Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

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Supplementary material for:

Safer prescribing: A trial of education, informatics and financial incentives

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Contents

1. Detailed methods

Trial design

The DQIP trial was a pragmatic, cluster-randomised trial using the stepped wedge design, in which all participating primary care practices received the DQIP intervention but were randomised to one of 10 start dates between October 30, 2011, and September 2, 2012. We chose a cluster design because the DQIP intervention was delivered to primary care practice teams (clusters) with the intention of changing patient-level high-risk prescribing, and so contamination was an unavoidable risk in a patient-randomised trial. Although a conventional parallel-arm trial was feasible in principle, we chose a stepped wedge design primarily because we anticipated disadvantages to recruitment and retention under a conventional design (since offering financial incentives to control practices was not possible), and because our NHS collaborators expressed concern about identifying high-risk prescribing in control practices and not doing anything to address it (in a stepped-wedge design, all practices receive the intervention).[1] Figure S1 shows practice flow through the trial over time. Each practice received the intervention for a 48-week period, with continued data collection for 48 weeks after the active intervention ceased. The study was approved by the NHS Scotland Fife and Forth Valley Research Ethics Committee (REC reference 11/AL/0251) and registered at ClinicalTrials.gov (dossier number: NCT01425502). A designated member of staff gave written consent for each practice's participation in the trial, but consent from individual physicians was not required by the REC, nor individual patient consent since all clinical-decision making remained the responsibility of the primary care physician.

Participants

As per published protocol,[2] physician-owned practices with contracts to provide National Health Service (NHS) primary medical care in two Scottish health boards (NHS Tayside and NHS Fife) were eligible to participate if they used an electronic medical record system which permitted data extraction to the DQIP informatics tool. However, technical difficulties relating to firewall issues between the two Health Boards meant that implementing the DQIP tool in NHS Fife was significantly delayed. Since randomisation is to start time, this posed problems for the stepped-wedge analysis. With the consent of the trial steering committee and the Research Ethics Committee, the protocol was therefore amended to restrict the trial and analysis to NHS Tayside. In each practice, patients were included at each measurement point if they were alive, were permanently registered with the practice on that date (the UK National Health Service requires registration with a single practice in order to access care, and that practice does all community prescribing apart from more expensive or risky drugs like biologicals), and had one or more risk factors making them particularly vulnerable to NSAIDs or antiplatelet adverse drug events (ADEs).

Intervention

The DQIP intervention comprised three components whose development and design are described in detail elsewhere.[2, 3]

Education

A single educational outreach visit (EOV) by a pharmacist was delivered just before each practice started the intervention, with practices deciding which staff would attend. The EOV lasted approximately one hour and followed a standard format: (1) a presentation providing background evidence and guidance on targeted high-risk prescribing (the slides used are shown in section 4 below); (2) a demonstration of the DQIP informatics tool; and (3) facilitated discussion of how the practice was going to organise the review process. Practices were provided with printed and online educational material which summarised and expanded on the EOV. During the trial, practices received 8 weekly progress reports by email, which included both standardised elements (eg run charts of changes in high-risk prescribing) and educational messages tailored to each practice's activity and progress (an example letter is provided in section 5 below).

Financial incentive

Practices received a fixed participation fee of £350 ($600) and a payment of £15 ($25) for every patient with the targeted high-risk prescribing who was reviewed. Practices could claim for a chart-only review, but were encouraged to follow up any uncertainty about prescribing appropriateness with patients in person and were required to record any planned follow-up actions in the informatics tool. All such follow-up was at professional discretion, but practices were only paid once per patient for the initial review, irrespective of whether they were reviewed again for the same or different type(s) of high-risk prescribing or how often they subsequently saw the patient. The rationale was to avoid perverse incentives to re-issue high-risk prescriptions for the purpose of receiving payments for reviews. An average-sized practice with approximately three whole-time equivalent doctors and 5,500 registered patients could earn up to £1,650 ($2,750) for reviewing 110 patients during the intervention year (£550/$910 per full-time physician, ~0.6% of mean personal income).

Informatics tool

The informatics tool extracted data from each practice's electronic medical record (EMR), provided weekly updates on rates of high-risk prescribing and progress in reviewing, identified individual patients needing review, and facilitated patient reviews by providing graphical displays of relevant drug histories. Practices accessed the tool via a password protected web-based portal. At first log-on, all patients with risk factors for NSAID and antiplatelet ADEs who had received a high-risk prescription in the previous eight weeks were listed. Approximately half of all patients needing review in the 48 week intervention period were flagged for review at first log-in. The remainder flagged later in the intervention period being a mixture of prior intermittent use and true new use. Physicians could clear the flag by recording an explicit decision that the prescribing was appropriate, by stopping the offending drugs, or by adding a suitable gastroprotective drug (proton-pump inhibitor or histamine-2-receptor antagonists) for measures targeting risk of gastrointestinal bleeding. To support efficient review from the physician's perspective, the informatics tool was designed to avoid unnecessarily flagging patients for review of the same type of high-risk prescribing where a clear decision had been made to continue the prescription (such patients were set to flag for review in one year unless they were subsequently exposed to high-risk prescribing that they had not previously been reviewed for, meaning they triggered an additional high-risk prescribing measure) or those where the reviewer planned further action before deciding (for example, asking the patient to come for an appointment or checking with a specialist; such patients were set to reflag for review after 12 weeks if no clear decision had been recorded by then). Patients where a

decision was made to stop the high-risk drug were automatically reflagged for review if the drug was prescribed again so that appropriateness could be explicitly reassessed.

Outcome measures

The primary endpoint was a composite of nine prescribing outcome measures of high-risk NSAID and antiplatelet prescribing in people with risk factors for NSAID and antiplatelet ADEs (table 2 in the main paper and table S1 below). The nine individual measures focused on three types of ADE:

1. Gastro-intestinal (six measures eg prescription of an antiplatelet to a patient taking an oral anticoagulant without co-prescription of a gastroprotective drug[4])
2. Renal (two measures eg prescription of an NSAID to a patient with chronic kidney disease (CKD)[5]), and
3. Heart failure (one measure - prescription of an NSAID to a patient with heart failure[6]).

The composite was defined as the percentage of patients with any risk factor (eg taking an anticoagulant, having CKD, having heart failure) who were currently receiving any high-risk NSAID or antiplatelet as defined in table S2). All prescribing measures defined 'current high-risk prescribing' as being present when a patient with risk factors for NSAID or antiplatelet ADEs was prescribed the respective high-risk drug in the previous eight weeks. We chose eight weeks because most drugs in the UK are prescribed for 28 or 56 day treatment durations. In each practice, the primary outcome was repeatedly measured in all practices at eight weekly intervals in the pre-intervention baseline period, during the intervention, and post-intervention. Under the stepped wedge design, the length of the pre-intervention period was 48 weeks or longer, depending on each practice's randomised start date. The intervention period lasted 48 weeks during which practices were eligible to submit reviews and receive payment. Data continued to be collected from practices in the subsequent 48 weeks after payment ceased (see figure S1).

Pre-specified secondary prescribing outcomes included ongoing (prescribed one or more times in the last year) and new (not prescribed in the last year) high-risk prescribing, rates of the nine prescribing outcome measures individually, and composites of prescribing measures targeting the same adverse outcome (table 2 in the main paper and table S1 below). Pre-specified secondary hospital admission outcomes in patients with risk factors for NSAID and antiplatelet ADEs were examined for gastrointestinal bleeding, acute kidney injury or heart failure, considering both admissions preceded by (and therefore potentially attributable to) targeted high-risk prescribing and all such admissions, regardless of high-risk prescribing, in the trial population. A post-hoc analysis of changes in unrelated hospital admissions for hip fracture, cancer, surgical emergencies (appendicitis, cholecystitis and pancreatitis), and unrelated ambulatory care sensitive admissions in the same trial patients was also carried out at the request of the journal's peer reviewers (table 3 in the main paper and table S2 below).

Ascertainment of outcome data

Prescribing outcomes were measured using data extracted from participating primary care practices' EMRs which all practices had used for over a decade. Emergency admission outcomes were obtained via the NHS Tayside/University of Dundee Health Informatics Centre by data linkage to the Scottish

Morbidity Record (SMR01) which is a nationally audited record of all hospital admissions for patients resident in Tayside.

Randomisation and allocation concealment

Allocation of practices was independently carried out by the randomisation service provided by the UK Clinical Research Network registered Tayside Clinical Trials Unit. Recruited practices were stratified by list size tertile and randomly allocated within strata to one of 10 starting dates. Due to the nature of the study, allocation concealment was not possible for practices (who received the intervention), the core research team (who delivered the intervention) or the trial analyst (since analysis requires knowledge of the date that each practice started the intervention). However, all outcome data for the trial were remotely extracted from routine electronic data sources and all primary outcome measures were remotely calculated using the pre-specified algorithms used to provide feedback to practices during the trial. Data manipulation before data extraction or calculation of outcome measures was therefore not possible. Data cleaning and analysis was conducted by a statistician according to a pre-specified statistical analysis plan.

Statistical methods

On the basis of data from the pilot practices[3] and the recently completed PINCER trial,[7] we assumed an effect size of a 25% relative reduction in targeted high-risk prescribing. Using Hussey and Hughes' sample size method for stepped-wedge trials,[1] we estimated that there would be 83% power with α=0.05 for 10 practices randomised to 10 start dates.[2] There was therefore adequate power even after restriction to 34 practices in NHS Tayside. As per published protocol[2], we carried out both a practice and patient-level analysis, with the patient-level analysis pre-defined as primary. Both patient and practice-level analyses yielded consistent results. The primary analysis is reported in the main paper and the practice level analysis in section 3 below.

Analysis was by intention to treat with data from all eligible patients analysed irrespective of whether they actually received a review. The intervention was delivered to practices, but the outcome was measured at patient-level which requires accounting for in analysis. At patient-level, the primary outcome and secondary prescribing outcomes were binary (patients with risk factors for ADEs either received a high-risk prescription in the previous 8 weeks or not), and there was repeated measurement within patients (many patients were included in multiple measurements at different times). Patients were also clustered within practices, the extent of which is assessed by the intra-cluster correlation coefficient (ICC), which was 0.036 for the primary outcome (indicating that 3.6% of the variation in outcome was due to variation between practices – a typical value for a binary outcome in this context), and varied between 0 and 0.084 for the individual prescribing outcomes (table 2 in main paper). We therefore used multi-level logistic regression in order to estimate odds ratios and 95% CIs for exposure to high-risk prescribing across data points during the intervention compared to the pre-intervention period (figure S1), accounting for the clustering of patients within practices and for repeated measurement within patients. Stepped-wedge trials can be vulnerable to declining trends in the outcomes in the pre-intervention period. Prior to analysis, we therefore tested for the presence of a time trend in the primary outcome using all data points across the pre-intervention period, in order to explore whether a pre-intervention declining secular trend risked an overestimation of the intervention impact given the stepped-wedge design. There was evidence of a

statistically significant but clinically small rising trend in high-risk prescribing in the pre-intervention period (an absolute increase of 0.07 percentage points for every elapsed eight week interval, 95% CI 0.02-0.12, t=2.85, df=164, p=0.005), consistent with any observed reduction due to the intervention not being due to a declining long-term trend.

Pre-specified analyses of hospital admissions with gastro-intestinal bleeding, acute kidney injury and heart failure summed events across all practices during the pre-intervention and intervention periods, respectively, and calculated rates by dividing by the total person time during which patients had risk factors for ADEs from the corresponding high-risk prescribing. The incidence in the intervention versus pre-intervention periods was compared using the conditional maximum likelihood estimate of the rate ratio.[8]

Finally, in a post-hoc analysis, we examined whether the DQIP intervention effect was sustained beyond the 48 weeks of active intervention. Since the decline in high-risk prescribing over the intervention period was not immediate (see figure 1 in the main paper), and because reviews conducted during the intervention period were likely to impact on levels of high-risk prescribing for at least some time after payment stopped, we excluded the first 24 weeks of the intervention and post-intervention periods for the purposes of the sustainability analysis (figure S1).

Figure S1: Illustration of the stepped wedge design as implemented in the DQIP trial. Each row represents practices randomised to the same start date and each box represents an eight weekly measurement of the primary outcome.

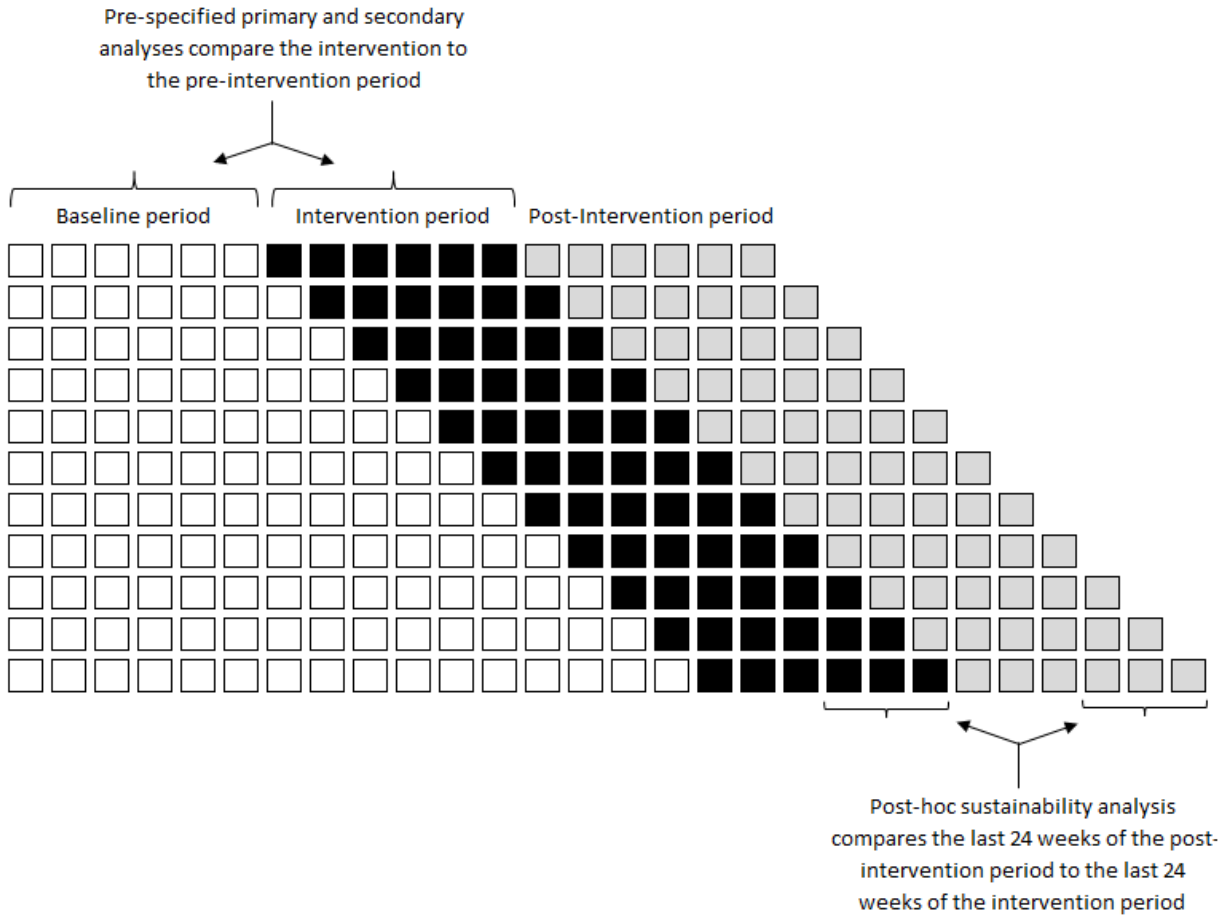


Table S1: Prescribing outcome measures (each measure is a percentage defined as percentage of those with a risk factor who received a high-risk prescription in the previous 8 weeks).

Risk factor definition (a)	High-risk prescription definition (b)	a/b (%) at the start of the intervention
Any risk factor	Any high-risk prescribing	1102/29537 (3.7)
Prevalent and incident high-risk prescribing		
Any risk factor	Any high-risk prescribing with a high-risk prescription in the previous 12 months	766/29537 (2.6)
Any risk factor	Any high-risk prescribing without a high-risk prescription in the previous 12 months	336.29537 (1.1)
Measures of gastrointestinal high-risk prescribing		
Any risk factor below	Any gastrointestinal high-risk prescribing as defined below	639/24734 (2.6)
Read Code for peptic ulceration ever recorded	Prescribed a traditional oral NSAID [A] or low dose aspirin in the previous 8 weeks and NOT prescribed a gastro-protective drug in the 12 weeks before, or since the most recent NSAID or aspirin prescription	252/3973 (6.3)
Aged 75 years and over	Prescribed a traditional oral NSAID [A] in the previous 8 weeks and NOT prescribed a gastro-protective drug in the 12 weeks before, or since the most recent NSAID prescription	214/17310 (1.2)
Aged 65 and over and prescribed aspirin in the previous 12 weeks	Prescribed a traditional oral NSAID [A] in the previous 8 weeks and NOT prescribed a gastro-protective drug in the 12 weeks before, or since the most recent NSAID or aspirin prescription	119/8799 (1.4)
Aged 65 and over and prescribed aspirin in the previous 12 weeks	Prescribed clopidogrel in the previous 8 weeks *and prescribed aspirin in the 12 weeks since their most recent clopidogrel prescription* [B] and NOT prescribed a gastro-protective drug in the 12 weeks before, or since the most recent aspirin or clopidogrel prescription	61/8799 (0.7)
Prescribed warfarin in the previous 12 weeks	Prescribed a traditional oral NSAID [A] in the previous 8 weeks and NOT been prescribed a gastro-protective drug in the 12 weeks before, or since the NSAID prescription	12/2483 (0.5)
Prescribed warfarin in the previous 12 weeks	Prescribed low dose aspirin or clopidogrel in the previous 8 weeks and NOT been prescribed a gastro-protective drug in the 12 weeks before, or since the aspirin or clopidogrel prescription	50/2483 (2.0)
Measures of renal high-risk prescribing		
Any risk factor below	Prescribed any renal high-risk prescribing as defined below	533/12166 (4.4)
Prescribed both a diuretic and an ACE inhibitor/ARB in the previous 12 weeks	Prescribed any oral NSAID in the previous 8 weeks	391/8033 (4.9)
On QOF chronic kidney disease (CKD) register (CKD ≥stage 3) [C]	Prescribed any oral NSAID in the previous 8 weeks	205/5841 (3.5)
On QOF heart failure register [C]	Prescribed any oral NSAID in the previous 8 weeks	33/1593 (2.1)

Key: NSAID = Non-steroidal anti-inflammatory drug; QOF = Quality and Outcomes Framework; CKD = Chronic kidney disease; ACE = Angiotensin converting enzyme; ARB = Angiotensin Receptor Blocker

A: All oral NSAIDs *except* Cox 2 selective inhibitors (of which only celecoxib and etoricoxib are licensed in the UK);

B: The underlined phrase was added to this outcome measure (with approval by the independent trial steering group and the research ethics committee) in response to a change in clinical guidance for secondary stroke prophylaxis, which recommended that clopidogrel monotherapy should be used instead of aspirin. During the intervention period, some practices participating in DQIP worked to systematically switch patients from low-dose aspirin to clopidogrel so that the measure in its original wording identified patients who were treated with aspirin and clopidogrel monotherapy sequentially, rather than receiving combination treatment with both. The amendment therefore aimed to more accurately identify combined use of aspirin and clopidogrel.
C: As specified in Quality and Outcomes Framework business rules, available at http://www.hscic.gov.uk/media/15378/HF-rulesetv300/pdf/HF_ruleset_v30.0.pdf

Table S2: Admissions outcome measures (each measure is an incidence rate defined as number of trigger events per 10,000 person years at risk)

Denominator *Person time with risk factors* [A]	**Numerator** *Trigger event*
Hospital admission with relevant high-risk prescribing in the 8 weeks before admissions (pre-specified)	
Person time with gastrointestinal risk factors	Number of emergency hospital admissions with gastrointestinal ulcer or bleeding recorded as the main condition *and* any gastrointestinal high-risk prescribing in the 8 weeks before admission
Person time with renal risk factors	Number of emergency hospital admissions with acute kidney injury[B] *and* any renal high-risk prescribing in the 8 weeks before admission
Person time with heart failure	Number of emergency hospital admissions with heart failure recorded as the main condition *and* prescribed an NSAID in the 8 weeks before admission
Hospital admission outcomes irrespective of preceding high-risk prescribing (pre-specified)	
Person time with gastrointestinal risk factors	Number of emergency hospital admissions with gastrointestinal ulcer or bleeding recorded as the main condition
Person time with renal risk factors	Number of emergency hospital admissions with acute kidney injury[B]
Person time with heart failure	Number of emergency hospital admissions with heart failure recorded as the main condition
Unrelated hospital admissions (post-hoc proposed by reviewers)	
Person time with any risk factor	Number of emergency hospital admissions with hip fracture recorded as the main condition
Person time with any risk factor	Number of emergency hospital admissions with cancer recorded as the main condition
Person time with any risk factor	Number of emergency hospital admissions with appendicitis, cholecystitis or pancreatitis recorded as the main condition
Person time with any risk factor	Number of emergency hospital admissions with ambulatory care sensitive admissions unrelated to the targeted prescribing[C] recorded as the main condition

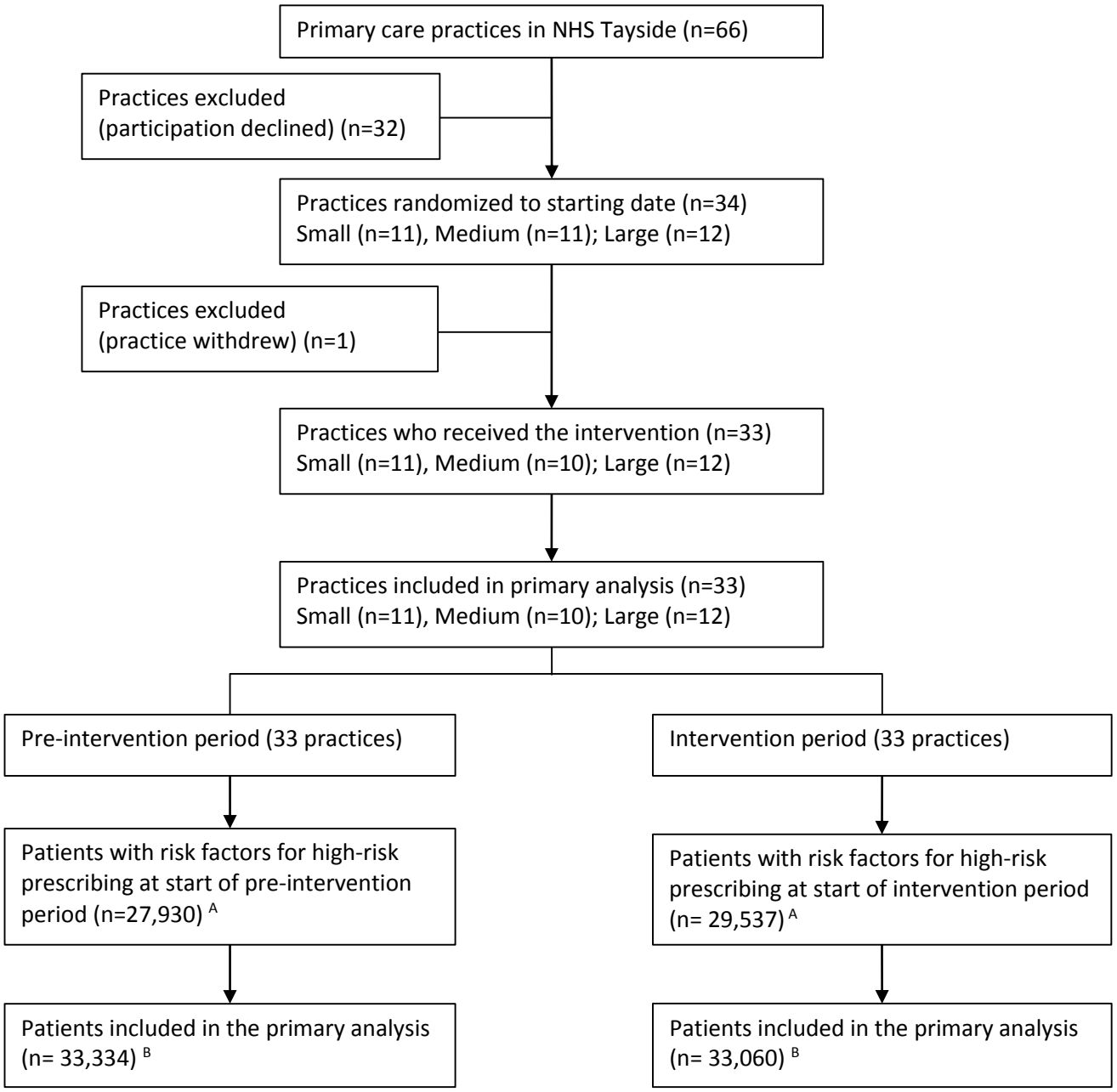
A: The denominator is the time that each patient is defined as having risk factors by virtue of age, disease or co-prescribing in the year before the intervention and the year of follow-up. Risk factors were defined as specified in table S1.

B: AKI based on KDIGO definitions measured using laboratory data as per our previous work.[9]

C: As defined by Purdy et al[10] for UK hospital admissions data but excluding heart failure, perforated peptic ulcer or bleeding, and iron deficiency anaemia as related to the targeted prescribing. Ambulatory care sensitive conditions included are: angina, asthma, cellulitis, convulsions and epilepsy, chronic obstructive pulmonary disease, dehydration and gastroenteritis, dental conditions, diabetes complications, ear/nose/throat infections, gangrene, hypertension, influenza and pneumonia, nutritional deficiency, other vaccine preventable diseases, pelvic inflammatory disease, pyelonephritis)

2. Consort flow diagram

Figure S2: Consort flow diagram.



A: Includes all registered patients with risk factors for NSAID and antiplatelet ADEs on the selected date at the start of each period

B: Includes all registered patients with risk factors for NSAID and antiplatelet ADEs at any point during each period

2. Detailed time trends in high-risk prescribing

Figure S3: Trends in the primary outcome of high-risk prescribing in each of the ten randomised groups of practices across pre-intervention, intervention and post-intervention periods. Each data point represents the percentage of patients with risk factors who received a high-risk prescription in the previous 8 weeks at the stated time point, with time point "0" being the randomised intervention start date in each practice.

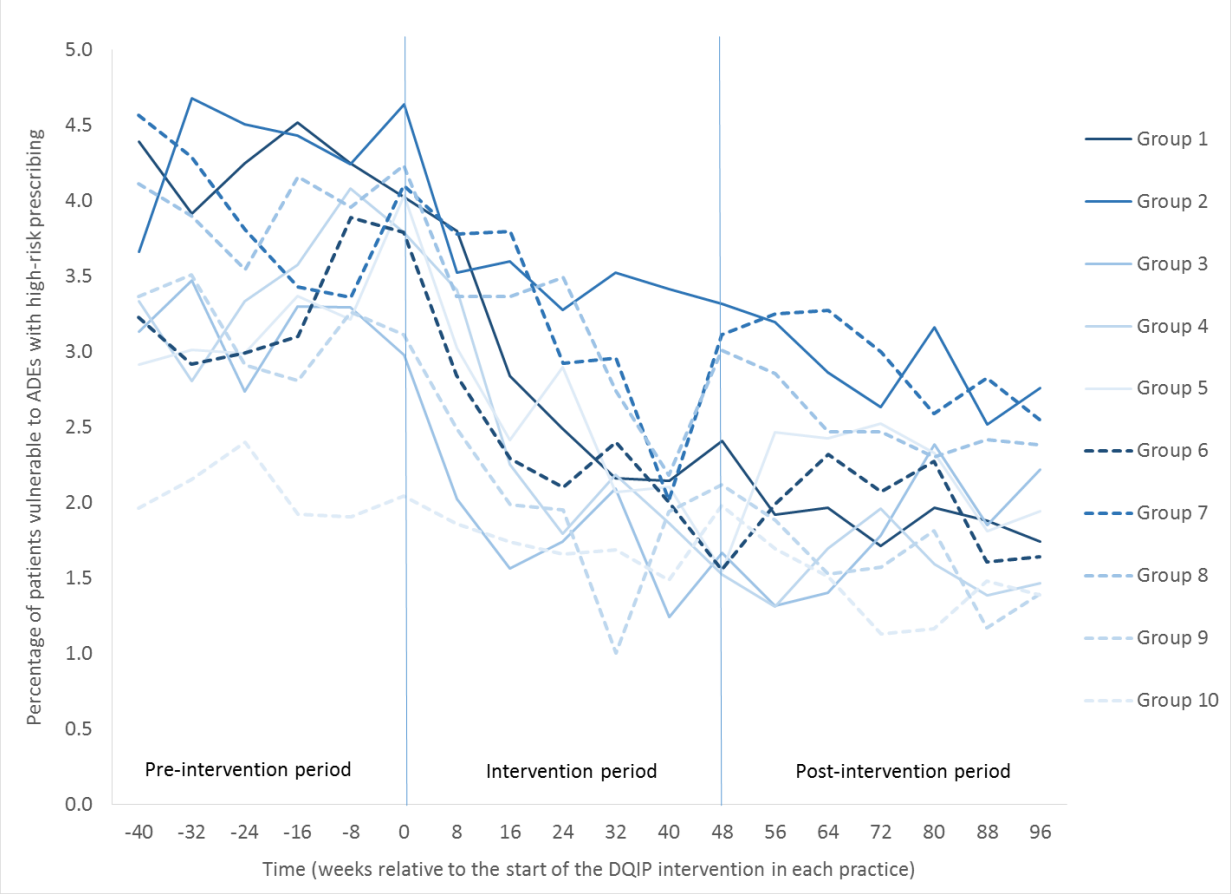
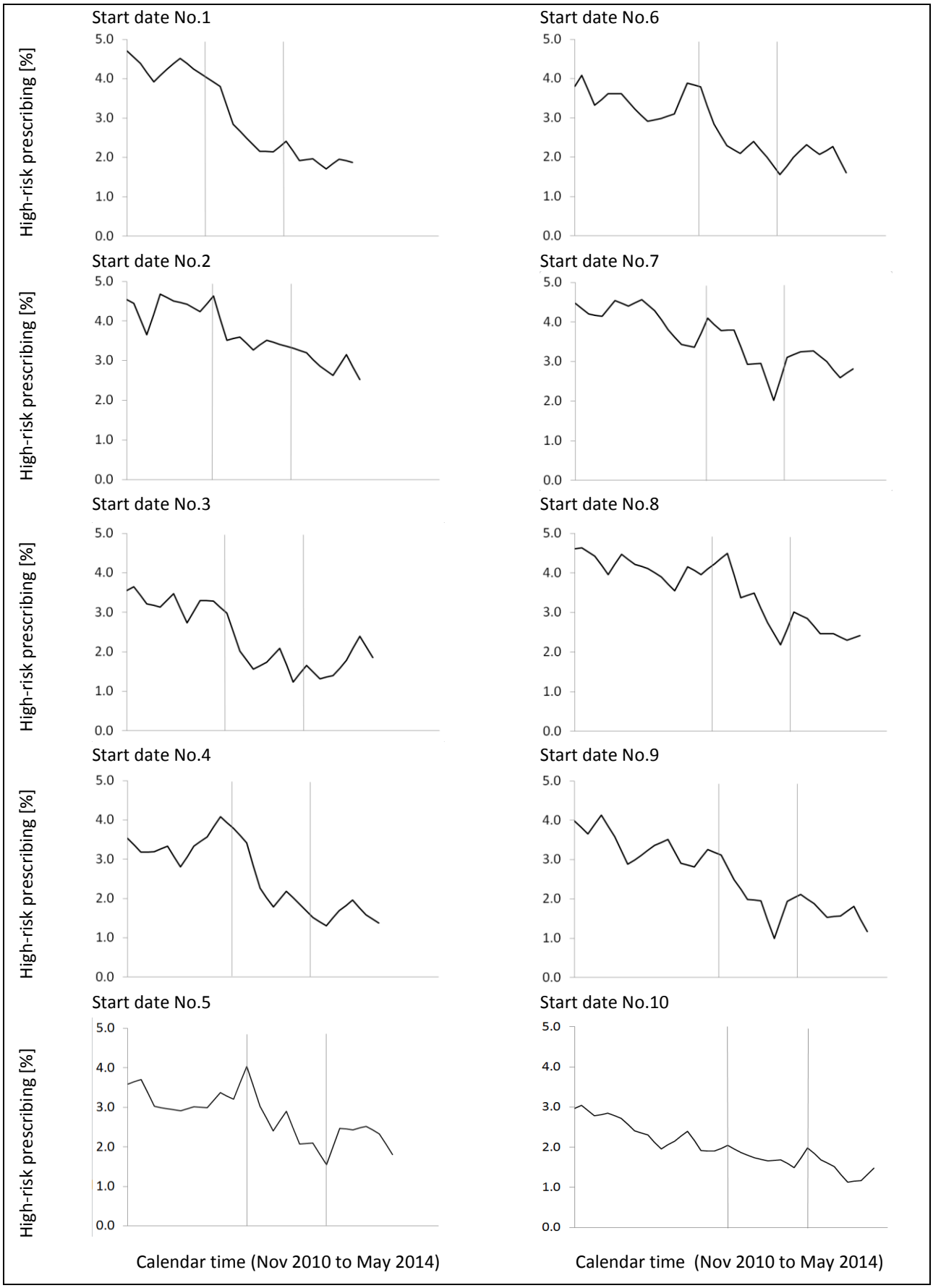


Figure S4: For practices randomised to the same start date, the charts show the overall percentage of patients with risk factors who received a high-risk prescription in the previous eight weeks at each time point. The vertical lines denote the start and end of the intervention period in respective practices.



3. Practice level analysis

Methods

The *practice* level analysis compared the primary outcome measure as the mean and standard deviation across practices for pre-intervention and intervention periods (the start of the latter having been randomly assigned under the stepped wedge design). Since this approach is potentially vulnerable to time trends, we first examined for the presence of such trends in the primary outcome. We found a small (but statistically significant) increasing trend over the pre-intervention period and a statistically significant decreasing trend over the intervention period and therefore concluded that analysis averaging the primary outcome would be appropriate (and relatively conservative). We therefore followed the standard approach for the analysis of stepped wedge trials proposed by Hussey at al[1] using mixed effect models that accounted for the correlation of repeated measures and adjusted for stratification by thirds of practice list size.

Results

Table S3 shows the findings of the practice level analyses, demonstrating overall consistency with the results of the primary patient level analyses. The multi-level adjusted mean prevalence of any high-risk NSAID and antiplatelet prescribing (primary outcome) in the intervention compared to the pre-intervention period fell from 3.6% to 2.5%, consistent with a 29.6% (95% CI 24.7 to 34.7) relative reduction. There was also a significant reduction in both 'ongoing' (from 2.7% to 1.8%, relative reduction 35.5% [95% CI 30.0 to 41.0]) and 'new' high-risk prescribing (from 0.9% to 0.8%, relative reduction 11.4% [95% CI 1.1 to 21.6]).

Consistent with the primary patient level analysis, we also found reductions in each individual measure of high-risk prescribing (relative reductions ranging from 18.7% to 61.1%), although two (NSAID use without gastroprotection in patients on oral anticoagulants and NSAID use in patients with heart failure) were not statistically significant.

The reductions in the composites of gastrointestinal high-risk prescribing (from 2.3 to 1.2%, relative reduction 49.8% [95% CI 43.7 to 55.8]) and renal high-risk prescribing (from 4.6% to 3.7%, relative reduction 19.7% [95% CI 13.9 to 25.6]) were also statistically significant, but (as in the primary patient level analysis) the impact on gastrointestinal high-risk prescribing was larger.

Consistent with the primary patient level analysis, we found that the reductions in high-risk prescribing under the DQIP intervention were sustained in the 24-48 weeks after financial incentives were withdrawn compared to the final 24-48 weeks of the intervention period, with a further significant 18.4% (95% CI 10.6 to 25.9; $p<0.001$) relative reduction at practice level.

Table S3: Primary and secondary high-risk prescribing outcomes comparing pre-intervention and intervention periods. Detailed definitions are provided in table A1

Measure No. - High-risk prescribing pattern/risk factor(s)	Multilevel adjusted mean prevalence of high-risk prescribing across each period (%) [A]		Multilevel adjusted relative difference (95% CI)*	*p-value*
	Pre-intervention period	Intervention period		
Primary outcome				
Any high-risk prescribing in patient with any risk factor	3.6	2.5	-29.6 (-34.7 to -24.7)	<0.001
Secondary prescribing outcomes				
'Ongoing' high-risk prescribing in patient with any risk factor [B]	2.7	1.8	-35.5 (-41.0 to -30.0)	<0.001
'New' high-risk prescribing in patient with any risk factor [B]	0.9	0.8	-11.4 (-21.6 to -1.1)	0.03
Gastrointestinal composite (any of the below)	2.3	1.2	-49.8 (-55.8 to -43.7)	<0.001
NSAID or low dose aspirin without gastroprotection in patient with history of peptic ulcer	6.4	2.9	-55.7 (-62.0 to -49.3)	<0.001
NSAID without gastroprotection in patient aged ≥75 years	1.0	0.5	-46.5 (-57.6 to -35.4)	<0.001
NSAID without gastroprotection in patient aged ≥65 years on antiplatelet drug	1.5	0.6	-61.1 (-73.2 to -49.0)	<0.001
Clopidogrel without gastroprotection in patient aged ≥65 years on low dose aspirin	0.6	0.4	-27.9 (-45.9 to -9.8)	0.002
NSAID without gastroprotection in patient on oral anticoagulant	0.3	0.2	-36.4 (-84.8 to 12.1)	0.13
Antiplatelet without gastroprotection in patient on oral anticoagulant	2.1	1.1	-48.1 (-66.4 to -29.9)	<0.001
Renal composite (either of the below)	4.6	3.7	-19.7 (-25.6 to -13.9)	<0.001
NSAID in patient on both renin-angiotensin system blocker and a diuretic	4.9	4.0	-19.1 (-26.1 to -12.2)	<0.001
NSAID in patient with chronic kidney disease	4.2	3.1	-25.8 (-33.9 to -17.7)	<0.001
NSAID in patients with history of heart failure	2.5	2.0	-18.7 (-39.0 to 1.60)	0.07

*Mean rates during entire baseline period and during 48 week intervention period estimated from the practice level analysis, which accounted for the correlation of repeated measures (eight-week periods) and adjusted for stratification by practice list size tertiles

4. Presentation used in the educational outreach visit

The DQIP trial

Tayside Centre for General Practice
Quality, Safety and Informatics Research Group
Bruce Guthrie, Tobias Dreischulte, Aileen Grant

Thank you for taking part !!!

What is DQIP?

- A 5-year research programme to improve prescribing safety in general practice; funded by Chief Scientist Office
- **2009 to 2011**: Pilot work in four general practices in NHS Fife and NHS Tayside
- **2011 to 2013**: DQIP trial in 40 practices across the two boards
- Focus is on high-risk NSAID and antiplatelet prescribing

Outline

- Why NSAID and antiplatelet prescribing?
- Current evidence and guidance
- Introduction to the DQIP Informatics tool
- Using the DQIP tool to manage high-risk prescribing in you practice

Why high-risk prescribing of NSAIDs and antiplatelets?

1. It's risky
2. Risk factors are known
3. It's common
4. It can be improved

It's risky ...

- **Important cause of hospital admission due to pADEs**
  - 3 to 4% of hospital admissions related to preventable ADEs
  - NSAIDs, antiplatelets and anticoagulants account for ~ a third of these
- **Mostly due to high-risk prescribing, for example:**
  - ⚠ NSAIDs/antiplatelets in patients with GI risk factors
    - ➲ GI bleeding
  - ⚠ NSAIDs in patients with renal risk factors
    - ➲ Chronic renal impairment and acute renal failure when stressed
  - ⚠ NSAIDs in patients with cardiac risk factors
    - ➲ Heart failure de-compensation, vascular events

Risk factors are known ...

- ⚠ **Antiplatelet/NSAID induced GI bleeding**
  - History of peptic ulcer (Risk > 10 - fold ↑)
  - Age (65 to 75: Risk ~ 5 - fold ↑; > 75: Risk ~ 10 - fold ↑)
  - On warfarin or antiplatelets (Risk 5 to 10 - fold ↑)
  - Risk can only partly be mitigated by gastro-protection
- ⚠ **NSAID induced renal failure**
  - Advanced age or Chronic Kidney Disease ↑
  - On ACE inhibitors/ARBs and diuretics (↑ implicated in deaths)
- ⚠ **NSAID induced cardiac events**
  - History of heart failure (↑ hospital admission, ↑ MI, ↑ death)

It's common ...

High risk prescription in the previous 12 months		Estimated number of patients in Tayside and Fife	
		No.	Relative frequency
GI risk			
1	NSAID in over-75s w/o GI-protection	~ 1750	
2	NSAID or aspirin in peptic ulcer w/o GI-protection	~ 1500	
3	NSAID + aspirin in over-65s w/o GI-protection	~ 1500	
4	Aspirin + clopidogrel in over-65s w/o GI-protection	~ 500	
5	Aspirin or clopidogrel AND warfarin w/o GI -protection	~ 450	
6	NSAID + warfarin/No GI gastroprotection	~ 60	
Cardiovascular risk			
7	NSAID in heart failure	~ 350	
Renal risk			
8	NSAID, ACE/ARB AND diuretic in over 65s	~ 1500	
9	NSAID in patient with eGFR<60	~ 1000	
1 to 9	Any of the above	**~ 7500**	

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It can be improved!

- Data from 315 Scottish GP practices: ~ 4-fold variation between practices after case mix adjustment
- Pilot practices stopped high-risk prescriptions or prescribed gastro-protection in ~ 40% of identified patients

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Current guidance (1)

Patients at GI risk (peptic ulcer, elderly, on antithrombotics)

Avoid NSAIDS

Patients at cardiovascular risk (especially heart failure, post MI)

Avoid NSAIDS (including coxibs)

Patients at renal risk:

Avoid NSAIDS (including coxibs)

NOTE: Even single prescriptions carry significant risk !

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Current guidance (1)

Patients with GI risk factors

If NSAIDs are essential:

- Ibuprofen (≤1200mg/day) has lowest risk profile
- Naproxen (≤1000mg/day) has intermediate GI risk but lowest CV risk
- **Gastro-protection (PPI) reduces but does not abolish risk!**
- Low dose misoprostol (e.g. Arthrotec) is not sufficient
- Patients with previous peptic ulcer:
  - Coxibs + PPI is probably the safest option in terms of GI risk
  - Ibuprofen/naproxen + PPI may be preferable in patients, who are also at cardiovascular risk (balance cardiovascular and GI risk)

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Current guidance (2)

Patients with renal risk factors

If the NSAID is judged to be essential:

- Monitor renal function closely
- Advise vulnerable patients to seek medical advice if at risk of dehydration (eg diarrhoea, vomiting, fever, reduced fluid intake)

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Current guidance (3)

Patients with heart failure

If the NSAID is judged to be essential:

✓ Use ibuprofen or naproxen for shortest possible duration

✓ But: Even ibuprofen and naproxen at standard doses increase the risk of heart failure de-compensation

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What will DQIP involve?

- High-risk prescriptions may not always be avoidable, but require risk management to prevent harm
- We want you to review patients with targeted high-risk prescribing and check if it's appropriate
- The DQIP tool facilitates this by remotely identifying patients, who have recently received high-risk prescriptions: Updated every Sunday
- Up to you to decide what needs doing:
  - Record review, telephone, face to face
  - Continue or stop drug, try an alternative, add gastro-protection

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Introduction to the functionalities of the DQIP tool

NHS Tayside: http://10.252.0.87:3000

NHS Fife: http://10.252.0.87:3001

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Managing high-risk prescribing: Experiences from pilot work

Review process:

- Start with a notes review – decide further action (e.g. notify patient of changes, invite for consultation to discuss, contact specialist) – implement changes (if any)

Options used by pilot practices to share workload :

- Divide patients by DQIP indicator. Each GP reviews patients triggering a specific indicator. **Note:** Patients may trigger multiple measures so may appear more than once.
- Divide patients by usual GP: Patients' usual GPs conducts both notes review and follow-up
- Divide notes review and follow-up: Initial review by one GP or practice pharmacist; follow up by patients' usual GP
- Divide review and documentation: Print patient list - fit in notes review when time – decide further action - documentation in DQIP tool by admin staff. **Note:** Need to make sure lists are up to date !

Discussion

How are you going to organise the DQIP work in **your** practice ?

5. Example text from an 8 weekly newsletter sent 24 weeks after the practice started the intervention where little initial change in prescribing

DQIP

Making prescribing safer

Dear GP/PM,

Six months have now passed since your practice has started the DQIP programme, with 6 months remaining. We are writing to you today in order to give you an update on your progress with the DQIP work.

Trends in high-risk prescribing

The run chart below (screenshot from the DQIP tool) shows that the total numbers of patients affected by any high-risk NSAID or antiplatelet prescribing have dropped to some extent since the last update 8 weeks ago, but the overall level of high-risk prescribing has remained similar to that seen before you've started DQIP. Figure 2 shows an update of the run chart of a practice who have successfully minimised their high-risk prescribing over 6 months.

Figure 1: Run chart for your practice

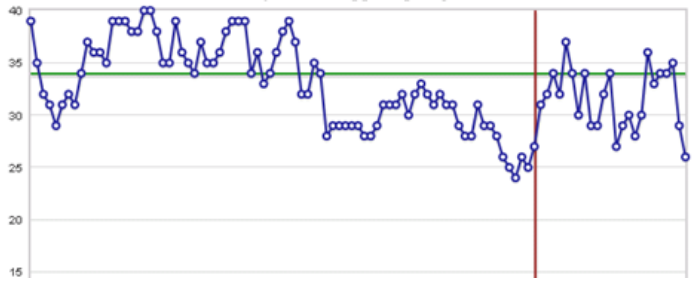

Figure 2: Run chart for a practice with comparable numbers of patients affected at DQIP start

DQIP start date

Mean number of patients before DQIP start

We know it is challenging to reduce high-risk prescribing at practice level and maintain such reductions over time, because it requires not only stopping high-risk prescriptions in patients who have been flagged up by the DQIP tool, but also avoiding new high-risk prescriptions in patients with risk factors. This is especially the case when not all prescribers in the practice are involved in conducting the DQIP reviews. Where it is not possible to involve all prescribers in the review work, alerting colleagues when high-risk prescriptions have been issued may be crucial to increase awareness of future high-risk situations, in which NSAIDs and antiplatelets should be avoided or risk mitigating strategies implemented (if avoidance is not possible).

Can we help?

Please let us know if there is anything we can do to help (including a further practice visit if you think this would be helpful). You can contact us via email at dqip@dundee.ac.uk or by phone under 01382-420000.

Medication reviews

The practice has reviewed a total of 42 patients since the beginning of the DQIP trial corresponding to a payment of £630. There are currently 8 patients in your practice, who have yet to be reviewed. Please note that because we are measuring high-risk prescribing in the last 8 weeks, the *full* impact of any medication changes made may take a few weeks to show up in the run chart.

Kind regards,
The DQIP team

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