

Towards a Framework for Better Management of Patients with Hypertension

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for Health Innovation

1 September 2009



CVD/Hypertension

- CVD is a major problem - In 2007 over 38% of deaths (i.e. >233,000 deaths!) in the UK were due to a CVD related problem, ~40% in NZ
- In 2005, CVD related cost burden to EU economy €169 billion/yr
- Hypertension is a significant risk factor of CVD
- The risk of CVD beginning at 115/75 mmHg doubles with each increment of 20/10 mmHg;

What we did

- Collaborated with a (largely Pacific) general practice in West Auckland
- Worked with a 'panel' – practice manager, two practice nurses, two GPs of the practice along with an external GP.
- Identified some important *explicit* quality audit criteria they thought were important
- Developed a 'system' that could answer GP queries



Persistence of treatment – No large gaps in therapy?

Identified criteria

Lack of persistence of medication; and/or lapsed BP recording

1. A lapse in AHT of >30 days and the lapse extends into the Evaluation Period (EP)
2. A period of >180 days with no BP measurements extending into the EP
3. A BP measurement of $\geq 160/100$ mmHg followed by a gap of >120 days in BP measurements extending into the EP

Persistently high BP; lacking indicated therapy; and/or lab test contraindicating treatment

4. Three or more consistently high BP measurements ($\geq 160/100$ mmHg) over 120 days or more where either
 - i) the last of these high BPs was within the EP or
 - ii) with no subsequent "controlled" BP ($< 160/100$ mmHg) measurements after the consistently high BPs
5. Classified with diabetes mellitus and not on ACEi/ARB at any time during EP*
6. Classified with myocardial infarction and not on beta-blocker at any time during EP*
7. Classified with renal impairment and on ACEi/ARB and with $eGFR < 60$ mL/min at any time during EP
8. On thiazide(s) and with serum uric acid > 0.42 mmol/l at any time during EP and not on Allopurinol or Colchicine

EP – Evaluation period (9 May to 8 Nov 2007); * i.e., a lapse of the indicated drug at some time during the EP and after the indicating diagnosis.

Measurement related – Have we recorded BP into the PMS record

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Achieving targets – Patients not taking ‘too long’ to achieve target BP

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Management of other complications
E.g., renal function and gout
issues

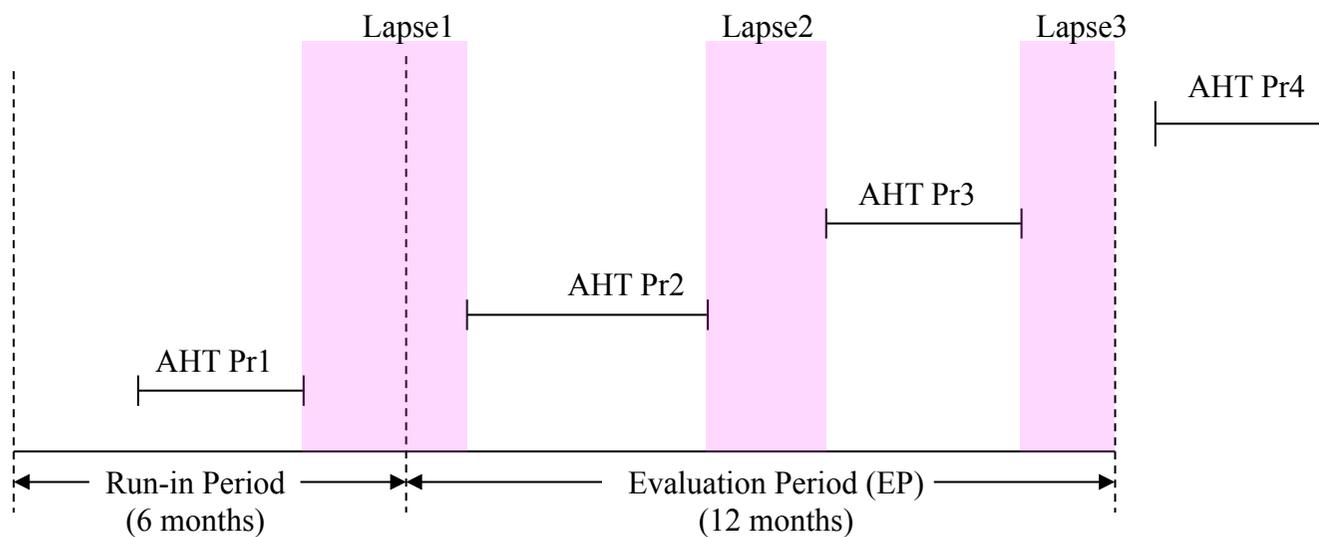
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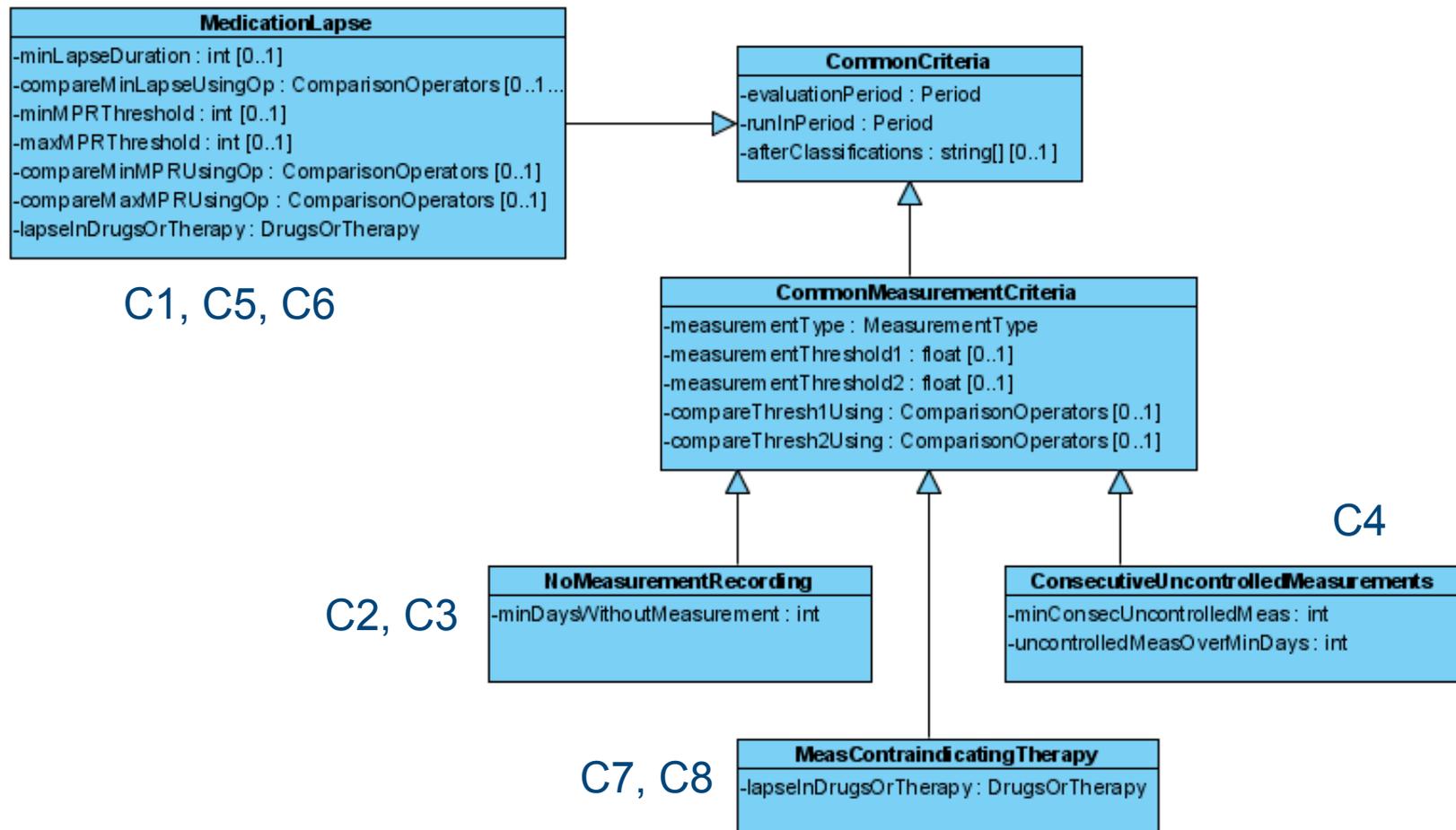
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Temporal issues

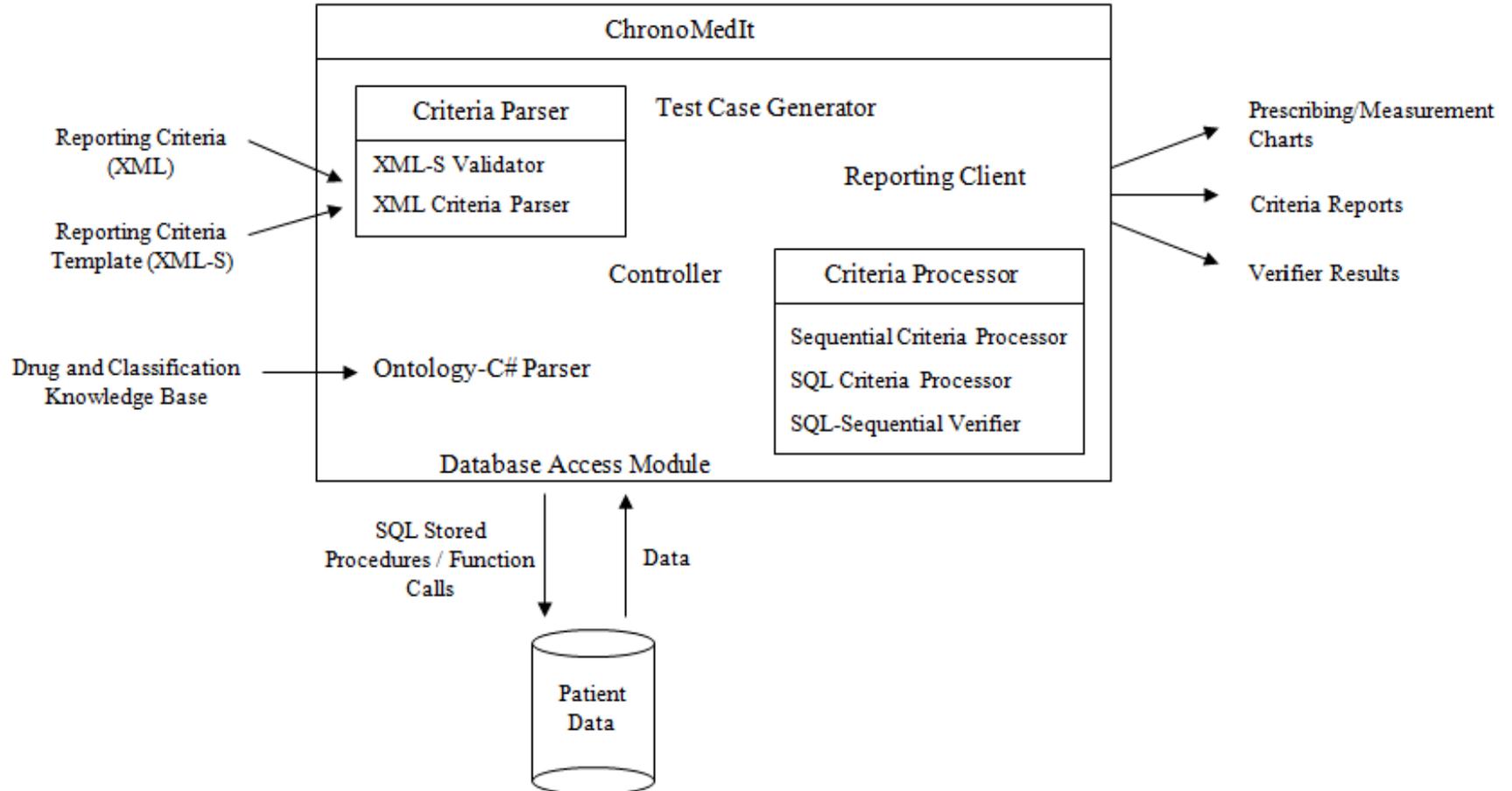
- A lapse should be running-into, during or at the end (on-going) of the evaluation period



UML criteria model



Framework architecture



Drug and classification knowledge bases

- ▼ ● Drugs_and_Drug_Classes
 - ▼ ● Drug_Classes
 - ▶ ● Antidepressants
 - ▼ ● Antihypertensives
 - ▼ ● ACE-Inhibitors
 - ACE-Inhibitor_and_Calcium_Channel_Blocker_Combination (2)
 - ACE-Inhibitor_and_Diuretic_Combination (8)
 - Benazepril_DrugClass (3)
 - Captopril_DrugClass (2)
 - Cilazapril_DrugClass (2)
 - Enalapril_DrugClass (2)
 - Enalaprilat_DrugClass (1)
 - Fosinopril_DrugClass (2)
 - Lisinopril_DrugClass (2)
 - Moexipril_DrugClass (2)
 - Perindopril_DrugClass (1)
 - Quinapril_DrugClass (2)
 - Ramipril_DrugClass (1)
 - Trandolapril_DrugClass (2)
 - ▶ ● Alpha-2_Agonists
 - ▶ ● Alpha_Blockers
 - ▶ ● ARBs
 - ▶ ● Beta_Blockers
 - ▶ ● Calcium_Channel_Blockers
 - ▶ ● Diuretics
 - ▶ ● Vasodilators (2)
 - MedTech32_SpecificVariants (42)
 - ▶ ● Problems_and_Classification_Codes
- ▶ ● Drugs_and_Drug_Classes
- ▼ ● Problems_and_Classification_Codes
 - ▼ ● ClassificationSchemes
 - Read_Codes (68)
 - ▼ ● Problems
 - Depression (8)
 - Diabetes (23)
 - Hypertension (5)
 - Myocardial_Infarction (6)
 - Renal_Impairment (29)

Specifying criteria details in XML – C1

```
<Report xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="ReportCriteria.xsd">
  <evaluation_period>
    <start_date>2007-06-01</start_date>
    <end_date>2008-05-31</end_date>
  </evaluation_period>
  ...
  <med_lapse_after_classification>
    <medication_lapse>
      <min_lapse_duration_days>30</min_lapse_duration_days>
      <lapse_in_drugs>
        <selected_drug_class>ACE-Inhibitors|ARBs</selected_drug_class>
      </lapse_in_drugs>
    </medication_lapse>
    <selected_problems>Hypertension^Diabetes</selected_problems>
  </med_lapse_after_classification>
  ...
</Report>
```

Lapse constraints

Drugs and diagnoses

Patient data

Entity	Practice-1 (primarily Pacific Island population)	Practice-2 (primarily NZ- European population)
Number of patients	21057	9009
Number of prescriptions	63269	95634
Number of classifications (diagnoses)	46575	49894

Practice level reports

-EP = 1-May-08 to 30-April-09
- 6-month run-in

	Criterion	Practice 1 (N = 607)	Practice 2 (N = 679)
C1	A lapse in AHT of >30 days and the lapse extends into the EP	355 (59%)	230 (34%)
C2	A period of >180 days with no BP measurements extending into the EP	258 (43%)	136 (20%)
C3	A BP measurement of $\geq 160/100$ mmHg followed by a gap of >120 days in BP measurements extending into the EP	38 (6%)	15 (2%)
C4	Three or more consistently high BP measurements ($\geq 160/100$ mmHg) over 120 days or more where either i)the last of these high BPs was within the EP or ii)with no subsequent “controlled” BP ($< 160/100$ mmHg) measurements after the consistently high BPs	5 (1%)	6 (1%)
C5	Classified with diabetes mellitus and not on ACEi/ARB at any time during EP	240 (40%)	113 (17%)
C6	Classified with myocardial infarction and not on beta-blocker at any time during EP	14 (2%)	22 (3%)
C7	Classified with renal impairment and on ACEi/ARB and with eGFR < 60 mL/min at any time during EP	39 (6%)	21 (3%)
C8	On thiazide(s) and with serum uric acid > 0.42 mmo/l at any time during EP	62 (10%)	15 (2%)

Detailed patient reports

C3 ABP measurement of $\geq 160/100$ mmHg followed by a gap of >120 days in BP measurements extending into the EP

5 TP186

Measurement Details:

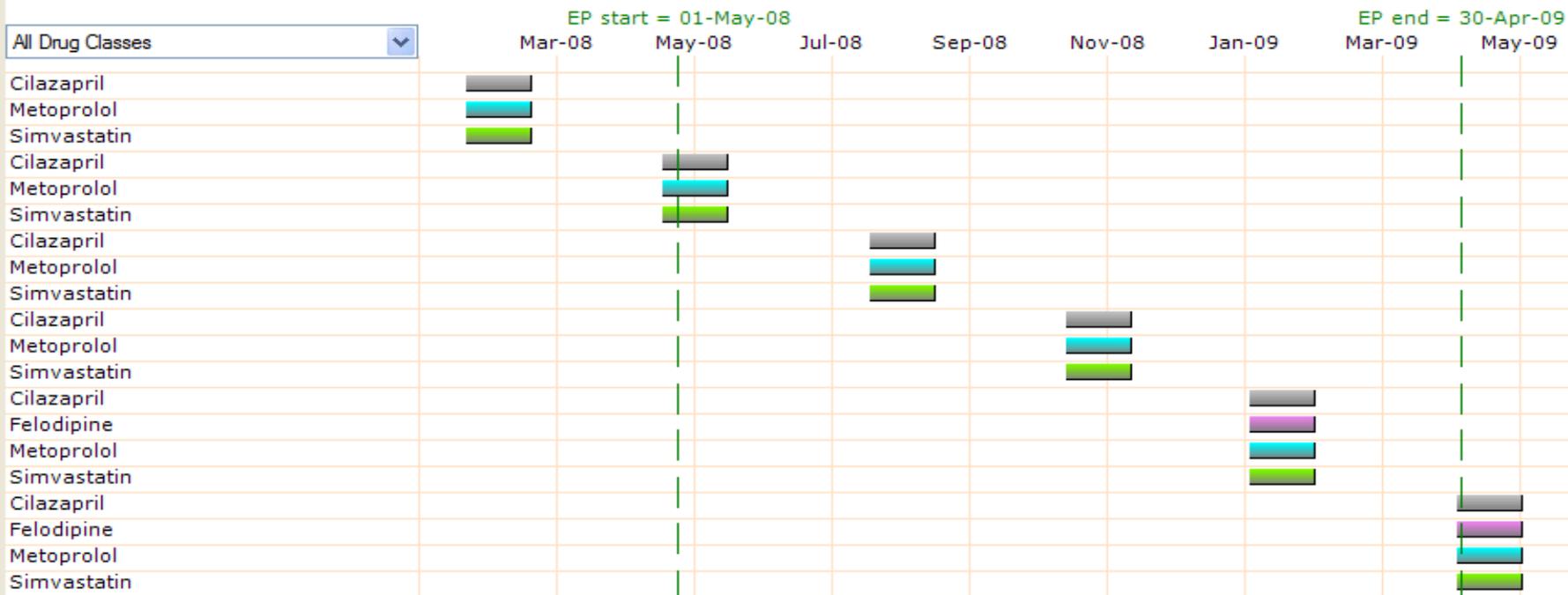
<i>Measurement Date</i>	<i>Systolic / Diastolic</i>	<i>Next BP Measurement on or No BP Measurement till EP End</i>
18-Dec-2008	165/107	30-Apr-2009 (133 days)

After Classified with:

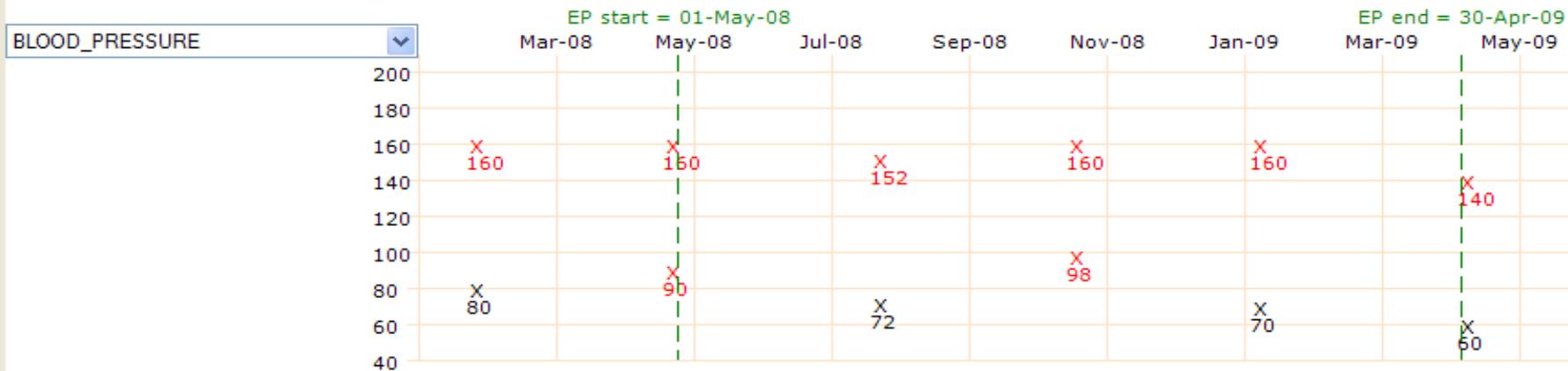
<i>Classification Description</i>	<i>Classification Code</i>	<i>Classified on</i>
BP - hypertensive disease	G2.11	21-Feb-2006

Save Graphs

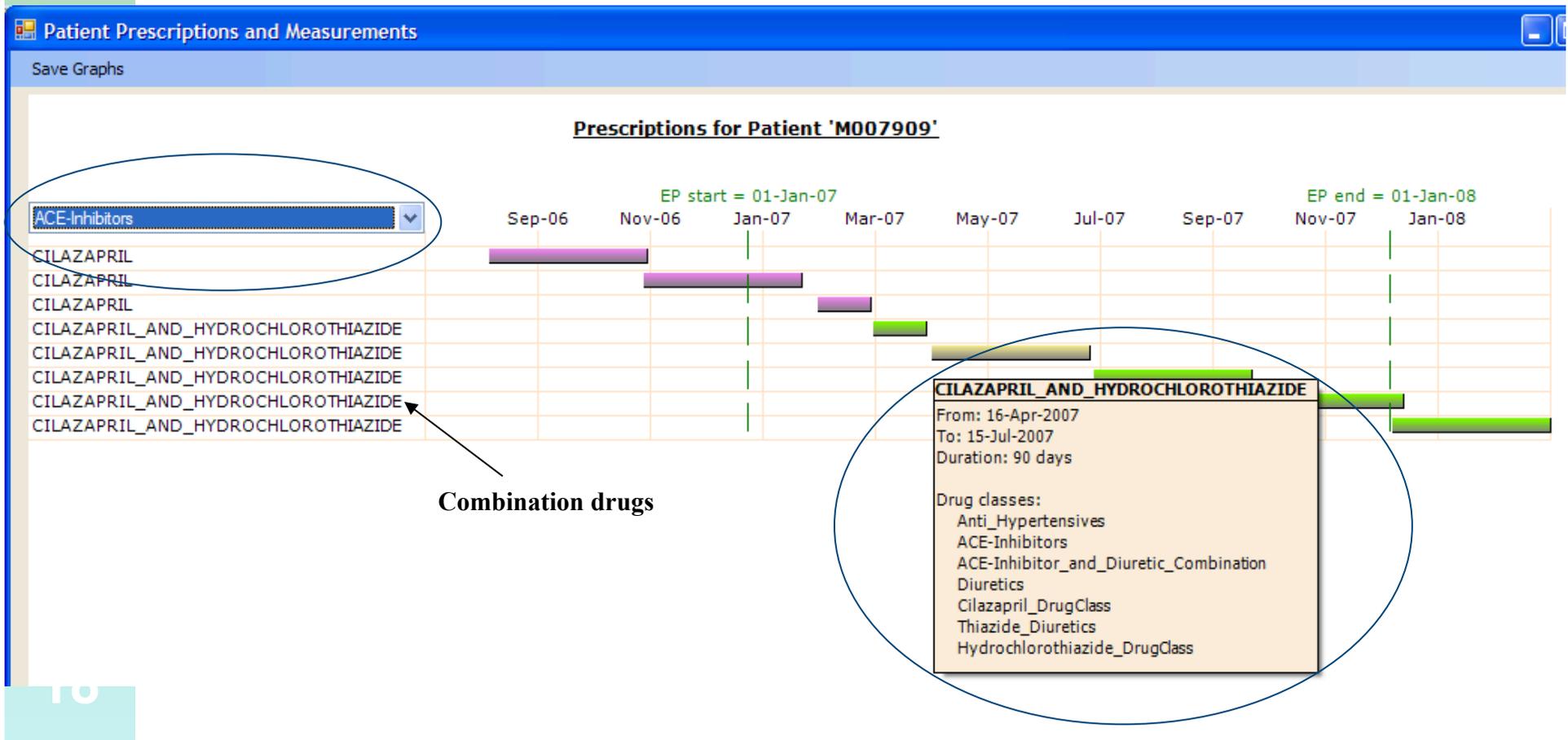
Prescriptions for Patient 'TP_47251'



Blood Pressure Measurements for Patient 'TP_47251'



An interactive visualisation tool



Key messages

- There's lots of good information in routinely collected EMR data that can be used to identify chronic patients whose clinical outcomes can be improved (using explicit quality indicators)
- The framework can be used to identify cohorts of patients with hypertension on suboptimal therapy
- Currently looking at a feasibility study to identify issues behind poor adherence and persistence

Contact, Further Reading

- **Thusitha Mabotuwana**
thusitha@cs.auckland.ac.nz
- Methods/results of two recent studies:
 - Mabotuwana, T. and Warren, J., ChronoMedIt – A Computational Quality Audit Framework for Better Management of Patients with Chronic Conditions. *Journal of Biomedical Informatics*, 2009 (epub available online)
 - Mabotuwana, T., Warren, J. and Kennelly, J., A Computational Framework to Identify Patients with Poor Adherence to Blood Pressure Lowering Medication. *International Journal of Medical Informatics*, 2009 (epub available online)
- Opinion/review piece:
 - Warren J, 'General Practice EMRs: What they can tell us, and how,' *Health Care and Informatics Review Online*, December 2007

Prescribing-dispensing matching

- Prescription drugs will work only if you take them
- Some patients collect their prescriptions, but fail to fill the scripts at the pharmacy
- Prescription based adherence calculations are useful – PPV 81%, NPV is 76%

Mabotuwana, T., Warren, J., Harrison, J. and Kenealy, T., What Can Primary Care Prescribing Data Tell Us about Individual Adherence to Long-Term Medication? – Comparison to Pharmacy Dispensing Data. *Pharmacoepidemiology and Drug Safety*, 2009 (Pubmed ref #19609958)

Comparison with Quality and Outcomes Framework (QOF)

- Our criteria include identifying patients who need a follow-up (eg: “A lapse in AHT >30 days” criterion) which is required for sound adherence
- QOF DM15 indicator is “...patients with diabetes... who are treated with ACE inhibitors (or A2 antagonists)” but what is *treated with* without an EP?
- DM 12. The percentage of patients with diabetes in whom the last blood pressure is 145/85 or less
- BP 5. The percentage of patients with hypertension in whom the last blood pressure (measured in the previous 9 months) is 150/90 or less