Towards a Framework for Better Management of Patients with Hypertension

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With: Prof. Jim Warren

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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
## Identified criteria

**Persistence of treatment – No large gaps in therapy?**

<table>
<thead>
<tr>
<th>Lack of persistence of medication; and/or lapsed BP recording</th>
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<td>1. A lapse in AHT of &gt;30 days and the lapse extends into the Evaluation Period (EP)</td>
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**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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### Identified criteria

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

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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.
### 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 ≥ 160/100 mmHg followed by a gap of >120 days in BP measurements extending into the EP

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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.
Identified criteria

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

- 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
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  6. Classified with myocardial infarction and not on beta-blocker at any time during EP*

- Classified with renal impairment and on ACEi/ARB and with eGFR $\leq 60$ mL/min at any time during EP

- 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.
Temporal issues

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

- Reporting Criteria (XML)
- Reporting Criteria Template (XML-S)
- Drug and Classification Knowledge Base
- Reporting Client
- Criteria Parser
  - XML-S Validator
  - XML Criteria Parser
- Ontology-C# Parser
- Database Access Module
- SQL Stored Procedures / Function Calls
- Data
- Patient Data
- ChronoMedIT
  - Criteria Processor
    - Sequential Criteria Processor
    - SQL Criteria Processor
    - SQL-Sequential Verifier
  - Test Case Generator
  - Controller
- Prescribing Measurement Charts
- Criteria Reports
- Verifier Results
Drug and classification knowledge bases

- **Drugs_and_Drug_Classes**
  - **Drug_Classes**
    - Antidepressants
    - Antihypertensives
    - ACE-Inhibitors
      - ACE-Inhibitor_and_Calcium_Channel_BlockerCombination (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
- **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

```xml
<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

<table>
<thead>
<tr>
<th>Entity</th>
<th>Practice-1 (primarily Pacific Island population)</th>
<th>Practice-2 (primarily NZ-European population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>21057</td>
<td>9009</td>
</tr>
<tr>
<td>Number of prescriptions</td>
<td>63269</td>
<td>95634</td>
</tr>
<tr>
<td>Number of classifications (diagnoses)</td>
<td>46575</td>
<td>49894</td>
</tr>
<tr>
<td>Criterion</td>
<td>Practice 1 (N = 607)</td>
<td>Practice 2 (N = 679)</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>C1</td>
<td>A lapse in AHT of &gt;30 days and the lapse extends into the EP</td>
<td>355 (59%)</td>
</tr>
<tr>
<td>C2</td>
<td>A period of &gt;180 days with no BP measurements extending into the EP</td>
<td>258 (43%)</td>
</tr>
<tr>
<td>C3</td>
<td>A BP measurement of ≥160/100 mmHg followed by a gap of &gt;120 days in BP measurements extending into the EP</td>
<td>38 (6%)</td>
</tr>
<tr>
<td>C4</td>
<td>Three or more consistently high BP measurements (≥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 (&lt;160/100 mmHg) measurements after the consistently high BPs</td>
<td>5 (1%)</td>
</tr>
<tr>
<td>C5</td>
<td>Classified with diabetes mellitus and not on ACEi/ARB at any time during EP</td>
<td>240 (40%)</td>
</tr>
<tr>
<td>C6</td>
<td>Classified with myocardial infarction and not on beta-blocker at any time during EP</td>
<td>14 (2%)</td>
</tr>
<tr>
<td>C7</td>
<td>Classified with renal impairment and on ACEi/ARB and with eGFR &lt; 60mL/min at any time during EP</td>
<td>39 (6%)</td>
</tr>
<tr>
<td>C8</td>
<td>On thiazide(s) and with serum uric acid &gt; 0.42mmo/l at any time during EP</td>
<td>62 (10%)</td>
</tr>
</tbody>
</table>
Detailed patient reports

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

| 5 | TP186 |

**Measurement Details:**

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

**After Classified with:**

<table>
<thead>
<tr>
<th>Classification Description</th>
<th>Classification Code</th>
<th>Classified on</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP - hypertensive disease</td>
<td>G2.11</td>
<td>21-Feb-2006</td>
</tr>
</tbody>
</table>
An interactive visualisation tool

Combination drugs
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:

  - Opinion/review piece:
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%

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