Opportunity – environmental factors which prompt the desired behaviour, such as clinical guidelines and professional ownership.

Capability - including the knowledge, clinical and data management skills and psychological capacity to engage with the activity.

Motivation - which combines comparative peer performance review, emotional response to energise and direct behaviour and financial incentives.

In this model CEG provided the analytic support for practice IT capability, and practice based facilitators to train and engage staff in using data entry templates, dashboards, patient recall searches and on-screen prompts. These facilitators connect individual practices to the delivery of new programmes. The main components of the CEG approach to data enabled improvement are summarised in table 1.

Table 1. Core components of CEG approach to data enabled improvement.

Prioritisation: Agreement with local clinicians and managers on areas to target. Based on evidence, ability to make change, alignment of financial incentives, measurability and overall value.	**Guidelines:** The CEG publishes local guidelines for target conditions, to achieve consensus on standards. These are evidence based and locally trusted.
Education: At CCG and local networks events, CEG contributes to teaching on the content of agreed local guidelines.	**Clinical data entry templates:** These standardise clinical coding for common chronic disorders, and support performance measurement. Designed by the CEG team and embedded within the electronic health record system.
Computerised clinical prompts: a range of 'in consultation' and 'back office' searches and prompts. These increase guideline adherence by reminding clinicians of best practice and providing lists of patients for review.	**Analytics and dashboards:** Data are pulled centrally from practice systems to the CEG. Interactive dashboards show comparative performance, which is benchmarked locally, regionally and nationally.
Practice Facilitation: serves to align CEG functions across practices. Facilitators get to know a group of practices and support data management and use of QI tools. This role also provides feedback to the CEG for continuous improvement.	

Based on "sharing to improve" Health Foundation Briefing May 2018 (11)

Trust and leadership

The CEG programmes won the trust of GPs by supporting them to work more efficiently, with greater patient benefit at reduced cost, whilst also increasing practice income. CEG functioned as a non-aligned 'honest-broker'. The neutral university location of CEG reduced GP anxieties about the policing of performance by commissioners, and commissioner anxieties about GPs 'gaming' their performance for financial benefit.

Trust was further strengthened by CEG clinical leads, who worked locally as GP principals, had part-time academic appointments in the university and held prominent positions in local commissioning organisations. Clinical leadership influenced the 'sign up' to data sharing agreements with all GPs, the service agreements with hospital clinicians for novel care pathways, and the support from commissioners for new QI programmes requiring additional funding. Effective clinical leadership has also been a major feature in American health care improvement and was highlighted in the Wachter report.(12-15)

The Wachter Report also pointed out that digitisation is only one part of a whole system of change, and that: *"..implementing health IT is one of the most complex adaptive changes in the history of healthcare, and perhaps of any industry. Adaptive change involves substantial and long-lasting engagement between the leaders implementing the changes and the individuals on the front lines who are tasked with making them work."* (12)

IMPACT ON CLINICAL PERFORMANCE

Delivering the Quality and Outcomes Framework

The east London boroughs of Tower Hamlets, City and Hackney and Newham include a population of 1 million people, registered at 140 general practices, who are among the most disadvantaged and ethnically diverse in the UK. Almost half the population in each of these CCGs is of non-white ethnic origin. Some 35% of children live in poverty, with one in three children obese at the age of 11. Rates of ill-health high, Newham has a higher prevalence of tuberculosis than anywhere else in Western Europe.(16)
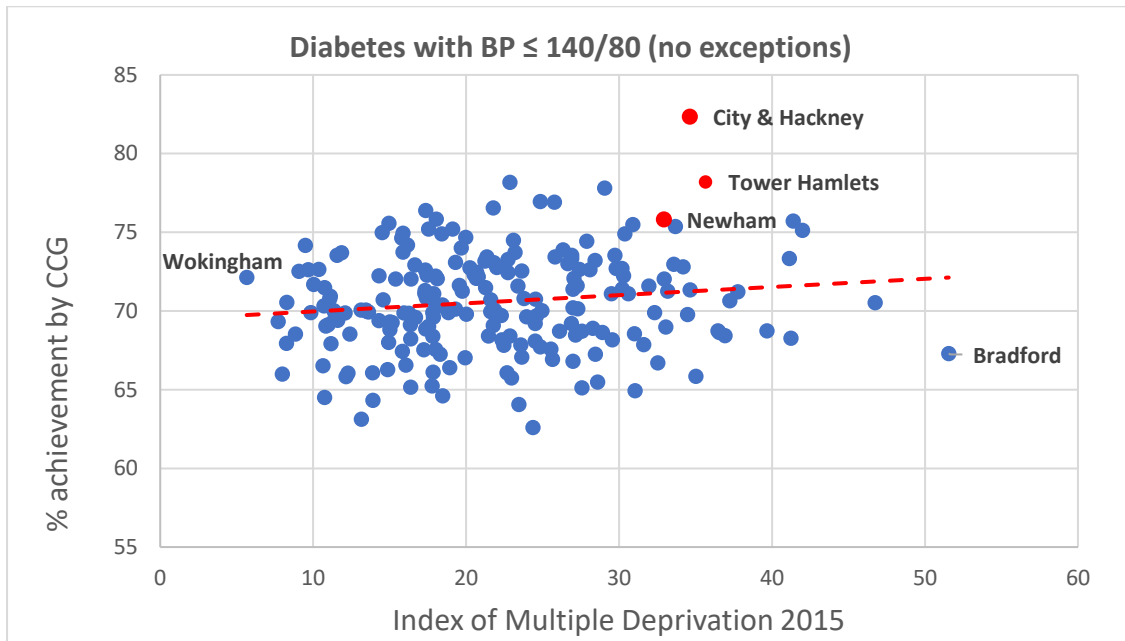
In 2000 the UK government established the National Service Frameworks which for the first time set out a road map for evidence based chronic disease management.(17) This paved the way for the introduction of the Quality and Outcomes Framework (QOF) for general practice

in 2004, a pay for performance scheme covering a broad range of chronic diseases, with financially incentivised targets for clinical indicators, designed to improve evidence based care across the country. At the start of this programme general practices in east London were often in the lowest quintile of national performance. Over the next decade these three CCGs became among the most improved in England, with rankings in the top three positions among the 209 CCGs nationally for 25% of the 60 clinical Quality and Outcome Framework indicators in 2016/17.(18)

The focus of CEG is on clinical improvement, particularly for chronic disease management and preventive programmes including cardiovascular disease, diabetes, chronic kidney, lung disease and immunisation. It promotes programmes with a robust evidence base, high impact and value for money.

Using regular, comparative practice audits to harness professional activity, blood pressure control across the domains of hypertension, CHD and diabetes improved faster than the London average. (19) These improvements were even more impressive when compared with the achievement of CCGs across England. Although in the top decile of deprivation two of the three CCGs achieved the highest performance in England for blood pressure control in those with diabetes. (Figure 1) The three CCGs perform above the English average by 5%, and above similarly deprived CCGs by 10% - each 1% represents about 1 year of improvement in these metrics indicating a gap of 10 years in achievement between east London and some similarly disadvantaged areas. (19)
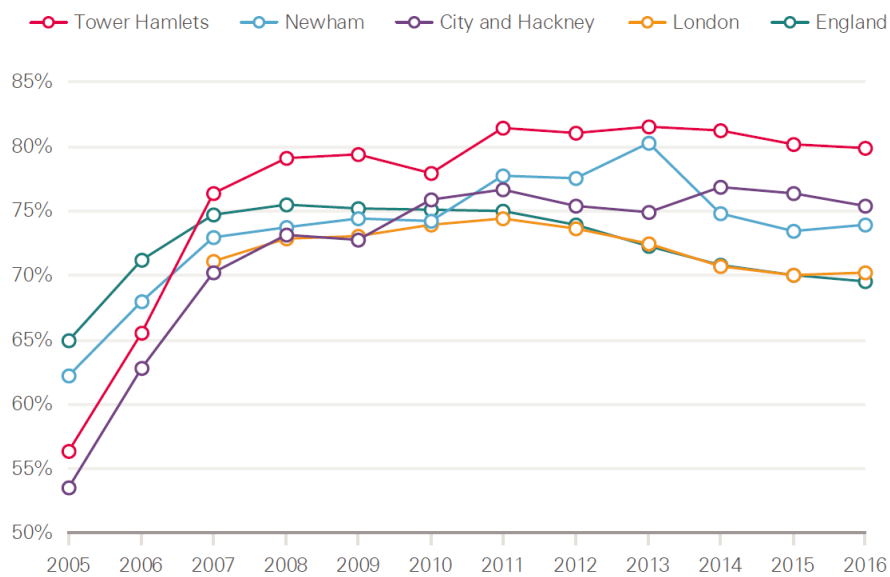
Figure 1. Blood pressure control for people with diabetes by CCG ranked by IMD: Quality and Outcomes Framework 2015

Source: Quality and Outcomes Framework and NHS digital. Average trend in red
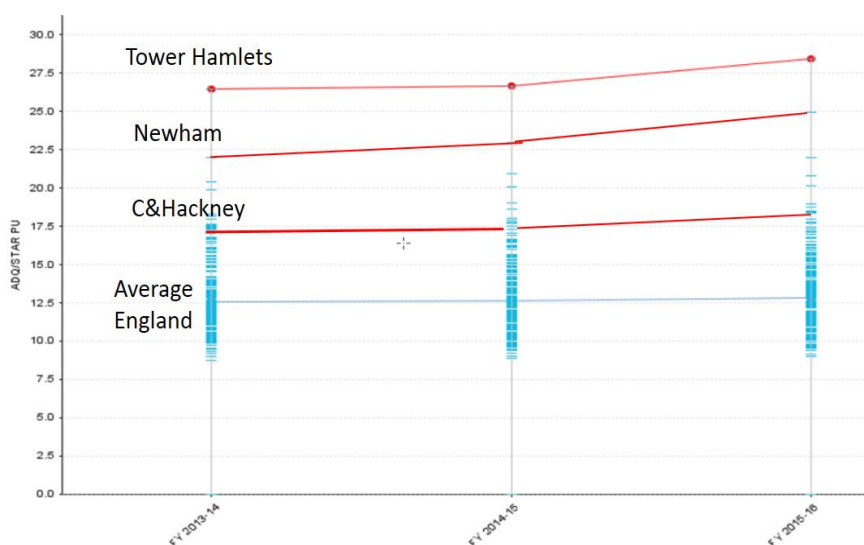
Cardiovascular diseases are the commonest major ameliorable diseases, and along with smoking and blood pressure reduction, lipid lowering treatment has a substantial impact on reducing hospital admissions or death.   East London CCGs showed rapid improvement in the proportion of people with diabetes achieving cholesterol levels <5 mmol/l (Figure 2a). Over 90% of patients in these CCGs with established cardiovascular disease – CHD, stroke or peripheral arterial disease - are on a statin. Figure 2b shows that Tower Hamlets has the highest per capita spend on statins in the UK with City and Hackney and Newham not far behind, with a widening gap compared to most CCGs in England from 2014-2016.

Figure 2a. Percentage of diabetic patients achieving target serum cholesterol <5 mmol/l in east London CCGs compared to London and England, 2016

Source: Quality and Outcomes Framework and Health Foundation briefing (11)

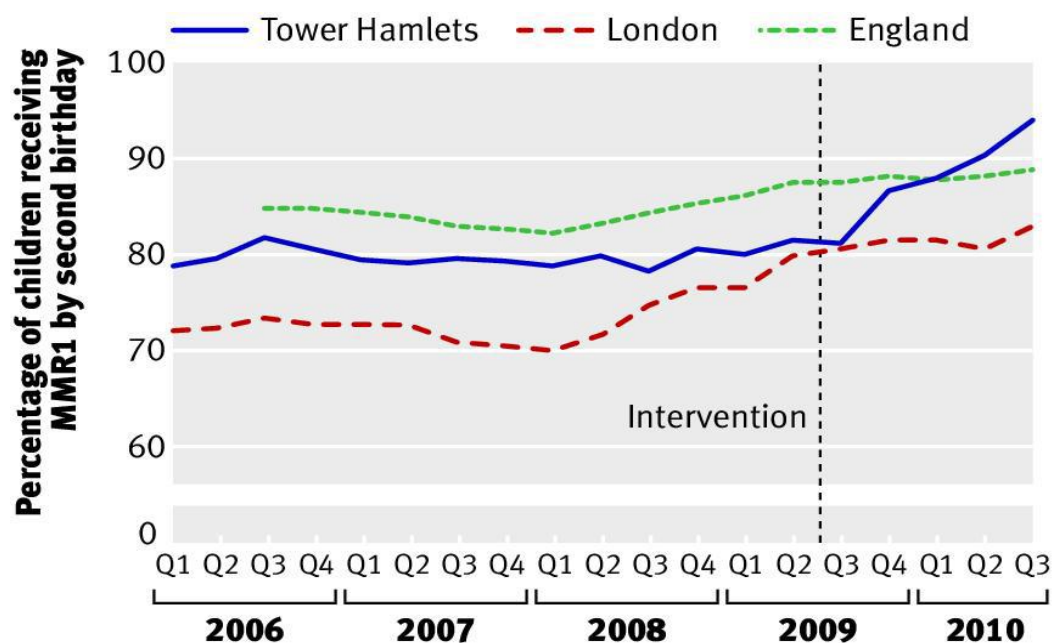**Figure 2b. Statin prescribing across all CCGs in England 2015-16: Average Daily Quantity per standard prescribing unit:**

Source: Data Epact from NHS Business Services Authority 2017

Supporting local enhanced services and programmes for managed practice networks

In 2008 Tower Hamlets invested growth money into eight managed practice networks each with 4-5 practices covering 20-30,000 patients. Networks were created to improve the systematic delivery of chronic disease management, and to engage practices in collaborative working to find solutions for care delivery in a multi-ethnic, socially deprived area with rapid patient turnover. Practices were rewarded financially at network level, but retained autonomy over how improvements were delivered.(20) The CEG provided IT support, including near real-time network dashboards, which enabled data sharing and inter-practice scrutiny which fostered improvement. There were rapid early successes for these programmes, examples include the early improvement in childhood immunisation rates (see Fig. 3), uptake of pulmonary rehabilitation for chronic lung disease and attendance at retinal screening for patients with diabetes.(21-23) Enhanced services programmes with similar clinical content and successful implementation, without using practice networks, were developed in the other two CCGs. Recently all have developed CCG provider networks which contribute to the choice of programmes and to practice support.

Figure 3. Quarterly uptake of the MMR1 vaccine for Tower Hamlets 2006-10 compared with London and England

Source: Cockman P, Dawson L, Mathur R, Hull S. Improving MMR vaccination rates: herd immunity is a realistic goal. BMJ. 2011

CEG LED QUALITY IMPROVEMENT PROGRAMMES

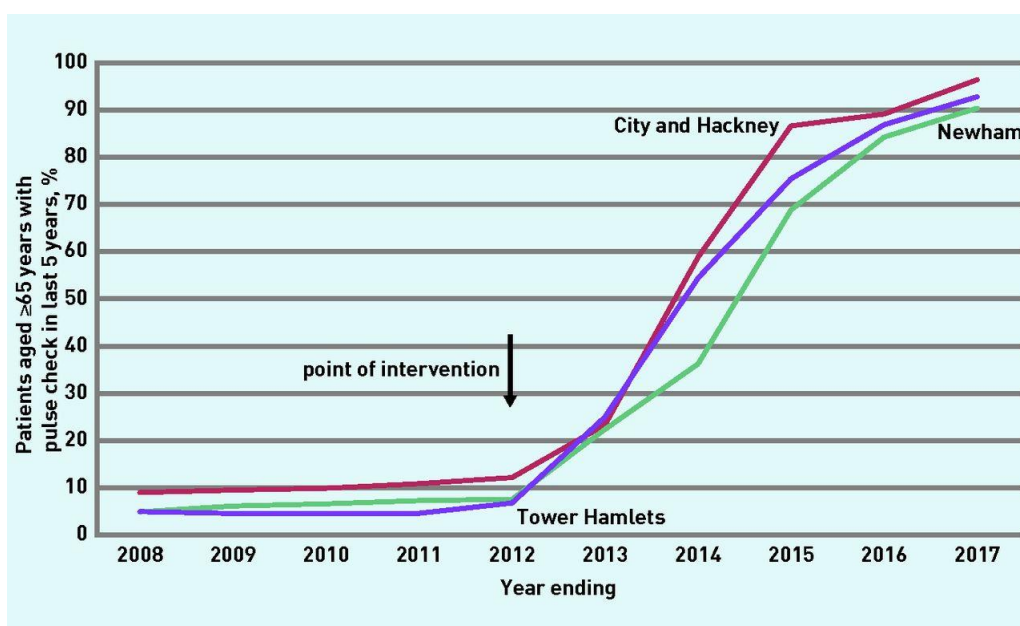*Extending the population reach of effective interventions*

Additional CEG led quality improvement programmes, supported by local practices, were introduced in participating CCGs. The following examples include programmes which extend the reach of evidence-based interventions into the population, and those which reduce ineffective activity.

Pulse checks and use of anticoagulation for atrial fibrillation (AF)

A programme of opportunistic recording of pulse regularity in people 65 years and older was started in 2014. Within three years the recording culture had changed and pulse checks had become the new normal, with 90% uptake across all participating CCGs (see Figure 4). The size of the atrial fibrillation registers increased by 9% over three years – comprising an additional 790 patients identified with AF across the three CCGs.(24)

Over this period aspirin monotherapy (no longer recommended) for AF was reduced by more than half in 3 years, and anticoagulation increased by 15% as patients were switched from aspirin to anticoagulants. East London CCGs now have among the best performance in London for managing atrial fibrillation.

Figure 4. Proportion of people over 65 years with a pulse check in the previous 5 years in participating CCGs.

Source: Cole J. et al. Opportunistic pulse checks in primary care to improve recognition of atrial fibrillation: Br J Gen Pract. 2018.
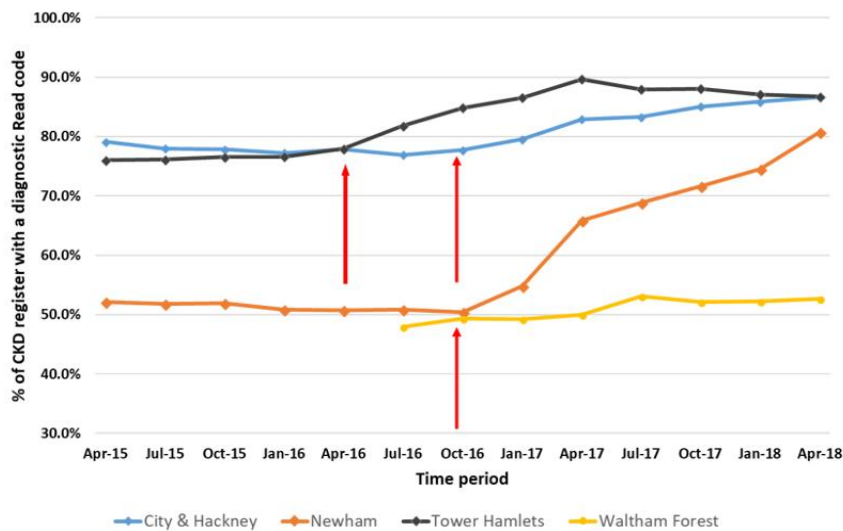
Improving CKD coding and primary care management

There is good evidence that the high rates of cardiovascular risk associated with chronic kidney disease (CKD) can be reduced by blood pressure control and the use of statins (25), and that progression of CKD can be delayed by lowering blood pressure.(26)

Data from the recent national CKD audit demonstrates an association between coding status and better primary care management. (27) Lack of coding is associated with higher rates of unplanned hospital admission. (28)

The east London programme to improve coding rates included CKD dashboards, local guidance and data driven in-practice facilitation, focusing clinical visits for practices in the lowest decile of CKD coding. (29) Figure 5 shows the improvement in the three CCGs implementing this programme with little change in neighbouring Waltham Forest which acted as a natural control.

Figure 5. CKD Coding improvement across east London 2015-18.

Source: Hull SA, Rajabzadeh V, Thomas N, et al. Improving coding and primary care management for patients with chronic kidney disease: Br J Gen Pract. 2019.
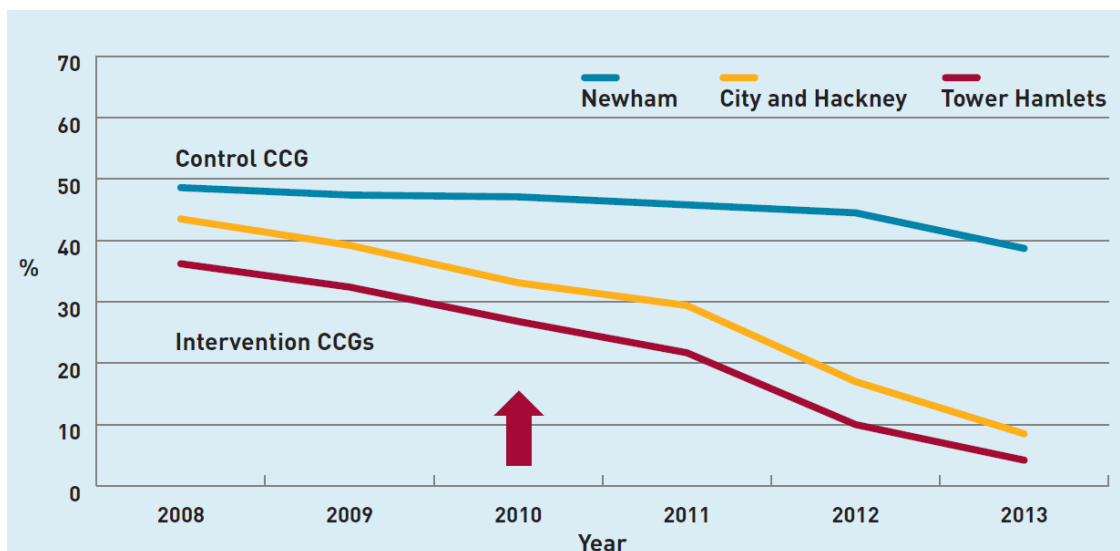
STOPPING INEFFECTIVE INTERVENTIONS AND SAVING MONEY

Reducing blood sugar testing

Self-monitoring for type 2 diabetes is, after insulin, the most expensive aspect of diabetes care. Free machines supplied by drug companies, are handed out in pharmacies and diabetes clinics 'locking-in' patients to a lifetime supply of expensive testing strips.

Consensus on self- testing for diabetes was developed among local GP leads, consultants, specialist nurses and prescribing advisors to reduce unnecessary self-testing. A programme supported by guidelines, dashboards and local education reduced test strip prescribing from 40% to less than 10% among people not on insulin in the two intervention CCGs, with Newham acting as a natural control as it did not initially take part (see Figure 6). If replicated nationally this programme would avoid unnecessary testing in 340,000 people and reduce prescribing costs by £21.8 million per annum.(30)

Figure 6. Proportion of patients with type 2 diabetes on no treatment or metformin only, who are prescribed self-monitoring blood glucose. The red arrow marks the start of the intervention. CCG = clinical commissioning group.

Source: Robson J, et al. Reduction in self-monitoring of blood glucose in type 2 diabetes: an observational controlled study in east London. Br J Gen Pract. 2015

Reducing Liver function tests for monitoring statins

Routine liver function tests (LFTs) for statin monitoring account for about 40% of all liver function testing and annual testing costs more than the cost of the statin. For most CCGs a full array of 6-7 analytes are bundled together as the only ordering option for LFTs. For routine statin monitoring NICE guidance recommends measurement of a single analyte, the ALT. Our intervention consisted of unbundling LFTs to enable ordering ALT alone, providing guidance to GPs and reporting on continuing progress. This achieved a 20% reduction in total liver function tests, and reduced cost in Tower Hamlets CCG by £130,000 within a year.(31)

DEVELOPING SERVICES ACROSS PRIMARY AND SECONDARY CARE

UK primary care has been an international leader in the use of electronic health records since the 1980s. In contrast, NHS hospitals were slow to follow international examples of integrated clinical record systems such as Geisinger in Pennsylvania, Intermountain in Utah and Partners Healthcare in Massachusetts, relying instead on administrative data such as Hospital Episode Statistics to attempt to drive clinical improvement.(32)

In general practice clinical work is now almost entirely paperless and telephone and e-mail have become commonplace.(33) However, interoperable records between hospital and primary care continue to elude most of these initiatives. Typically, electronic GP referral letters to hospitals are still printed on arrival and then scanned as attachments to the hospital record.

There are important recent initiatives for change. Viewing of selected data between the GP EHR and the hospital EHR has become standard practice in east London. When a patient arrives in the hospital ward, a summary view of the GP EHR is available indicating current medication and comorbidities. In the hospital record, the imaging reports and blood tests results are viewable by GPs.(34)

East London community renal service

This novel community renal service, developed by CEG and Barts Health NHS Trust, is one example of integrating primary care population data with a hospital service. Population components include practice searches to code and manage patients where blood tests indicate they have unrecognised CKD, and a practice 'trigger tool' to identify patients with a falling eGFR who may be at risk of progressive CKD.(35) All patients requiring routine

specialist advice are consented for record sharing and referred into the locality 'virtual renal clinic'. The entire patient record is reviewed by the consultant nephrologist using their hospital version of EMIS, and a management plan is written for GPs to view.

Many of these 'virtual' patients are elderly and have multiple co-morbidities. They no longer need to travel further than their GP surgery for specialist advice. Wait time for a consultant nephrology opinion has fallen from three months to less than 10 days.

The integration of secondary and primary care services along the entire patient pathway has major applications for the commonest causes of hospital admission. However, changing the social organisation of care is a complex task in which usable data is only one element.

INTERNATIONAL PERFORMANCE

In this report we describe progression to national excellence in local CCG performance. East London performance is also internationally good. Table 2 compares performance in the 2017 English QOF with the USA performance metrics from Healthcare Effectiveness Data and Information Set (HEDIS) for Kaiser Permanente Southern California, a high performing American health care provider. Comparative results for diabetes care were better in east London, where care is provided for the entire population without exclusion. We estimate that about 20-30% would be excluded in the USA. The east London data, from QOF 2016/2017 are without exception reporting. The 2017 HEDIS figures for commercial and Medicare clients have been averaged.(36) The UK blood pressure target is more stringent than the Kaiser target.

Table 2. Comparison of performance measures for people with diabetes from HEDIS and QOF: Kaiser and east London CCGs 2017

	City & Hackney	*Tower Hamlets*	*Kaiser Permanente*
HbA1c<9%	80.4%	80.1%	78.8%
East London: blood pressure <140/80 mmHg Kaiser <140/90 mmHg	84.2%	81.2%	77.0%

DISCUSSION

The success of quality improvement in east London primary care is contingent upon several factors. These include local GP champions, farsighted commissioners and a 'wise choice' of target conditions to ensure that programme choice was clinically important, measurable and achievable within primary care. A further common factor in all three CCGs has been facilitated support for practice digital enablement by the CEG. Located in the university, and with independence from the CCGs, it enables practice data to be used for learning and improvement, rather than simply managing performance or attributing blame. Together these factors have formed the components of a local learning health system able to learn collectively and respond actively to the needs of both patients and providers.

Scaling up – next steps

Collaborative working is now well established in east London. How transferable are these programmes and patterns of working? Currently CEG is working by invitation in other east London CCGs, being careful to 'choose wisely' to ensure early successes using established programmes such as diabetes and atrial fibrillation. We expect it to take three years to build engagement and trust with new CCGs and GP practices. The importance of understanding the local context, and building trust with early successes, cannot be overstated. Providing practice tools and facilitation to support a core programme leads to increased capability, in turn this leads to willingness to try more complex initiatives. Similar programmes are established in Southwark, and the North West London Integrated Care Services have independently developed similar projects across a comparable population.(37, 38)

East London is now engaged in a new chapter of digital maturity with the development of Discovery. This is a data service which will integrate primary and secondary care data and contribute to the extension of such services across London. (39, 40) Discovery is a system which will provide real time access to the EHR for the extended clinical team – wherever they are based. It will also provide commissioning intelligence and an expanded information service for quality improvement, service redesign and research into the next decade.

Ethical approval

All data from reported publications were de-identified and managed according to the UK NHS information governance requirements. Ethical approval was not required for these reports as they rely on the use of routinely recorded de-identified data published in aggregate form.

Competing Interest statement

All authors declare there are no competing interests.

Author Contributions

SH and JR conceived the report, all three authors contributed to drafts.

Data sharing

No additional data are available.

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