A New Health Economic Model for Improving Management of Advanced Prostate Cancer

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Background

• Prostate Cancer is a chronic disease with potential long term impact on patients and their carers

• Increasing Disease burden also puts a burden on national health services

• A strong need to understand the patient journey

• Continuously innovate and suggest changes to advanced prostate cancer management and delivery of health services
Global Prostate Cancer Statistics

- Incidence Rates in Australia among the highest in the world

- Incidence Rates in Australia are projected to increase until 2020

- Need for Change and Improvement especially for Advanced Stages of Prostate Cancer


What is a Patient Journey?

• A general perspective in Health Services:
The workflow involving patients accessing various health services to treat a health condition over a period of time
A Typical Patient Journey Perspective

**PATIENT**

Prostate Symptoms
Patient’s demographics etc

Inform patient

Yes

No

<<Manual>> Assess Prostate Symptoms

<<System>> Record Patient Details

<<Manual>> Refer to Urologist

<<System>> Refer to Oncologist Correspondence

<<Manual>> Consult Patient

GP

<<Manual>> Record Patient Details

<<Manual>> Require Further Investigation?

Yes

Refer to Urologist

<<Manual>> Receive Urologist/Oncologist Correspondence

<<Manual>> Prescribe Treatment

<<Manual>> Refer to Oncologist

Urologist

<<Manual>> Record Patient Details

<<Manual>> Order Pathology Tests

<<Manual>> Update Patient Records

<<System>> Blood Tests

<<System>> CT Scans

<<Manual>> Biopsy

<<Manual>> Require Further Investigation?

End

<<Manual>> Suppose Urologist

<<Manual>> Urologist Records

<<System>> Biopsy

<<Manual>> Require Further Investigation?

Medical Oncologist

<<Manual>> Review Patient Findings

<<Manual>> Order Pathology Tests

<<Manual>> Update Patient Records

<<System>> Bone Scans

<<Manual>> Urologist Records

<<Manual>> Require Further Investigation?

<<Manual>> Refer to Radiation Oncologist

<<Manual>> Medical Oncologist Records

<<System>> Record Patient Details

<<System>> Bone Scans

<<Manual>> Require Further Investigation?

Radiation Oncologist

<<Manual>> Review Patient Findings

<<Manual>> Prescribe Radiation Therapy

<<Manual>> Record Patient Details

<<System>> Radiation Oncologist Records

<<Manual>> Require Further Investigation?

Inform GP

<<Manual>> Treatment Finished

End
Understanding Patient Journey

• National e-Health Initiative will enable efficient Sharing of Patient’s Clinical Data Across Service Providers

• **Will that be enough** to really understand disease progression especially at **Advanced Stages** of Chronic disease such as Prostate Cancer?

• Understanding patient journey is key to make any improvements in the management of advanced prostate cancer

• Need a method that will complement and translate clinical/scientific research into practice
How can we better understand the patient journey?

Our approach:

• Focus on

  ✓ Health States
  ✓ Interventions at each health state
  ✓ Economic factors (E.g. Cost or $Health Dollars)
  ✓ Health Outcomes at each Health State
Health States

✓ A Journey Described and modelled using unique Health States

✓ Each Health state is characterised by set of interventions with Cost and Specific health outcomes
Modelling the patient journey using Health States

✓ Markov Model developed to describe natural history of advanced prostate cancer patients

ADT = androgen deprivation therapy
## Health States Definition

<table>
<thead>
<tr>
<th>No</th>
<th>Health State</th>
<th>Specific Rules for Health State Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS1</td>
<td>Localised Prostate Cancer</td>
<td>Cancer is restricted to the local prostate region</td>
</tr>
<tr>
<td>HS2</td>
<td>Remission</td>
<td>No sign of any cancer. Cancer may reappear.</td>
</tr>
<tr>
<td>HS3</td>
<td>Locally Advanced Prostate Cancer</td>
<td>The cancer has spread outside of the prostate gland</td>
</tr>
<tr>
<td>HS4</td>
<td>PSA Recurrence following surgery or radiation</td>
<td>Rising PSA Levels after surgery or radiation treatment</td>
</tr>
<tr>
<td>HS5</td>
<td>Metastatic Prostate Cancer</td>
<td>The cancer has spread beyond the prostate area to other regions of the body</td>
</tr>
<tr>
<td>HS6</td>
<td>Castrate Resistant Metastatic Prostate Cancer</td>
<td>Unresponsive to Androgen Deprivation Therapy (ADT)</td>
</tr>
<tr>
<td>HS7</td>
<td>End-of-life care</td>
<td>Terminal prostate cancer</td>
</tr>
<tr>
<td>HS8</td>
<td>Death</td>
<td>Death caused by Prostate Cancer</td>
</tr>
</tbody>
</table>
A Baseline Model for an annual cycle

Death

Remission

Death

Death

Death

Death

Death

Remission

Remission

Remission

Remission

Remission

Remission

Death

Death

Death

Death

Death

Death
# Health states Transition – An Example

<table>
<thead>
<tr>
<th></th>
<th>HS1</th>
<th>HS2</th>
<th>HS3</th>
<th>HS4</th>
<th>HS5</th>
<th>HS6</th>
<th>HS7</th>
<th>HS8</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>HS2</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>HS3</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>HS4</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>HS5</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>HS6</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>HS7</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>HS8</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Legend:**
- HS: Health State;
- Y: Yes; (i.e. the cancer may progress to a specific Health State (HS))
- N: No (i.e. the cancer may not progress to a specific Health State (HS))
Method

• Identify Unique Health states for modelling patient cohort movement during 20 years time span

• Identify Transition Matrix

• Determine Health Costs at each Health states

• Determine health outcomes as a result of treatment interventions and

• Determine Quality Adjusted Life Cycle Years (QALYs)
## Initial Simulation Illustration

<table>
<thead>
<tr>
<th>Health State</th>
<th>Existing Treatments Cost</th>
<th>Existing Utility</th>
<th>Cost With New Intervention</th>
<th>Utility due to new intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS1</td>
<td>$500</td>
<td>0.8</td>
<td>$1,000</td>
<td>0.9</td>
</tr>
<tr>
<td>HS2</td>
<td>$7,000</td>
<td>0.4</td>
<td>$7,000</td>
<td>0.4</td>
</tr>
<tr>
<td>HS3</td>
<td>$10,000</td>
<td>0.6</td>
<td>$10,000</td>
<td>0.6</td>
</tr>
<tr>
<td>HS4</td>
<td>$16,000</td>
<td>0.7</td>
<td>$16,000</td>
<td>0.7</td>
</tr>
<tr>
<td>HS5</td>
<td>$20,000</td>
<td>0.8</td>
<td>$20,000</td>
<td>0.8</td>
</tr>
<tr>
<td>HS6</td>
<td>$10,000</td>
<td>0.5</td>
<td>$10,000</td>
<td>0.5</td>
</tr>
<tr>
<td>HS7</td>
<td>$25,000</td>
<td>0.7</td>
<td>$25,000</td>
<td>0.7</td>
</tr>
<tr>
<td>HS8</td>
<td>$5,000</td>
<td>0</td>
<td>$5,000</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Existing Total cost per QALYs (n=1000)</th>
<th>Increase in QALYs</th>
<th>Increase in Cost per patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>$17,519</td>
<td>0.44</td>
<td>$4,414</td>
</tr>
</tbody>
</table>
Opportunities and Challenges

**Opportunities**

- Comparative Cost Effectiveness Research (CCER) to evaluate specific set of interventions at given Health States
- Lack of CCER for Advanced Prostate Cancer in Australia and worldwide.
- Online Simulation as a decision making capability for patients, care providers
- E.g. Online Patient Journey Browser

**Challenges**

- Accurate Estimation of Health Dollars spent
- Synthesis of evidence related to effectiveness of specific interventions at advanced stages of the disease (Often Difficult)
CCER Studies for advanced prostate cancer in Australia

Comparative Effectiveness Research (CER) is becoming a significantly important discipline.

Signs:
- $1.1 billion Funding Allocated in US for CER\(^1\)
- Proposal for new NHMRC Funding Stream \(^2\) for CER

But CER lacks Cost Aspect needed for realistic and rational policy changes decisions.

- Large Scale implementation of our proposed health economics based model
- Smart Methods to Leverage off electronic data sources to simulate patient journey pathways and patterns of care

Conclusion

• Modelling Patient Journey using Health Economics factors is highly important for making changes in Advanced Prostate Cancer Management

• Opportunities can result in tangible improvement of health services if challenges are addressed properly

• Comparative Cost Effectiveness Research (CCER) is a good tool for suggesting changes in advanced prostate cancer management.
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AeHRC is the leading national eHealth research group in Australia currently 60-70 staff, students, visiting researchers

Funding from
• CSIRO
• Qld Govt - DEEDI, Queensland Health
• engagement partners
• revenue

Investment into research programs

National reach - Brisbane HQ, smaller teams nationally - NSW, Victoria, SA, and now WA, and through CSIRO in Tasmania and ACT

Success built on partnering - Government, clinicians, industry
• Local engagement to drive national benefit
Discussion
The Australian e-Health Research Centre (AEHRC)

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Thank you