Why inventory medical imaging

Medical imaging key to decision-making in all specialties and subspecialties
• make / exclude diagnosis
• monitor normal development
• plan surgical or catheter intervention
• design personalized implants and prostheses (3D printing)
• investigate post-surgical complications
• monitor response to treatment
• monitor relapse / recurrence
Also ...

Outside direct use in patient care

• Training of healthcare students in anatomy, pathology, procedures
• Communicating with patients, patients caretakers and decision makers
• Communicating to the wider public: health promotion, fund-raising, value of medicine – iconic images
But …

- Big ticket items with substantial ongoing costs
- Require special facilities: reinforced floors, shielded walls, access controls
- Technological dependencies
  - parts supply chain
  - availability of contrast agents or radiolabels – reliable transport, or nearby manufacturing
  - storage, security and distribution of (large) images
- Skilled staff for operation and maintenance
Past

2001 - 2012
2001: CCOHTA

- CCOHTA Inventory, equipment operational as of July 16, 2001
- Data collection June 7 to July 16, 2001
- CT, MRI, NM (SPECT and gamma cameras), PET, angiography suites, catheterization labs, lithotriptors
- Data from web-based survey, with assistance of radiologists associations, manufacturers
- Published lists of units and locations, and report of unit ages and timing of installation
## 2001: Snapshot

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>MRI</th>
<th>NM</th>
<th>PET</th>
<th>Angio</th>
<th>Cath</th>
<th>Litho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>296</td>
<td>110</td>
<td>379</td>
<td>9</td>
<td>170</td>
<td>64</td>
<td>13</td>
</tr>
<tr>
<td>Units per million population</td>
<td>9.5</td>
<td>3.5</td>
<td>12.2</td>
<td>0.3</td>
<td>5.5</td>
<td>2.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Provinces/territories</td>
<td>11</td>
<td>9</td>
<td>10</td>
<td>4</td>
<td>10</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Average age (years)</td>
<td>4.7</td>
<td>3.8</td>
<td>7.7</td>
<td>5.3</td>
<td>6.7</td>
<td>6.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Oldest (years)</td>
<td>18</td>
<td>16</td>
<td>28</td>
<td>11</td>
<td>39</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>≤10 years</td>
<td>87.8%</td>
<td>94.5%</td>
<td>64.6%</td>
<td>77.8%</td>
<td>72.9%</td>
<td>78.1%</td>
<td>76.9%</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>12.2%</td>
<td>5.5%</td>
<td>35.4%</td>
<td>22.2%</td>
<td>27.1%</td>
<td>21.9%</td>
<td>23.1%</td>
</tr>
</tbody>
</table>

CCOHTA, 2001
2003 – 2012: CIHI

- CIHI inventory, collected by ProMed Associates Ltd.
- 2003-2005 CT, MRI, NM (SPECT and gamma cameras), PET, angiography suites, catheterization labs, lithotripters
- 2006-2007 added PET-CT, SPECT-CT
- 2009, 2011 CT, MRI, NM, PET, PET-CT, SPECT-CT
- 2010, 2012 added angio, cath, litho
- 2012 asked about interest in emerging technologies, radiation safety, PACS
Growth of imaging 1990-2012
Growth of imaging 1990-2012

CCOHTA 2001; CIHI 2007, 2012
### 2012: Snapshot

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>MRI</th>
<th>NM</th>
<th>PET</th>
<th>PET-CT</th>
<th>SPECT-CT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>510</td>
<td>308</td>
<td>578</td>
<td>9</td>
<td>34</td>
<td>142</td>
</tr>
<tr>
<td><strong>Units per million</strong></td>
<td>14.7</td>
<td>3.9</td>
<td>16.7</td>
<td>0.3</td>
<td>1.0</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Provinces/territories</strong></td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>(7)</td>
<td>(7)</td>
<td>10</td>
</tr>
<tr>
<td><strong>Average age</strong></td>
<td>4.9</td>
<td>5.4</td>
<td>7.8</td>
<td>9.9</td>
<td>4.5</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>(years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oldest (years)</strong></td>
<td>15</td>
<td>19</td>
<td>25</td>
<td>16</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td><strong>≤ 5 years</strong></td>
<td>57</td>
<td>53</td>
<td>34</td>
<td>12</td>
<td>68</td>
<td>86</td>
</tr>
<tr>
<td><strong>6 – 10 years</strong></td>
<td>39</td>
<td>37</td>
<td>38</td>
<td>50</td>
<td>32</td>
<td>13</td>
</tr>
<tr>
<td><strong>&gt; 10 years</strong></td>
<td>4</td>
<td>10</td>
<td>28</td>
<td>38</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

CIHI 2012
Present

2015 - 2017
2015 CMII: Survey

- CADTH resumed the Canadian Medical Imaging Inventory, building on CIHI dataset, inventory to December 31, 2015.
- Data collection September 16 to November 17, 2015, with updates to January 4, 2016.
- Included CT, MRI, SPECT, PET-CT, PET-MRI, SPECT-CT.
- Asked for unit counts, exams in last fiscal year, breakdown of use, technical specs for new units, PACS, radiation safety.
- Web-based data collection, with supplement by email.
- Counts validated at regional or provincial level.
## 2015: Snapshot

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>MRI</th>
<th>SPECT</th>
<th>PET-CT</th>
<th>PET-MRI</th>
<th>SPECT-CT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>538</td>
<td>340</td>
<td>264</td>
<td>47</td>
<td>2</td>
<td>214</td>
</tr>
<tr>
<td><strong>Units per million population</strong></td>
<td>15.01</td>
<td>9.48</td>
<td>7.36</td>
<td>1.31</td>
<td>0.06</td>
<td>5.97</td>
</tr>
<tr>
<td><strong>Provinces/territories</strong></td>
<td>13</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td><strong>Average age (years)</strong></td>
<td>6.8</td>
<td>7.2</td>
<td>9.9</td>
<td>7.2</td>
<td>-</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Oldest (years)</strong></td>
<td>18</td>
<td>22</td>
<td>23</td>
<td>19</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>≤ 5 years</td>
<td>38</td>
<td>37</td>
<td>46</td>
<td>29</td>
<td>-</td>
<td>46</td>
</tr>
<tr>
<td>6-10 years</td>
<td>48</td>
<td>42</td>
<td>51</td>
<td>58</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>14</td>
<td>21</td>
<td>3</td>
<td>12</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
2015: CT
2015: SPECT
2015: SPECT-CT
2015: PET-CT
2015: PET-MRI
Growth of imaging 1990-2015

CCOHTA 2001; CIHI 2007, 2012; CADTH 2015
Growth of imaging 1990-2015

CCOHTA 2001; CIHI 2007, 2012; CADTH 2015
Use of imaging 2004-2015

CIHI 2007, 2012; CADTH 2015
Aging of equipment 2001-2015

Modality
- CT
- MRI
- SPECT
- PET
- PET-CT
- PET and PET-CT
- SPECT-CT
- NM
- Angio
- Cath

CCOHTA 2001; CIHI 2007, 2012; CADTH 2015
Equity and access

- Inventory focuses on large equipment
- Large equipment tends to be located in urban centres
- CT and MRI most widely distributed
- Geographic spread associated with growth in all modalities
- Comparisons in per-population counts difficult to assess due to fluctuations in small numbers
- Patients in remote areas have difficulty accessing due to distance
2017: CMII

The survey for the 2017 Canadian Medical Imaging Inventory (CMII) is now open

To assess your eligibility to participate in the survey, please answer the following question:

Name *

E-mail *

Do you work for, or provide oversight for, a publicly or privately funded healthcare facility that provides the following imaging services: CT, MRI, SPECT, PET, PET-CT, PET-MRI, SPECT-CT? *

- Yes
- No

If you answered "Yes", you are eligible.
2017: CMII

- Second cycle, updating equipment in use as of April/May 2017.
- Data collection open April 18 to May 29, 2017.
- Web-based form, with more sophisticated database allowing direct input and editing of data
- CT, MRI, SPECT, PET or PET-CT, PET-MRI, SPECT-CT
- Number of units, exams in last fiscal year, breakdown of use by discipline
- Report due early 2018
- CADTH customers to have access to database
2017: CMII

- Opportunity to correct and update already collected data
- Refinement of questions:
  - 24 hour operation: staffed or on-call
  - Reporting use by major disciplines
  - Identifying PACS networks
Future

2017 - ?
Beyond 2017: CMII

- Ongoing biennial cycles of data collection
- Starting / resuming collection of additional modalities
- Ongoing innovation in diagnostic imaging
- Upgrade cycles of current equipment
- Use of used equipment
- Capturing network effects
- Determinants of use patterns (staffing, funding)
- Requests for information from CADTH customers
Beyond 2017: Health Technology Management

• Beyond traditional HTA (adoption): tracking equipment through entire life-cycle
• Planning for the replacement of equipment using age of equipment data (using CAR Lifecycle Guidance)
• Planning for other medical needs that require medical imaging (e.g., proton beam therapy will require a CT, MRI and PET/CT scanner, the inventory can identify where these already exist)
• Equity and access
Authorship

Presentation author:
Alison Sinclair

Presentation based on:

CADTH adheres to the authorship and contribution guidelines established by the International Committee of Medical Journal Editors (ICMJE).
References

• National inventory of selected imaging equipment. 1.2 Analysis by age and geographic distribution of equipment. Ottawa: CCHOTA, 2002. https://www.cadth.ca


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• QuickStat. Selected medical imaging equipment in Canada [Internet]. Ottawa: Canadian Institute for Health Information (CIHI); 2012 http://apps.cihi.ca/mstrapp/asp
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Disclosure

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• Application fees for three programs:
  • CADTH Common Drug Review (CDR)
  • CADTH pan-Canadian Oncology Drug Review (pCODR)
  • CADTH Scientific Advice