

RCGP Prescribing Indicators

Clarity Informatics

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Indicator results and analysis

Background

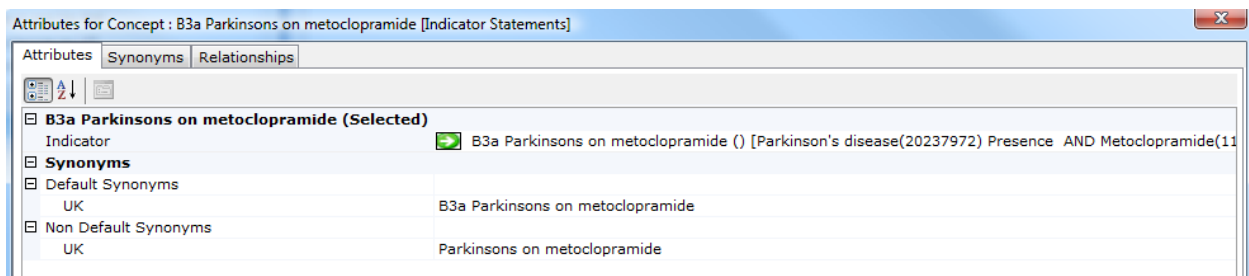
As part of a series of quality initiatives on GP prescribing, medicines management and quality improvements, we are developing a mechanism whereby we take data extracted from a clinical system (in this example in primary care), and analyse it by applying a set of rules to it derived from a complex knowledge base (or ontology). This also provides us with the ability to take set of indicators from elsewhere and convert them into 'computable statements' that we can then apply to the extracted data. The RCGP indicator project derived such a set of indicators. This phase of the project aimed to take these indicators and explore the feasibility of 'computerising' the indicators and testing them against some 'real' patient data.

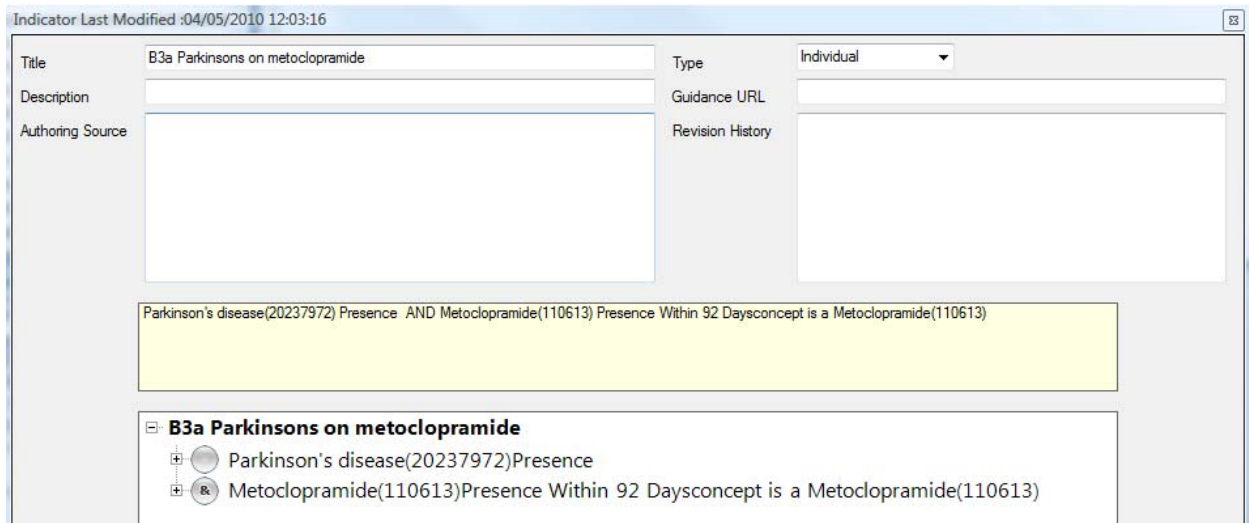
Project methods

Initially, we attempted to recruit 4 GP practices into this phase of the project. We also intended to gain access to patient data from different clinical systems to allow us to begin to explore any issues relating to the differences in EPR (electronic patient record) structures and the differences in functionality offered by the different clinical system suppliers. Whilst we managed to recruit an EMIS practice and 2 'Synergy' practices, we are still in the process of gaining access to a 'Vision' practice.

Access to the data is provided by extracting data using Apollo Medical Systems. In conjunction with Apollo we designed and built a summary record schema into which the actual medical record data is extracted. This allows us to ignore any types of data that are not relevant for this process, such as administrative data etc. In reality, all the indicators in this project relate to 'Events' (these are non-drug or 'clinical' medical record entries) and 'Prescriptions' (medications that have been prescribed to the patient by the GP).

Each indicator in the initial set of 40 that was provided to us was analysed and described in terms of a logical statement that could then be represented in the assessment software.

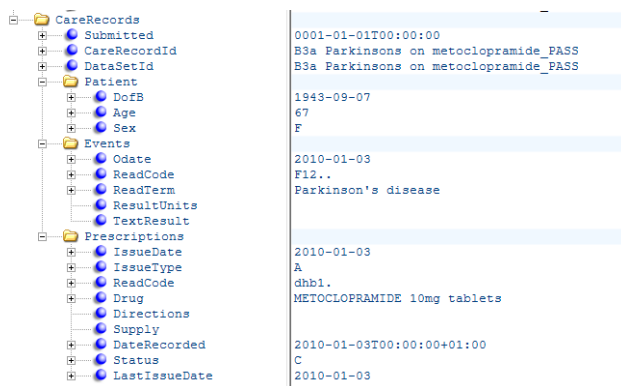




This project is forming a significant part of the work to scope the range of indicators and the mechanisms we will need to allow the simple authoring of these in the future.

The current mechanism we are using to encode the indicators is such that the indicators will only be applied to a patient record if the indicator is triggered by the ‘trigger concept’ being present. We are experimenting with this idea as it will influence how we can subsequently report the findings from the analysis. In the example here, Parkinson’s disease is the trigger concept, so the indicator will be tested in all patients with Parkinson’s disease. It doesn’t however ‘look at’ all patients on Metoclopramide. This will have implications for reporting denominators.

Once each indicator has been created in the tool they are subjected to a QA and testing process. Each indicator has a series of test cases to demonstrate a ‘pass’ or ‘fail’, for example



Once all encoded indicators have passed their tests, the full practice data extracts are subjected to the indicator rule-set. The data processing is left to run and the resultant output is collated and analysed.

Results

NB. The 'raw' data is available to view in the associated spreadsheet. The data is presented as a count of individuals who have a value of 'true' or 'false' for that indicator. This doesn't imply any subjective reading of whether its 'good' or 'bad' – it simply means the logic of the statement was fulfilled or not.

We tested the feasibility of encoding all 40 indicators in the set. We then reduced that number due to issues we found with some negation and temporal issues which need further development. We also encountered some problems due to delays in data extraction.

We present the data from a set of 32 indicators for the three practices. For each indicator we present;

	Practice X	
	True	False
COUNT	1	3
%	25	75

A Cardiovascular and respiratory disease

AI(c)

Prescription of a beta-blocker to a patient with asthma (excluding patients who also have a cardiac condition, where the benefits of beta-blockers may outweigh the risks)

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
43	45	39	52	62	90	144	187
48.9	51.1	42.9	57.1	40.8	59.2	43.5	56.5

A3

Prescription of short acting nifedipine (excluding patients with Raynaud's disease)

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
53	2	8	2	58	7	119	11
96.4	3.6	80	20	89.2	10.8	91.5	8.5

A4

In a patient with renal impairment, prescription of digoxin at a dose greater than 125 micrograms daily (e.g. CKD 3+)

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
4	0	2	0	1	0	7	0
100	0	100	0	100	0	100	0

A5a

HF on digoxin

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
24	68	7	55	15	81	46	204
26.1	73.9	11.3	88.7	15.6	84.4	18.4	81.6

A5b

Prescription of digoxin at a dose of greater than 125 micrograms daily for a patient with heart failure who is in sinus rhythm

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
2	78	1	61	2	94	5	233
2.5	97.5	1.6	98.4	2.1	97.9	2.1	97.9

Note: We also looked at the number of patients with heart failure who were on digoxin at any dose

- Practice A – 14 with HF on digoxin (2 > 125 micrograms daily)
- Practice B – 7 with HF on digoxin (1 > 125 micrograms daily)
- Practice C – 15 with HF on digoxin (2 > 125 micrograms daily)

This indicator also highlights that it is possible to derive the prevalence in the practice of a condition e.g. Heart failure

- Practice A = 80 / 10225 = 0.78%
- Practice B = 62 / 5041 = 1.23%
- Practice C = 96 / 10083 = 0.95%

A6

Prescription of diltiazem or verapamil in a patient with heart failure

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
2	90	6	56	5	91	13	237
2.2	97.8	9.7	90.3	5.2	94.8	5.2	94.8

A7

In an older patient (>65yrs) the prescription of aspirin at a dose >75mg daily

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
5	231	10	208	12	569	27	1008
2.1	97.9	4.6	95.4	2.1	97.9	2.6	97.4

A11

The prescription of a long-acting beta-2 agonist inhaler to a patient with asthma who is not also using an inhaled corticosteroid

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
11	251	9	171	10	230	30	652
4.2	95.8	5	95	4.2	95.8	4.4	95.6

B Central nervous system (including analgesics)

B1

The prescription of aspirin to a child aged 16yrs and under

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	1202	1	440	0	1015	1	2657
0	100	0.2	99.8	0	100	0	100

B3(a)

In a patient with Parkinson's disease, the prescription of metoclopramide

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	19	1	5	1	25	2	49
0	100	16.7	83.3	3.9	96.1	3.9	96.1

B3(b)

In a patient with Parkinson's disease, the prescription of prochlorperazine

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	19	0	6	0	26	0	51
0	100	0	100	0	100	0	100

C Anti-infective agents

C2(b)

Prescription of mefloquine to a patient with a history of convulsions

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	208	0	107	0	253	0	568
0	100	0	100	0	100	0	100

D Women's health and urinary disorders

D1

Prescription of a combined hormonal contraceptive to a woman with a history of venous or arterial thromboembolism

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	382	0	156	1	386	1	924
0	100	0	100	0.3	99.7	0.1	99.9

D2(a)

Prescription of oral or transdermal oestrogens to a woman with a history of breast cancer

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	126	0	35	1	109	1	270
0	100	0	100	0.9	99.1	0.4	99.6

D5

Prescription of a combined hormonal contraceptive to a woman aged 35 years or older who is a current smoker.

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
1	112	1	854	5	1034	7	3013
0.1	99.9	0.1	99.9	0.5	99.5	0.2	99.8

D6

Prescription of a combined hormonal contraceptive to a woman with a body mass index of ≥ 40

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	615	0	385	0	737	0	1737
0	100	0	100	0	100	0	100

E Musculoskeletal

EI(a)X

Prescription of an Oral NSAID to a patient with a history of peptic ulceration

True	False	True	False	True	False	True	False
46	135	21	58	28	127	95	320
25.4	74.6	26.6	73.4	18.1	81.9	22.9	77.1

EI(b)X

Prescription of an NSAID to an older patient (>65yrs) with a history of peptic ulceration

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
35	146	14	65	17	138	66	349
19.3	80.7	17.7	82.3	11	89	15.9	84.1

E1(c)X

Prescription of an NSAID, without co-prescription of an ulcer healing drug, to a patient with a history of peptic ulceration

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
5	176	4	75	8	147	17	398
2.8	97.2	5.1	94.9	5.2	94.8	4.1	95.9

E5X

In a patient with heart failure, the prescription of an NSAID

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
40	52	40	22	52	44	132	118
43.5	56.5	64.5	35.5	54.2	45.8	52.8	47.2

E6X

In a patient with chronic renal failure, the prescription of an NSAID (e.g CKD 3 or worse)

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
15	9	12	13	22	24	49	46
62.5	37.5	48	52	47.8	52.2	51.6	48.4

F Hazardous co-prescriptions, interactions and allergy

F2

Prescription of warfarin in combination with an oral NSAID

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
22	119	3	82	8	160	33	361
15.6	84.4	3.5	96.5	4.8	95.2	8.4	91.6

F3

Prescription of a phosphodiesterase type-5 inhibitor, e.g. sildenafil, to a patient who is also receiving a nitrate or nicorandil

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	70	0	30	3	54	3	154
0	100	0	100	5.3	94.7	1.9	98.1

F4(b)

Prescription of clarithromycin or erythromycin to a patient who is also receiving simvastatin, with no evidence that the patient has been advised to stop the simvastatin whilst taking the antibiotic

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
14	993	5	327	9	696	28	2016
1.4	98.6	1.5	98.5	1.3	98.7	1.4	98.6

F5(b)

Prescription of a potassium salt or potassium sparing diuretic (excluding aldosterone antagonists such as spironolactone) to a patient who is also receiving an ACE inhibitor or AR-II receptor antagonist

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
48	977	12	374	17	673	77	202
4.7	95.3	3.1	96.9	2.5	97.5	3.7	96.3

F6

Prescription of verapamil to a patient who is also receiving a beta-blocker drug

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
0	10	0	3	0	11	0	24
0	100	0	100	0	100	0	100

G Laboratory test monitoring

G1

Prescription of warfarin to a patient without a record of INR having been measured within the previous 12 weeks

Practice A		Practice B		Practice C		Total	
True	False	True	False	True	False	True	False
141	0	60	0	127	1	328	1
100	0	100	0	99.2	0.8	99.7	0.3

G2X

Prescription of amiodarone without a record of liver function being measured in the previous 9 months

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
2	10	1	2	4	3	7	15
16.7	83.3	33.3	66.7	57.1	42.9	31.8	68.2

G3X

Prescription of amiodarone without a record of thyroid function being measured within the previous 9 months

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
11	1	3	0	7	0	21	1
91.7	8.3	100	0	100	0	95.5	4.5

G5(b)

Prescription of lithium without a record of a lithium level being measured within the previous six months

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
12	0	1	1	16	0	29	1
100	0	50	50	100	0	96.7	3.3

G6

Prescription of methotrexate without a record of a full blood count within the previous three months

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
9	28	8	11	3	23	20	62
24.3	75.7	42.1	57.9	11.5	88.5	24.4	75.6

G7

Prescription of methotrexate without a record of liver function having been measured within the previous three months

Practice A		Practice B		Practice C		Total	
<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>	<i>True</i>	<i>False</i>
12	25	8	11	3	23	23	59
32.4	67.6	42.1	57.9	11.5	88.5	28.1	71.9

Summary of issues and discussion

This process has demonstrated that it is possible to develop a mechanism for data extraction, indicator encoding and data assessment based on those indicators. The flexibility and power of the indicator authoring environment means that it is possible, if the information has been encoded in the clinical record, to generate indicators that will elicit many scenarios. We have already demonstrated being able to 'find'

- 'Current' and 'past' prescriptions
- Clinical entries (Conditions, lab tests etc)
- Drugs that are members of a drug class (e.g. beta-blockers)
- Drugs given by a specific route
- Simple temporal operations (e.g. in the last 6 months)
- Logical combinations of the above
- Simple dosage patterns

We are also developing

- Complex Dosage pattern recognition
- Relative temporal sequencing (e.g. occurs before)
- Dashboard-based reporting and analysis

We have observed a series of issues and have identified several areas for discussion and further work.

Indicators

- The structure of the indicator and the logical statement derived from it need some further investigation. This influences how the indicator result can be reported. It is important to determine which denominator population you are interested in. By reversing an indicator you can get from "All those with asthma who are taking a beta-blocker" to "All those on a beta-blocker who also have asthma". Two different populations and two ways of reporting a percentage of 'patients on BB with asthma'.
- We have observed some problems 'triggering' the indicator correctly. If you have an indicator such as 'H/O Peptic ulcer, on NSAID, on ulcer healing drug' then there is more than one way of failing this indicator. If you 'trigger' the indicator only on 'history of peptic ulcer' then you will fail if you're not on NSAID. So we need to develop a composite trigger that correctly identifies the population we want. We are already working on a mechanism that will resolve this discrepancy.
- Should indicators be written as negative or positive statements or doesn't it matter? These prescribing indicators are stating the situation that is better to avoid whereas some other quality-focused indicators state an ideal scenario of good practice. For compound indicators all the clauses within the indicator have to be true for the indicator to be true. This means that there are more than one way to 'fail' the indicator, but should these all be reported separately rather than simply 'fail'?
- Definition of terms is important when trying to get a computer to 'understand' what you are trying to represent. Phrases such as 'excluding patients who also have a cardiac condition' can be

ambiguous. In a controlled terminology they literally mean ALL conditions that can affect the heart, whereas in clinical practice there is a subset of heart conditions that wouldn't necessarily be relevant.

- There will always inevitably be some indicators that will not be 'computable' in the sense that it is not possible to derive the necessary distinctions from the medical record. In those situations it is conceivable that the clinician could be prompted to give a judgement (i.e. by filling out a questionnaire) and then that data used to populate the indicator assessment.

Data extraction and processing

- The current mechanism has been developed to work with a data extraction from a clinical system. This currently uses Apollo to provide the extraction services but there is no absolute dependency on Apollo – it could work just as easily directly integrated into the clinical system, either 'live' or as an extract. It can also quite easily use an alternative third party for the data extraction.
- The scalability of such a system is important. We are able to process a single record against a set of indicators and perform a medication review assessment in about 11 seconds. This is made possible by creating and using 'release ontology' (technically... a binary object which is held in memory). By ramping up the hardware and using parallel processing platforms we predict that we can cope with very large datasets. This needs more specific description to allow a more accurate calculation. The scalability of the indicator authoring is not an issue. The mechanism is designed with a modular architecture to allow us to build 'atomic' units from which the compound indicators are built. In time, it will be possible to enable users to build different combinations of the indicators if they so wish.

User requirements

- How do users want to use such a system? This method provides the capability of GPs drilling down from a set of indicator statistics to an individual patient where they can confirm why they may have passed or failed an indicator. The same data can provide the administrators with the figures and analysis that they require.
- The use of these quality measures will allow monitoring of health care practices. There is also much interest in using such data to populate appraisal and revalidation records via an eportfolio. Taking 'direct' observations from your own prescribing behaviour is seen as a very efficient and reliable way of providing evidence of your capability to practice in a safe and effective way. This may require some modification in the practice workflow as GP systems often can't reliably record the individual themselves, especially if locums are widely used. It is currently seen more as a joint practice responsibility. Technically however it would be straightforward to associate an individual GP with prescribing entries.