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PINCER National Rollout

Progress Report to NHS England and the AHSN Network

Extended Executive Summary

July 2020

Prepared by the PRIMIS Team at the University of Nottingham, July 2020

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EXECUTIVE SUMMARY

1. Introduction

Medication errors in general practice are an important and expensive preventable cause of patient safety incidents associated with morbidity, hospitalisations and deaths. A large-scale study in English general practices identified errors in 5% of prescription items, with one in 550 items containing a potentially life-threatening error. Given the prevalence of medication errors, and the severity of harm associated with these, there is an urgent need to implement interventions known to correct these errors.

We have developed and tested a pharmacist-led, IT-based intervention (PINCER) to reduce clinically important medication errors in primary care. PINCER involves searching GP clinical systems using computerised prescribing safety indicators to identify patients at risk from their prescriptions, and then acting to correct the problems with pharmacist support. Findings from the PINCER trial, published in the Lancet, demonstrated that PINCER is an effective method for reducing a range of clinically important and commonly made medication errors in primary care and is now incorporated into national guidelines to support medicines optimisation by the National Institute for Health and Care Excellence (NICE).

Prior to nationwide adoption, it is important to assess the effectiveness of any intervention in a large-scale rollout as the conditions in routine care may be different to those in the trial. To do this, we obtained funding from the Health Foundation and East Midlands Academic Health Science Network (AHSN) to evaluate the rollout of PINCER in 370 general practices (94%) across 12 East Midlands Clinical Commissioning Groups (CCGs) between 2015 and 2017. Findings from this evaluation showed a statistically significant reduction in hazardous prescribing with the greatest differences demonstrated for prescribing safety indicators associated with gastrointestinal bleeding. The findings from this study, coupled with further PINCER rollout work in Wessex AHSN, led to the inclusion of PINCER in the national AHSN innovation network programme.

2. Developing a replication model for the scale and spread of PINCER

Having successfully obtained further funding from the Health Foundation to work with Spring Impact, a non-profit global leader in social replication, the University of Nottingham PINCER Team (including PRIMIS), who led the development and testing of the PINCER intervention, has designed a replication model for PINCER for further scale up using a social franchise approach, whereby the University of Nottingham acts as “Franchisor” and the 15 AHSNs in

England act as “Franchisees”. The replication model includes an AHSN Year 1 Implementation Package, with options to extend for Years 2 and 3 comprising:

- Training and support services for AHSNs and CCGs.
- Access to the National PINCER indicators.
- Access to a comparative analysis service for PINCER (CHART Online comparative analysis service).
- Tools to support AHSN reporting requirements and metrics.
- National communication and promotion of the PINCER intervention.

Since 2018, PRIMIS has been working with Medicines Optimisation Leads from all 15 AHSNs in England to implement PINCER in their localities. As part of the national rollout, information on numbers of patients at risk of potentially hazardous prescribing based on the 13 PINCER prescribing safety indicators has contributed to a national comparative data service (Appendix 1). This has provided the ability to monitor changes in numbers of at-risk patients across localities and on a national basis.

3. Changes in policy over time in relation to PINCER

In recent years, a number of policy changes have happened in England that have been helpful when discussing the place of PINCER with general practices and CCGs.

Firstly, and arguably most importantly, NHS England in early 2019 set out in its long-term plan a commitment for pharmacists to take on an expanded role at the heart of local Primary Care Networks (PCNs) across the country. The new GMS contract set out the ambition for every PCN to have access to a pharmacist. In essence, this ensured that there was a commitment to establishing and expanding the workforce in place capable of carrying out the PINCER intervention in collaboration with CCG teams.

In April 2019, the GMS contract encouraged general practices to “engage with their local AHSNs to use PINCER” as part of the quality improvement domain. Practices were incentivised to demonstrate continuous quality improvement in relation to prescribing safety. And whilst not exclusively directed to PINCER, the PINCER intervention was highlighted as an example: https://www.england.nhs.uk/wp-content/uploads/2019/05/gms-contract-qof-guidance-april-2019.pdf

In July 2019, NHS Improvement published their Patient Safety Strategy. It stated that in its first year, they would “enable case finding in primary care; for example, PINCER, a

pharmacist-led information technology intervention for reducing clinically important errors in general practice prescribing. This will support work to reduce prescribing error rates by 50%, improving safety and reducing costs. AHSN-supported national roll-out will reach at least 40% of general practices by 2020":
https://improvement.nhs.uk/documents/5472/190708_Patient_Safety_Strategy_for_website_v4.pdf

These national policy signals helped local conversations move away from "the data" and how to carry out the searches to more meaningful discussions about how to implement the PINCER intervention and how to replicate the results found in the original PINCER trial.

The purpose of this Progress Report is to give an overview of the first 18 months of the national rollout of PINCER to GP practices in England using a social franchise approach, present early findings in terms of impact, and provide insight into lessons learned from implementing a proven intervention at scale in the primary care setting.

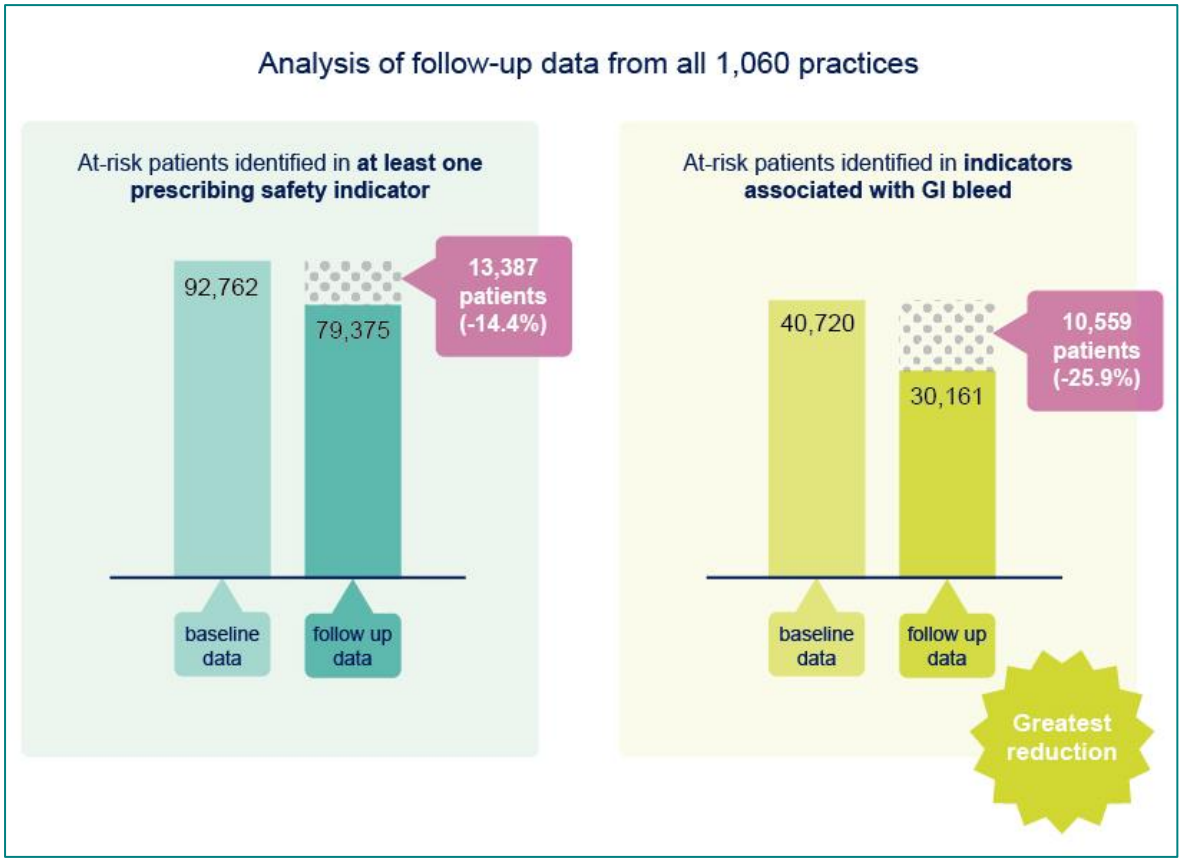
4. Summary of key findings

In terms of the scale and spread of PINCER, as of 3 April 2020, 130 (68%) CCGs in 14 AHSN localities have engaged in the PINCER rollout. A total of 2,430 general practices (of 7,131 general practices in England) have uploaded baseline data to the national PINCER comparative analysis service (Appendix 2) showing that a minimum of 23.35 million patient records have been searched to identify instances of potentially hazardous prescribing using 13 evidence-based prescribing safety indicators. In total, 187,534 at-risk patients have been identified in at least one prescribing safety indicator at baseline giving an overall prevalence of 8.03 patients at risk of medication error per 1,000 registered patients (Appendix 3).

Of the 2,430 practices that have uploaded baseline data to CHART Online, almost half (1,060) have uploaded follow-up data on at least one occasion. These practices are located within 86 CCGs in 13 AHSN localities. The time between baseline and latest upload for these practices ranges from less than one month to 15.5 months with 916 (86.4%) practices uploading follow-up data at least three months post-baseline.

Analysis of follow-up data from all 1,060 practices shows a reduction in the absolute number of at-risk patients identified in at least one prescribing safety indicator of 13,387 patients (from 92,762 to 79,375 patients; -14.4%). Greatest reductions can be seen for those indicators associated with GI bleed which showed a decrease of 10,559 at-risk patients (from 40,720 to 30,161 patients; -25.9%) (Appendix 4). These findings are summarised below:

Summary of key findings



A more detailed analysis of follow-up data at AHSN/CCG level and changes in numbers of at-risk patients for each of the PINCER indicators are presented in Appendices 5-10.

Over 1,138 pharmacists (of a total 1,622 individuals) have been trained to deliver the PINCER intervention through a combination of eLearning tools, online resources and face-to-face action learning set sessions. One interesting observation during training sessions is that GPs and pharmacists working in primary care report that these PINCER action learning sets are the first time they have ever done any QI or root cause analysis training. This in an important and worrying finding that warrants further exploration.

5. Factors for successful implementation of PINCER

The success to date of the national rollout of PINCER has been dependent on a number of factors, including contextual factors, such as NHS England setting out in its long-term plan for pharmacists to take on an expanded role at the heart of local Primary Care Networks. However, five key critical success factors are outlined below.

a) **Evidence-based intervention.** The fact that PINCER is an evidence-based intervention and was included in NICE guidance. The team that developed the intervention were integral to the design and implementation of the replication model and the fact that the rollout was being led by the University of Nottingham gave added credibility, trust and confidence.

b) **Robust replication model.** The development of a robust replication model which was rigid enough to maintain fidelity to the PINCER intervention, but flexible enough to allow for adaptation for local implementation.

c) **Strong Leadership.** Strong leadership and unwavering support, both from within the PINCER team and from the AHSN Network, was critical in the early stages of the rollout. Building trusted, supportive relationships between PRIMIS, the AHSN Network, policy leads and the localities adopting PINCER, was critical to the success of the programme.

d) **PINCER training provision.** Provision of a comprehensive PINCER training programme using a QI approach, was key to the success of the rollout, both in terms of engaging and supporting primary care pharmacists to deliver the PINCER intervention, but also in terms of engaging AHSNs through the Train-the-Trainer programme.

e) **Local support ("PINCER champions").** The extent to which stakeholders engage with PINCER at different stages of implementation is a crucial factor for PINCER uptake, use and sustainability; as is securing agreement for the allocation of pharmacist resource. In keeping with the research findings, we encouraged the development of a network of "PINCER Champions", to increase levels of engagement and strategic direction at general practice, CCG and AHSN levels.

6. Challenges

There have been a number of challenges encountered at different stages of implementing PINCER nationally which the team have had to overcome. Key challenges and factors influencing the scale and pace of rollout are summarised below:

a) **Planning and preparation for national scale and spread.** There was a rapid shift from plans for a phased, national scaling over three years to a more rapid adoption of the PINCER intervention over a shorter period. Both the capacity and capability of the PINCER Team and the AHSN Network could perhaps have been reviewed and aligned to match this level of ambition.

b) **The setting of national AHSN targets.** AHSNs were set targets to meet by March 2019 (ahead of the planned rollout). These were based on uptake of the PINCER intervention in at least 40% of general practices within each AHSN territory. This provided a focus and urgency that was very helpful; yet in some instances it also induced behaviours that

focused on the means (the target), at the expense of the end (sustainable change in practice).

c) **Ensuring a shared interpretation of the PINCER intervention.** There have been several iterations of the PINCER intervention spanning 15 years, leading to different interpretations of what the PINCER intervention actually comprises. National policy guidance referring to "PINCER or equivalent" raised questions about the "equivalence" of other primary care provider solutions. We recognise that "or equivalent" is driven by a legitimate desire to avoid "lock-in" to a single process innovation, and that it may not be possible for national policy to be specific. However, in the absence of a clear articulation by policy bodies of "equivalence", the result was that a number of adopter communities asserted that their existing processes were "equivalent" when this was not the case. Engaging with such communities was particularly challenging for the AHSNs.

d) **Return on Investment (ROI).** Some AHSNs had a need to develop ROI models as part of their CCG engagement activities. This is very different to the economic analysis that was done as part of the PINCER trial and was not something that the PINCER Team could provide. In some instances, this impacted on CCG ability to release resources for the implementation of PINCER. This was further confounded when PINCER was included in QOF with the perception that CCGs were supporting an initiative that GP practices could be rewarded for undertaking.

e) **Implementation of local solutions in two AHSN regions.** The early decision to implement PINCER using local solutions across the Health Innovation Network and North East and North Cumbria AHSNs, has led to the scale and spread of PINCER using the national model being limited to 13 AHSN localities and this is reflected in the data. However, the PINCER Team are supporting these two AHSNs on their local implementation of PINCER.

7. Lessons learned

Key lessons learned from the national rollout of PINCER are summarised below:

a) A clear commissioning pathway and agreed milestones and outcomes are required from the outset, with input from all stakeholders.

b) Whichever replication model is used for scale and spread of any intervention, it needs to be flexible to allow for local implementation. It also must be sensitive to the different histories, sets of beliefs and capabilities in the adopting localities.

c) Mechanisms need to be in place to systematically collect qualitative as well as quantitative outcome data.

d) Involvement of the academic team who developed and tested PINCER was crucial to the success of the rollout. Although the academic team were involved in the design of the

intervention from the outset, the secondment of a member of the academic team to the role of PINCER National Programme Manager, did not happen until August 2019, which was a year into the national rollout. Ideally, it would have been beneficial if this appointment had occurred sooner.

8. Recommendations

a) There is a need to establish a National Strategic Advisory Group to set the longer-term strategy for the development and continued funding of PINCER. This will help ensure that PINCER retains a high profile within the national patient safety strategy.

b) As AHSN Network support for this work tapers off, there is a need to identify national champions for this work committed to ensuring that a supportive policy context for implementation continues and that the learning from implementation is fed back in order to inform further policy and guidance development.

c) Further work needs to be done to establish whether reducing the risk of medication error translates into actual reduction in non-elective hospital admissions in these patient cohorts. The PINCER Team are currently undertaking an NIHR-funded programme of work to explore this in the East Midlands and opportunities to do this work also exist in localities such as Wessex AHSN where the majority of practices implemented PINCER.

d) The opportunity for PRIMIS to work with national NHS organisations and system suppliers to further improve the accessibility and reporting of the PINCER prescribing indicators to all GP practices in the UK.

e) The provision of QI training for GPs and pharmacists working in primary care should be increased.

f) Further consideration should be given to the wider use of social franchising as a method for scale and spread of innovation within the NHS setting.

9. Conclusions

PINCER has been widely implemented in general practices across England with reductions in hazardous prescribing, particularly for prescribing safety indicators associated with gastrointestinal bleeding. These early findings demonstrate the impact that PINCER is having in terms of making primary care prescribing even safer for patients and are comparable with findings from the original research study, which we have managed to replicate at scale and pace. The time between baseline and latest upload varies from less than one month to 15.5 months and we know from previous studies that it takes at least 6-12 months for the intervention to bed-in and for maximum impact to be seen. Therefore, we would expect to see even greater impact as the rollout progresses. It also needs to be noted that some AHSNs

such as East Midlands AHSN started from a lower baseline prevalence of at-risk patients than other AHSNs due to having implemented previous iterations of PINCER.

The extent to which stakeholders engage with PINCER at different stages of implementation is a crucial factor for PINCER uptake, use and sustainability as is securing agreement for the allocation of pharmacist resource. The intervention is likely to be even more acceptable for wider use in general practice with increased access to adequate resources (particularly time for pharmacists and pharmacy technicians) and more information on the potential for PINCER to provide cost-savings through reductions in hospital admissions.

We now have commitment from the majority of AHSNs for continued rollout of PINCER during 2020 to 2021 and further training sessions are planned. To meet demand for training, we have developed a Train-the-Trainer model to enable AHSN Training Partners and PRIMIS Training Associates to deliver training on our behalf. In response to the COVID-19 pandemic, we have developed a suite of online resources and eLearning tools to enable online provision of training sessions. We continue to monitor the impact of PINCER, as increasing numbers of practices upload their follow-up data to the PINCER national comparative analysis service.

We have identified that in light of the creation of Primary Care Networks (PCNs), coupled with increasing numbers of pharmacists working within these networks, with continued funding PINCER has the potential to become fully embedded into everyday clinical practice in primary care. We have been working with Spring Impact and the Health Foundation to update our replication model in readiness for AHSN Network support tapering off post-March 2021 and look forward to working with national bodies to ensure that this important safety work is embedded in areas yet to take up the intervention, and that it is sustained long-term.

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- NHS England, the AHSN Network and the 15 AHSNs in England for funding the national rollout of PINCER. Particular thanks to colleagues from the East Midlands AHSN for their support throughout the whole PINCER programme of work.
- The AHSN Directors, MO Leads, Project Managers and other key AHSN staff for working with us in partnership to implement PINCER at scale and pace to general practices in England.
- AHSN Training Partners and PRIMIS Training Associates for delivering PINCER training on our behalf.
- The CCGs, Medicines Management Teams, PCNs, GPs and general practices involved in the national rollout.
- The pharmacists and pharmacy technicians delivering the PINCER intervention.

The PINCER programme of work has been led by the University of Nottingham (including PRIMIS). It is the result of collaboration with or funding received from the organisations acknowledged below:

- Department of Health and Social Care
- East Midlands Academic Health Science Network
- Lincolnshire Community Health Services NHS Trust
- NHS England
- NIHR Greater Manchester Patient Safety Translational Research Centre
- NIHR School for Primary Care Research
- Spring Impact
- The Health Foundation
- The University of Edinburgh
- The University of Lincoln
- The University of Manchester

APPENDICES

Appendix 1. National PINCER prescribing safety indicators

QUERY	DESCRIPTION OF INDICATOR	GROUP AT RISK (DENOMINATOR)	GROUP EXPOSED TO HAZARDOUS PRESCRIBING (NUMERATOR)
	OUTCOME: GI BLEED		
A2	Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient aged ≥65 years	Patients aged ≥65 years without co-prescription of an ulcer-healing drug (PPI or H2 antagonist) in the 3 months leading up to the audit date	Patients prescribed an oral NSAID in the 3 months leading up to the audit date
B2	Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient with a history of peptic ulceration	Patients aged ≥18 years with a Read code for peptic ulcer or upper GI bleed at least 3 months before audit date and not prescribed an ulcer healing drug (PPI or H2 antagonist) within the 3 months leading up to the audit date	Patients prescribed an oral NSAID within the 3 months leading up to the audit date
B3	Prescription of an antiplatelet drug without co-prescription of an ulcer-healing drug, to a patient with a history of peptic ulceration	Patients aged ≥18 years with a Read code for peptic ulcer or GI bleed at least 3 months before audit date and not prescribed an ulcer healing drug (PPI or H2 antagonist) within the 3 months leading up to the audit date	Patients prescribed an antiplatelet drug (aspirin or clopidogrel or prasugrel or ticagrelor) within the 3 months leading up to the audit date
C2	Prescription of warfarin or DOAC in combination with an oral NSAID	Patients aged ≥18 years prescribed warfarin or a DOAC (apixaban or dabigatran or rivaroxaban or edoxaban) within the 3 months leading up to the audit date	Patients prescribed an oral NSAID within the 3 months leading up to the audit date
D2	Prescription of warfarin or DOAC and an antiplatelet drug in combination without co-prescription of an ulcer-healing drug	Patients aged ≥18 years prescribed warfarin or DOAC without co-prescription of ulcer-healing drug (PPI or H2 antagonist) within the 3 months leading up to the audit date	Patients prescribed an antiplatelet drug (aspirin or clopidogrel or prasugrel or ticagrelor) within the 3 months leading up to the audit date and within 28 days of the warfarin/ DOAC prescription
E2	Prescription of aspirin in combination with another antiplatelet drug (without co-prescription of an ulcer-healing drug)	Patients aged ≥18 years prescribed aspirin without co-prescription of ulcer-healing drug (PPI or H2 antagonist) within the 3 months leading up to the audit date	Patients prescribed another antiplatelet drug (clopidogrel or prasugrel or ticagrelor) within the 3 months leading up to the audit date and within 28 days of the aspirin prescription
	OUTCOME: HEART FAILURE		
F2	Prescription of an oral NSAID to a patient with heart failure	Patients aged ≥18 years who have a diagnosis of heart failure at least 3 months before the audit date	Patients prescribed an oral NSAID within the 3 months leading up to the audit date
	OUTCOME: ACUTE KIDNEY INJURY		
G2	Prescription of an oral NSAID to a patient with eGFR <45	Patients aged ≥18 years with chronic renal failure: eGFR <45 at least 3 months before the audit date	Patients prescribed an oral NSAID within the 3 months leading up to the audit date
	OUTCOME: EXACERBATION OF ASTHMA		
H2	Prescription of a non-selective beta-blocker to a patient with asthma	Patients aged ≥18 years with a Read code for asthma at least 3 months before audit date and no subsequent asthma resolved code during that time period	Patients prescribed a non-selective β-blocker within the 3 months leading up to the audit date

QUERY	DESCRIPTION OF INDICATOR	GROUP AT RISK (DENOMINATOR)	GROUP EXPOSED TO HAZARDOUS MONITORING (NUMERATOR)
	OUTCOME: MONITORING INDICATORS		
I2	Patients aged 75 years and older who have been prescribed an angiotensin converting enzyme (ACE) inhibitor or a loop diuretic long term who have not had a computer-recorded check of their renal function and electrolytes in the previous 15 months	Patients aged ≥75 years prescribed an ACE inhibitor or a loop diuretic long-term i.e. first prescription for an ACE inhibitor or a loop diuretic at least 15 months prior to the audit date and at least one prescription (for the same drug) in the 6 months leading up to the audit date	Patients who have not had a computer-recorded check of their renal function and electrolytes within the previous 15 months leading up to the audit date
J2 **J3**	Patients receiving methotrexate for at least 3 months who have not had a recorded: • Full blood count (FBC) within the previous 3 months • Liver function test (LFT) within the previous 3 months	Patients aged ≥18 years with one or more prescriptions for methotrexate 3 to 6 months prior to the audit date and in the 3 months leading up to the audit date	**J2.** Patients who have not had a computer-recorded FBC within the 3 months leading up to the audit date **J3.** Patients who had not had a computer-recorded LFT within the 3 months leading up to the audit date
K2	Patients receiving lithium for at least 3 months who have not had a recorded check of their lithium concentrations in the previous 3 months	Patients aged ≥18 years with one or more prescriptions for lithium recorded on computer 3 to 6 months prior to the audit date and in the 3 months leading up to the audit date	Patients who have not had a computer-recorded lithium level within the 3 months leading up to the audit date
L2	Patients receiving amiodarone for at least 6 months who have not had a thyroid function test (TFT) within the previous 6 months	Patients aged ≥18 years with one or more prescriptions for amiodarone 6 to 12 months prior to the audit date and in the 6 months leading up to the audit date	Patients who have not had a computer-recorded TFT within the 6 months leading up to the audit date

Appendix 1. Practice baseline upload activity by quarter (AHSN Level)

AHSN name	Number of practices (n)									
	Number of CCGs (n)	Jul-Sept 2018/19 Q2	Oct-Dec 2018/19 Q3	Jan-Mar 2018/19 Q4	Apr-Jun 2019/20 Q1	Jul-Sept 2019/20 Q2	Oct-Dec 2019/20 Q3	Jan-Mar 2019/20 Q4	Total (n)	Percentage (%)
East Midlands	15	3		84	19	56	26	16	204	36.9
Eastern	11	1				46	16	53	116	24.7
Health Innovation Manchester	1					4			4	0.8
Health Innovation Network	11	1			100	49	31	30	211	49.5
Imperial College Health Partners	8	1		14	2	27	123	35	202	54.7
Innovation Agency	8					13	59	81	153	26.1
Kent Surrey Sussex	14					38	55	26	119	22.7
Oxford	4		17	7	138	22	15	5	204	82.6
South West	3			1		47	34	17	99	37.4
UCL Partners	12				36	65	77	61	239	31.5
Wessex	9				103	101	23	7	234	86.3
West Midlands	14	4					127	121	252	30.4
West of England	4			13	31	81	39	12	176	67.9
Yorkshire & Humber	16			131	25	13	14	34	217	32.2
Total	**130**	**10**	**17**	**250**	**454**	**562**	**639**	**498**	**2,430**	**34.1**

Appendix 2. Number of at-risk patients identified at baseline (AHSN Level)

AHSN name	Number of CCGs (n)	Number practices uploading to COL (n)	Number at-risk patients baseline (n)	Total practice population (n)	Prevalence per 1,000 registered patients (n)	Mean number of patients per practice (n)
East Midlands	15	204	11,800	1,833,712	6.44	57.8
Eastern	11	116	12,140	1,495,135	8.12	104.7
Health Innovation Manchester	1	4	229	27,109	8.45	57.3
Health Innovation Network	11	211	10,987	2,111,582	5.20	52.1
Imperial College Health Partners	8	202	8,596	1,496,066	5.75	42.6
Innovation Agency	8	153	12,775	1,210,980	10.55	83.5
Kent Surrey Sussex	14	119	11,444	1,247,611	9.17	96.2
Oxford	4	204	18,570	2,266,584	8.19	91.0
South West	3	99	11,412	1,033,696	11.04	115.3
UCL Partners	12	239	12,136	2,123,566	5.71	50.8
Wessex	9	234	28,623	2,652,721	10.79	122.3
West Midlands	14	252	16,717	2,068,728	8.08	66.3
West of England	4	176	15,180	1,873,604	8.10	86.3
Yorkshire & Humber	16	217	16,925	1,909,602	8.86	78.0
Total	**130**	**2,430**	**187,534**	**23,350,696**	**8.03**	**77.2**

Appendix 3. Change in number of at-risk patients identified in the composite indicators for 1,060 practices that have uploaded data at least twice to CHART Online

Indicator	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
	Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
Number of at-risk patients identified in at least one GI Bleed indicator	40,720	3.73	30,161	2.73	-10,559	-25.9	-1.00
Number of at-risk patients identified in at least one monitoring indicator	35,002	3.21	31,558	2.86	-3,444	-9.8	-0.35
Number of at risk patients identified in at least one other indicator (heart failure, AKI or exacerbation of asthma)	18,459	1.69	18,261	1.65	-198	-1.1	-0.04
Number of at-risk patients identified in at least one indicator (all indicators)	92,762	8.51	79,375	7.19	-13,387	-14.4	-1.32

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 4. Change in number of at-risk patients identified in at least one GI Bleed indicator for 1,060 practices that have uploaded data at least twice to CHART Online (AHSN Level)

AHSN	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
East Midlands	109	2,270	2.49	1,701	1.86	-569	-25.1	-0.63
Eastern	50	2,053	3.85	1,609	3.00	-444	-21.6	-0.85
Health Innovation Network	78	1,775	2.06	1,258	1.43	-517	-29.1	-0.63
Imperial College Health Partners	45	706	2.18	537	1.65	-169	-23.9	-0.53
Innovation Agency	37	1,219	4.41	967	3.68	-252	-20.7	-0.73
Kent Surrey Sussex	43	1,920	4.20	1,427	3.07	-493	-25.7	-1.13
Oxford	133	5,950	3.80	4,131	2.57	-1,819	-30.6	-1.23
South West	54	3,637	6.07	2,393	3.98	-1,244	-34.2	-2.09
UCL Partners	83	1,487	2.29	1,001	1.52	-486	-32.7	-0.77
Wessex	202	10,042	4.30	7,232	3.05	-2,810	-28.0	-1.25
West Midlands	16	430	3.02	322	2.25	-108	-25.1	-0.77
West of England	153	6,675	4.01	5,149	3.03	-1,526	-22.9	-0.98
Yorkshire & Humber	57	2,556	4.42	2,434	4.19	-122	-4.8	-0.23
Total	**1,060**	**40,720**	**3.73**	**30,161**	**2.73**	**-10,559**	**-25.9**	**-1.00**

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 5. Change in number of at-risk patients identified in at least one monitoring indicator for 1,060 practices that have uploaded data at least twice to CHART Online (AHSN Level)

AHSN	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
East Midlands	109	1,827	2.01	1,701	1.86	-126	-6.9	-0.15
Eastern	50	1,623	3.05	1,483	2.77	-140	-8.6	-0.28
Health Innovation Network	78	1,677	1.94	1,459	1.66	-218	-13.0	-0.28
Imperial College Health Partners	45	700	2.16	597	1.83	-103	-14.7	-0.33
Innovation Agency	37	816	2.95	683	2.60	-133	-16.3	-0.35
Kent Surrey Sussex	43	1,946	4.25	1,646	3.54	-300	-15.4	-0.71
Oxford	133	4,591	2.93	4,000	2.49	-591	-12.9	-0.44
South West	54	2,001	3.34	1,748	2.90	-253	-12.6	-0.44
UCL Partners	83	2,020	3.11	1,712	2.60	-308	-15.2	-0.51
Wessex	202	11,481	4.91	10,594	4.47	-887	-7.7	-0.44
West Midlands	16	406	2.85	382	2.67	-24	-5.9	-0.18
West of England	153	4,557	2.73	4,125	2.43	-432	-9.5	-0.30
Yorkshire & Humber	57	1,357	2.35	1,428	2.46	71	5.2	0.11
Total	**1,060**	**35,002**	**3.21**	**31,558**	**2.86**	**-3,444**	**-9.8**	**-0.35**

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 6. Change in number of at-risk patients identified in at least one other indicator (heart failure, AKI or exacerbation of asthma) for 1,060 practices that have uploaded data at least twice to CHART Online (AHSN Level)

AHSN	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
East Midlands	109	1,447	1.59	1,428	1.56	-19	-1.3	-0.03
Eastern	50	992	1.86	952	1.78	-40	-4.0	-0.08
Health Innovation Network	78	886	1.03	924	1.05	38	4.3	0.02
Imperial College Health Partners	45	370	1.14	387	1.19	17	4.6	0.05
Innovation Agency	37	699	2.53	586	2.23	-113	-16.2	-0.30
Kent Surrey Sussex	43	959	2.10	914	1.97	-45	-4.7	-0.13
Oxford	133	2,490	1.59	2,449	1.52	-41	-1.6	-0.07
South West	54	1,353	2.26	1,300	2.16	-53	-3.9	-0.10
UCL Partners	83	678	1.04	673	1.02	-5	-0.7	-0.02
Wessex	202	4,773	2.04	4,849	2.05	76	1.6	0.01
West Midlands	16	195	1.37	183	1.28	-12	-6.2	-0.09
West of England	153	2,604	1.56	2,542	1.50	-62	-2.4	-0.06
Yorkshire & Humber	57	1,013	1.75	1,074	1.85	61	6.0	0.10
Total	**1,060**	**18,459**	**1.69**	**18,261**	**1.65**	**-198**	**-1.1**	**-0.04**

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 7. Change in number of at-risk patients identified in at least one indicator (all indicators) for 1,060 practices that have uploaded data at least twice to CHART Online (AHSN Level)

AHSN	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
East Midlands	109	6,179	6.78	5,627	6.14	-552	-8.9	-0.64
Eastern	50	4,570	8.58	3,954	7.38	-616	-13.5	-1.20
Health Innovation Network	78	4,262	4.94	3,595	4.10	-667	-15.6	-0.84
Imperial College Health Partners	45	1,734	5.35	1,484	4.55	-250	-14.4	-0.80
Innovation Agency	37	2,672	9.67	2,188	8.32	-484	-18.1	-1.35
Kent Surrey Sussex	43	4,713	10.30	3,917	8.42	-796	-16.9	-1.88
Oxford	133	12,709	8.11	10,371	6.45	-2,338	-18.4	-1.66
South West	54	6,843	11.43	5,359	8.90	-1,484	-21.7	-2.53
UCL Partners	83	4,094	6.29	3,338	5.07	-756	-18.5	-1.22
Wessex	202	25,663	10.98	22,222	9.38	-3,441	-13.4	-1.60
West Midlands	16	1,016	7.14	878	6.14	-138	-13.6	-1.00
West of England	153	13,473	8.08	11,590	6.83	-1,883	-14.0	-1.25
Yorkshire & Humber	57	4834	8.36	4852	8.35	18	0.4	-0.01
Total	**1060**	**92,762**	**8.51**	**79,375**	**7.19**	**-13,387**	**-14.4**	**-1.32**

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 8. Change in number of at-risk patients identified in at least one indicator (all indicators) for 1,060 practices that have uploaded data at least twice to CHART Online (CCG Level)

AHSN/CCG	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
EAST MIDLANDS								
NHS Derby and Derbyshire	12	617	6.18	615	6.16	-2	-0.3	-0.02
NHS Mansfield and Ashfield	26	1,446	7.36	1,209	6.14	-237	-16.4	-1.22
NHS Nene	4	1,007	30.88	1,136	34.68	129	12.8	3.80
NHS Newark & Sherwood	8	548	7.58	421	5.86	-127	-23.2	-1.72
NHS Nottingham City	24	920	4.85	813	4.24	-107	-11.6	-0.61
NHS Nottingham N & E	12	533	5.41	465	4.68	-68	-12.8	-0.73
NHS Nottingham West	11	515	5.52	443	4.74	-72	-14.0	-0.78
NHS Rushcliffe	12	593	4.61	525	4.04	-68	-11.5	-0.57
East Midlands Total	***109***	***6,179***	***6.78***	***5,627***	***6.14***	***-552***	***-8.9***	***-0.64***
EASTERN								
NHS Bedfordshire	42	3,755	8.76	3,272	7.57	-483	-12.9	-1.19
NHS Cambridgeshire & Peterborough	6	584	6.87	511	6.03	-73	-12.5	-0.84
NHS Ipswich & East Suffolk	1	122	12.54	99	10.15	-23	-18.9	-2.39
NHS West Suffolk	1	109	11.87	72	7.86	-37	-33.9	-4.01
Eastern Total	***50***	***4,570***	***8.58***	***3,954***	***7.38***	***-616***	***-13.5***	***-1.20***
HEALTH INNOVATION NETWORK								
NHS Bromley	2	75	4.67	58	3.53	-17	-22.7	-1.14
NHS Kingston	3	234	6.70	229	6.47	-5	-2.1	-0.23
NHS Lambeth	20	808	3.64	697	3.11	-111	-13.7	-0.53
NHS Lewisham	8	289	4.27	257	3.42	-32	-11.1	-0.85
NHS Merton	1	153	5.13	125	4.17	-28	-18.3	-0.96
NHS Richmond	2	141	7.60	95	5.10	-46	-32.6	-2.50
NHS Southwark	15	743	3.97	639	3.37	-104	-14.0	-0.60
NHS Sutton	15	1,072	7.76	917	6.57	-155	-14.5	-1.19
NHS Wandsworth	12	747	5.01	578	3.88	-169	-22.6	-1.13
Health Innovation Network Total	***78***	***4,262***	***4.94***	***3,595***	***4.10***	***-667***	***-15.6***	***-0.84***

AHSN/CCG	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
IMPERIAL COLLEGE HEALTH PARTNERS								
NHS Brent	15	698	5.81	551	4.57	-147	-21.1	-1.24
NHS Central London	2	51	2.83	43	2.45	-8	-15.7	-0.38
NHS Ealing	7	265	5.22	268	5.19	3	1.1	-0.03
NHS Hammersmith & Fulham	3	91	4.17	92	4.15	1	1.1	-0.02
NHS Harrow	7	238	5.78	197	4.77	-41	-17.2	-1.01
NHS Hillingdon	4	167	7.19	122	5.22	-45	-26.9	-1.97
NHS Hounslow	3	124	5.87	117	5.52	-7	-5.6	-0.35
NHS West London	4	100	3.60	94	3.35	-6	-6.0	-0.25
Imperial College Health Partners Total	***45***	***1,734***	***5.35***	***1,484***	***4.55***	***-250***	***-14.4***	***-0.80***
INNOVATION AGENCY								
NHS Chorley & South Ribble	2	176	10.19	178	10.29	2	1.1	0.10
NHS Greater Preston	1	111	6.00	111	6.03	0	0.0	0.03
NHS Knowsley	6	260	8.49	173	5.55	-87	-33.5	-2.94
NHS Morecambe Bay	11	778	9.11	712	8.34	-66	-8.5	-0.77
NHS Warrington	1	39	6.97	20	7.34	-19	-48.7	0.37
NHS West Lancashire	10	837	9.92	716	8.47	-121	-14.5	-1.45
NHS Wirral	6	471	13.60	278	11.86	-193	-41.0	-1.74
Innovation Agency Total	***37***	***2,672***	***9.67***	***2,188***	***8.32***	***-484***	***-18.1***	***-1.35***
KENT SURREY SUSSEX								
NHS Brighton & Hove	8	488	6.62	408	5.50	-80	-16.4	-1.12
NHS East Surrey	2	196	8.43	186	6.36	-10	-5.1	-2.07
NHS Eastbourne, Hailsham & Seaford	14	1,760	12.74	1,493	10.80	-267	-15.2	-1.94
NHS Hastings & Rother	5	874	16.21	559	10.34	-315	-36.0	-5.87
NHS North West Surrey	6	392	6.72	366	6.20	-26	-6.6	-0.52
NHS Surrey Downs	1	65	5.42	64	5.36	-1	-1.5	-0.06
NHS Surrey Heath	7	938	9.55	841	8.55	-97	-10.3	-1.00
Kent Surrey Sussex Total	***43***	***4,713***	***10.30***	***3,917***	***8.42***	***-796***	***-16.9***	***-1.88***

AHSN/CCG	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
OXFORD								
NHS Berkshire West	16	2,093	9.14	1,809	7.54	-284	-13.6	-1.60
NHS Buckinghamshire	32	3,409	8.75	2,724	6.95	-685	-20.1	-1.80
NHS East Berkshire	37	2,955	7.56	2,361	5.97	-594	-20.1	-1.59
NHS Oxfordshire	48	4,252	7.61	3,477	5.99	-775	-18.2	-1.62
Oxford Total	***133***	***12,709***	***8.11***	***10,371***	***6.45***	***-2,338***	***-18.4***	-1.66
SOUTH WEST								
NHS Devon	38	4,326	10.85	3,527	8.78	-799	-18.5	-2.07
NHS Kernow	16	2,517	12.56	1,832	9.16	-685	-27.2	-3.40
South West Total	***54***	***6,843***	***11.43***	***5,359***	***8.90***	***-1,484***	***-21.7***	***-2.53***
UCL PARTNERS								
NHS Barking & Dagenham	10	494	6.86	461	6.38	-33	-6.7	-0.48
NHS Barnet	17	1,068	7.12	740	4.92	-328	-30.7	-2.20
NHS Camden	1	77	6.44	71	5.94	-6	-7.8	-0.50
NHS City & Hackney	12	331	4.14	268	3.32	-63	-19.0	-0.82
NHS Enfield	1	151	11.22	97	7.23	-54	-35.8	-3.99
NHS Haringey	8	342	5.97	314	5.43	-28	-8.2	-0.54
NHS Havering	14	921	11.02	817	9.75	-104	-11.3	-1.27
NHS Islington	8	338	5.19	285	4.34	-53	-15.7	-0.85
NHS Newham	9	268	2.72	228	2.21	-40	-14.9	-0.51
NHS Redbridge	1	22	3.91	22	3.92	0	0.0	0.01
NHS Waltham Forest	2	82	6.35	35	2.67	-47	-57.3	-3.68
UCL Partners Total	***83***	***4,094***	***6.29***	***3338***	***5.07***	***-756***	***-18.5***	***-1.22***

AHSN/CCG	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
WESSEX								
NHS Dorset	77	9,231	11.79	7,216	9.06	-2,015	-21.8	-2.73
NHS Fareham & Gosport	17	2,756	13.41	2,385	11.61	-371	-13.5	-1.80
NHS Isle of Wight	3	645	20.19	590	18.42	-55	-8.5	-1.77
NHS NE Hampshire & Farnham	2	199	10.51	138	7.23	-61	-30.7	-3.28
NHS North Hampshire	14	1,972	8.75	1,733	7.63	-239	-12.1	-1.12
NHS Portsmouth	15	2,270	9.80	2,092	8.98	-178	-7.8	-0.82
NHS South Eastern Hampshire	20	2,568	11.80	2,426	11.11	-142	-5.5	-0.69
NHS Southampton	6	361	5.54	363	5.48	2	0.6	-0.06
NHS West Hampshire	48	5,661	10.16	5,279	9.22	-382	-6.7	-0.94
Wessex Total	***202***	***25,663***	***10.98***	***22,222***	***9.38***	***-3,441***	***-13.4***	***-1.60***
WEST MIDLANDS								
NHS Birmingham & Solihull	1	100	8.81	76	6.70	-24	-24.0	-2.11
NHS North Staffordshire	1	57	5.00	60	5.26	3	5.3	0.26
NHS Sandwell & West Birmingham	8	337	5.27	204	3.17	-133	-39.5	-2.10
NHS Shropshire	1	61	5.56	55	5.04	-6	-9.8	-0.52
NHS South Warwickshire	3	294	10.94	318	11.69	24	8.2	0.75
NHS Stoke-on-Trent	2	167	9.36	165	9.22	-2	-1.2	-0.14
West Midlands Total	***16***	***1,016***	***7.14***	***878***	***6.14***	***-138***	***-13.6***	***-1.00***
WEST OF ENGLAND								
NHS Bath and NE Somerset	20	1,205	7.78	1,054	6.76	-151	-12.5	-1.02
NHS Bristol, N Somerset & S Gloucestershire	73	7,139	7.43	5,941	6.01	-1198	-16.8	-1.42
NHS Gloucestershire	60	5,129	9.31	4,595	8.30	-534	-10.4	-1.01
West of England Total	***153***	***13,473***	***8.08***	***11,590***	***6.83***	***-1883***	***-14.0***	***-1.25***

AHSN/CCG	Number of practices (n)	Baseline*		Latest **		Change in absolute number of at-risk patients (n)	% change in absolute number of at-risk patients (%)	Change in prevalence per 1,000 patients (n)
		Numerator (n)	Prevalence per 1,000 patients (n)	Numerator (n)	Prevalence per 1,000 patients (n)			
YORKSHIRE & HUMBER								
NHS Barnsley	4	393	9.35	405	9.58	12	3.1	0.23
NHS Calderdale	25	1,934	8.71	2,237	10.01	303	15.7	1.30
NHS Greater Huddersfield	11	611	9.07	481	7.14	-130	-21.3	-1.93
NHS Leeds	2	80	8.29	80	8.29	0	0.0	0.00
NHS Rotherham	5	520	8.89	511	8.52	-9	-1.7	-0.37
NHS Scarborough and Ryedale	1	19	4.83	16	4.25	-3	-15.8	-0.58
NHS Vale of York	8	1,100	6.74	917	5.64	-183	-16.6	-1.10
NHS Wakefield	1	177	14.81	205	17.19	28	15.8	2.38
Yorkshire & Humber Totals	***57***	***4834***	***8.36***	***4,852***	***8.35***	***18***	***0.4***	***-0.01***

*Baseline total practice population = 10,906,453
**Latest total practice population = 11,043,137

Appendix 9. Change in numbers of at-risk patients for each of the PINCER indicators in 1,060 practices that have uploaded data at least twice to CHART Online

PINCER NATIONAL PRESCRIBING SAFETY INDICATORS		Baseline			Latest			Change in absolute number of at-risk patients n (%)
		Numerator (n)	Denominator (n)	Percentage (%)	Numerator (n)	Denominator (n)	Percentage (%)	
GI BLEED PRESCRIBING INDICATORS								
A2	Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient aged ≥65 years	18,591	1,355,707	1.4	12,134	1,361,134	0.9	-6,457 (-34.7)
B2	Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient with a history of peptic ulceration	1,188	83,104	1.4	915	81,999	1.1	-273 (-23.0)
B3	Prescription of an antiplatelet drug without co-prescription of an ulcer-healing drug, to a patient with a history of peptic ulceration	5,709	83,104	6.9	4,539	81,999	5.5	-1,170 (-20.5)
C2	Prescription of warfarin or DOAC in combination with an oral NSAID	4,005	245,778	1.6	3,486	254,936	1.4	-519 (-13.0)
D2	Prescription of warfarin or DOAC and an antiplatelet drug in combination without co-prescription of an ulcer-healing drug	4,860	146,801	3.3	3,884	149,831	2.6	-976 (-20.1)
E2	Prescription of aspirin in combination with another antiplatelet drug without co-prescription of an ulcer-healing drug	7,880	160,886	4.9	6,199	151,177	4.1	-1,681 (-21.3)
OTHER INDICATORS								
F2	Prescription of an oral NSAID to a patient with heart failure	1,544	87,804	1.8	1,400	91,336	1.5	-144 (-9.3)
G2	Prescription of an oral NSAID to a patient with eGFR <45	2,733	136,749	2.0	2,425	137,185	1.8	-308 (-11.3)
H2	Prescription of a non-selective beta-blocker to a patient with a history of asthma	14,410	1,146,807	1.3	14,674	1,167,475	1.3	264 (1.8)
MONITORING INDICATORS								
I2	Patients aged 75 years and older who have been prescribed an angiotensin converting enzyme (ACE) inhibitor or a loop diuretic long term who have not had a computer-recorded check of their renal function and electrolytes in the previous 15 months	23,866	393,932	6.1	21,280	399,045	5.3	-2,586 (-10.8)
J2 **J3**	Patients receiving methotrexate for at least three months who have not had: a full blood count (FBC) in the previous three months or liver function test (LFT) in the previous three months	 5,948 6,183	 36,094 36,094	 16.5 17.1	 5,582 5,769	 37,047 37,047	 15.1 15.6	 -366 (-6.2) -414 (-6.7)
K2	Patients receiving lithium for at least three months who do not have a recorded check of their lithium concentrations in the previous three months	2,539	7,746	32.8	2,335	7,751	30.1	-204 (-8.0)
L2	Patients receiving amiodarone for at least six months who have not had a thyroid function test (TFT) within the previous six months	2,125	5,709	37.2	1,814	5,495	33.0	-311 (-14.6)