Evaluating Predictive Analytics for Capacity Planning

HIC 2015
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MCKESSON
Change the view.
What is predictive analytics?

**Predictive analytics** is the practice of extracting information from existing data sets, and then applying various techniques (e.g., statistical, modelling) in order to determine patterns and predict future outcomes and trends.

*How can we practically evaluate and use predictive analytics solutions for capacity planning within health?*
Paradigm Shift Required for Analytics Maturity

Sources:
*Competing on Analytics*, Tom Davenport
Gartner IT Glossary
What to look for with Capacity Planning

1. Manages multiple planning horizons
   - Multi-year, annual, 6-8 week scheduling periods, weeks, days and hours

2. Continuously updates forecasts

3. Forecasts patient demand with consistently high absolute accuracy vs. stated accuracy % aggregated over time

4. Forecasts volumes for door-to-door patient flow vs. preset intervals and departments

5. Converts forecasts automatically into capacity and staffing needs

6. Supports user insight, input and adjustment as part of the planning process
Strategic & Annual Planning

- Discuss “what-if” options, regional plan
- Budget and physical capacity decisions
- Set targets and assumption (linking plans)

Monthly & Weekly Planning

- Manage “current” variation to plan
- Update forecasts & roster staff
- Informed decision making

Daily Planning

- Unit focus: manage current & projected pts.
- Focus on relieving immediate flow issues
- Replace sick leave? Book casual
Forecasting Methods Used for Operational Planning

Predictive modeling
Algorithmic modeling
Pattern identification
Scenario modeling
Simulation
Optimization
Predictive

Determining, mathematically, the relationship between the *explanatory* variables and the *predicted* variable, based on historical data

Examples:

**Insurance**: relationship between certain characteristics of a person and lifestyle and predicted outcome of a certain claim

**Capacity Planning**: relationship between status of ED at a given time of day and the impact on Inpatient beds tomorrow
Pattern Identification

‘Time series forecasting’ identifies different patterns within the predicted variable itself, such as trend, seasonality and day of the week. Various combinations of those patterns can then be used to derive a forecast.
Algorithmic

Take recent averages and distributions of past activity for certain locations, services and day of the week or special event days. Then apply an algorithm to utilize these to create a projection.
## Scenario

Allow users to input their own assumptions or ‘what ifs’ into the prediction to assess impacts (vs. based purely on patterns of past activity)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Bed days 4%</th>
<th>Activity 16%</th>
<th>ALOS 12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Surgery</td>
<td>43,161</td>
<td>43,830</td>
<td>41,924</td>
</tr>
<tr>
<td>Emergency</td>
<td>14,197</td>
<td>14,147</td>
<td>14,058</td>
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<tr>
<td>Scheduled</td>
<td>9,128</td>
<td>10,111</td>
<td>10,041</td>
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<tr>
<td>Cardiac ICU</td>
<td>6,675</td>
<td>6,800</td>
<td>6,943</td>
</tr>
<tr>
<td>Emergency</td>
<td>6,675</td>
<td>6,800</td>
<td>6,943</td>
</tr>
<tr>
<td>Scheduled</td>
<td>6,675</td>
<td>6,800</td>
<td>6,943</td>
</tr>
<tr>
<td>Hospital Total</td>
<td>145,201</td>
<td>150,721</td>
<td>151,870</td>
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<tr>
<td>Emergency</td>
<td>25,756</td>
<td>28,384</td>
<td>30,308</td>
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<tr>
<td>Scheduled</td>
<td>5,555</td>
<td>5,368</td>
<td>5,042</td>
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<tr>
<td>ICU</td>
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<td>764</td>
<td>787</td>
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<tr>
<td>Emergency</td>
<td>4,113</td>
<td>5,304</td>
<td>756</td>
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<tr>
<td>Scheduled</td>
<td>115</td>
<td>475</td>
<td>242</td>
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<tr>
<td>Cardiac ICU</td>
<td>2,732</td>
<td>2,764</td>
<td>2,536</td>
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<tr>
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<td>1,968</td>
<td>2,314</td>
<td>2,354</td>
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<tr>
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<td>1,302</td>
<td>1,200</td>
<td>17</td>
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<tr>
<td>ICU</td>
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<td>787</td>
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<td>727</td>
<td>756</td>
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<tr>
<td>Scheduled</td>
<td>17</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>Cardiac ICU</td>
<td>1,125</td>
<td>1,170</td>
<td>1,125</td>
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<tr>
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</tr>
<tr>
<td>Scheduled</td>
<td>17</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

- **Analyze which services were driving these trends?**
- **What do we expect this year? Sustain or continue trends?**
- **What change initiatives are we investing in to increase volumes and reduce ALOS?**
Simulation

Coded logic which emulates the actual individual patient ADT activity of planned patient admissions/bookings
Using either a mathematical or algorithmic approach to derive the optimal outcome, based on an ‘objective function’.

**Daily Patient Census at UK1S Actual vs. Smoothed**

- **Actual-Hip & Knee at UBCH**
- **Actual-All at UBCH**
- **Actual-Ortho Recon at VGH**
- **Smoothed @ 1700 CSI annual volume**

**Note:** Actual census is based on midnight snapshot and smoothed census is hourly average throughout the day. Therefore, considering the turnover, the smoothed midnight census or the peak time census will be higher than the average as shown.
Combining Approaches

**Pathways**
Patient pathways leveraged to simulate and/or optimise any impact on OR’s and inpatient units.

**Historical Data**
Develops base patient demand based on current trends seen from historical data.

**Algorithms**
Algorithms applied to forecast increasing accuracy of patient demand.

**Clinical Input**
Customers clinical expert input of areas that may impact any patient demand added.
Comparing Planning Approaches

Aggregate vs. Patient-level
Static vs. Dynamic
Short term vs multi-horizon
Top down vs. Bottom up
Learn from yesterday.
Deal with today.
Plan for tomorrow.

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