Disinvestment Strategies Based on Evidence Guided Adoption and Obsolescence of Technologies: The Ontario Experience

2011CEO Forum
Montreal

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Life-Cycle Diffusion Curve

- Steady State
- Diffusion
- Evidence & Uncertainty
- Preventive obsolescence
- Inflection Point
- Post-diffusion obsolescence
- R & D
- Unconditional Yes
- Uncertainty
- Unconditional No
- Field Study

TIME

U
MAS/OHTAC Associated Structures & Linkages

MOHLTC
- Physicians Schedule of Benefits
  - LHINs – Implementation: Hospitals, Community Agencies, etc…
- Requests
- Recommendations

Ontario Health System
- Requests

OHTAC
- Knowledge Transfer
- Stakeholder Engagement

MAS
- Field Evaluations
  - Post-market technology evaluation through PATH, THETA, ICES
  - Post-market safety evaluation through the Usability Lab
- Uncertainty

Outcomes Tracked by MOHLTC with GIS

Expert Panels

PATH (McMaster Univ)

THETA (Univ. of Toronto)

- POC/INR with QMPLS
- Intermediate care
- Cardiac
- Arthritis
- PET
- Diabetes
- Aging
- Wound care

Professional, public, and industry feedback loop
Ontario’s Evidence-Based Analyses (EBA) to Manage Technology Adoption and Obsolescence

- Single health technology EBA
- Mega-analysis EBA of technologies around disease conditions. Prioritized by effectiveness and cost-effectiveness
- Field evaluation EBA to assess performance of health technologies in real world conditions

Designed to better inform policy and funded by MOHLTC to address uncertainty in evidence prior to committing to long-term funding. Engages key clinical opinion leaders
Single Technology Analysis: Preventive Obsolescence Comparative Effectiveness by MAS, PATH & THETA (85% Conversion to Policy)

2010 (to July 2016)
- **Cardiac Computed Tomographic Angiography for the Diagnosis of Intermediate Risk Coronary Artery Disease**
- **Cancer Screening With Digital Mammography for Women at Average Risk for Breast Cancer, Magnetic Resonance Imaging (MRI) for Women at High Risk: An Evidence-Based Analysis**
- **Cardiac Magnetic Resonance Imaging for the Diagnosis of Coronary Artery Disease**
- **Clinical Utility of Vitamin D Testing**
- **Endovascular Laser Treatment for Varicose Veins**
- **Extra-anatomic Lung Support Technologies - Bridge to Recovery and Bridge to Lung Transplantation in Adult Patients**
- **Magnetic Resonance Imaging for the Assessment of Myocardial Viability**
- **Non-Invasive Cardiac Imaging Technologies for the Assessment of Myocardial Viability**
- **Non-invasive Cardiac Imaging Technologies for the Diagnosis of Coronary Artery Disease**
- **Population-Based Strategies for Smoking Cessation**
- **Pediatric Emission Tomography (PET) for the Assessment of Myocardial Viability**
- **Single Photon Emission Computed Tomography for the Diagnosis of Coronary Artery Disease**
- **Solid Organ Transplantation for End-Stage Organ Failure in Persons with HIV**
- **Stress Echocardiography for the Diagnosis of Coronary Artery Disease**
- **Stress Echocardiography with Contrast for the Diagnosis of Coronary Artery Disease**
- **Use of Contrast Agents with Echocardiography in Patients with Suboptimal Echocardiography**

2006
- **Airway Clearance Devices for Cystic Fibrosis**
- **Diabetes Strategy Evidence Platform**
- **Femorotibial Endovascular Osteotomy for the Repair of Juxtaarticular Aneurysms**
- **Intracerebral Lenses for the Treatment of Age-Related Cataract**
- **Interventional Cardiac Implants for Cardiac Tachyarrhythmias**
- **Optical Coherence Tomography, for Age-Related Macular Degeneration & Diabetic Macular Edema**
- **Oral Appliances for Obstructive Sleep Apnea**
- **Phakic Intracanal Lenses for the Treatment of Low to High Refractive Errors**
- **Point-of-Care International Normalized Ratio (INR) Monitoring Devices for Patients on Long-term Oral Anticoagulation Therapy**
- **Prevention and Management of Chronic Pressure Ucers**
- **Screening Method for Early Detection of Colorectal Cancer and Polyps**
- **Specialized Multidisciplinary Community-Based Care (SMCC) Series**
- **Ultrasound Therapy Management of Moderate-to-Severe Psoriasis**

2004
- **Aging in the Community**
- **Aging in the Community: Summary of Evidence-Based Analyses**
- **Caregiver- and Patient-Directed Interventions for Dementia**
- **Limbal Stem Cell Transplantation**
- **Prevention of Falls and Fall-Related Injuries in Community-Dwelling Seniors**
- **Social Isolation in Community-Dwelling Seniors**
- **The Falls/Fractures Economic Model in Ontario Residents Aged 55 Years and Older (FEMOR)**

2007
- **Audiometry Screening**
- **Low-Density Lipoprotein Atherosclerosis**
- **Multidetector Computed Tomography for Coronary Artery Disease: Screening in Asym. Pop.**
- **Screening Mammography as an Adjunctive Breast Imaging Technology**
- **Screening Mammography for Women Aged 40 to 49 Years at Average Risk for Breast Cancer**

2006
- **Ablation for Atrial Fibrillation**
- **Advanced Electrophysiological Mapping Systems**
- **Artificial Disc Replacement for Lumbar and Cervical Degenerative Disc Disease**
- **Coil Embolization for Intracranial Aneurysms**
- **Energy Delivery Systems for Treatment of Benign Prostatic Hyperplasia**
- **Enhanced External Counterpulsation (EECP)**
- **Extra-anatomic Procedures (EOP)**
- **Functional Brain Imaging**

2005
- **Catheter Electrical Stimulation**
- **Hydrophilic Catheters**
- **In Vitro Fertilization and Multiple Pregnancies**
- **Intravascular Ultrasound to Guide Percutaneous Coronary interventions**
- **Magnetic Resonance Imaging (MRI) for Women at High Risk: An Evidence-Based Analysis**
- **Midurethral Slings for Women with Stress Urinary Incontinence**
- **Nanotechnology**
- **Negative Pressure Wound Therapy**
- **Optimal Methadone Compliance Testing**
- **Polytomography in Patients with Obstructive Sleep Apnea**
- **Portable Ultrasound**
- **Routine Eye Exams**
- **Ultrasound Screening for Abdominal Aortic Aneurysm**
- **Utilization of DKA Bone Mineral Densitometry in Ontario**

2003
- **Balloon Surgery**
- **Deep Brain Stimulation in Parkinson’s Disease and Other Movement Disorders**
- **Sacral Nerve Stimulation for Urinary Incontinence, Urgency-Frequency, Urinary Retention, and Fecal Incontinence**
- **Spinal Cord Stimulation for Neuropathic Pain**
- **Multidetector Computed Tomography Angiography for Coronary Artery Disease**
- **Osteogenic Protein-1 for Lung Duct Prophylaxis**
- **Orthoarticular Bloodflow Pump for Spasticity**
- **Physiotherapy Rehabilitation After Total Knee or Hip Replacement**
- **Total Knee Replacement**
- **Intra-Articular Viscosupplementation With Hylan G-F 20 To Treat Osteoarthrits of the Knee**
- **Hyperbaric Oxygen Therapy for Non-Healing Ulcers in Diabetes Mellitus**
- **Arthroscopic Lavage and Debridement**
- **Bipolar Electrocautery Cardiac Resynchronization Therapy**
- **Implantable Cardioverter Defibrillators (ICD)**
- **Technologies for Osteoarthritis of the Knee**
- **Rheumatic Echocardiography for the Assessment of Myocardial Viability**
- **Air Cleaning Technologies for Scrubbed Areas**
- **Endovascular Repair of Descending Thoracic Aortic Aneurysm**
- **Antimicrobial External Defibrillators**

2004 (and prior)
- **Balloon Kyphoplasty**
- **Bioprosthetic Valve**
- **Bone Marrow Aspirate (BMA)**
- **Bone Morphogenetic Protein and Spinal Surgery for Degenerative Disc Disease**
- **Computed Tomographic Angiography**
- **Computer-Assisted Hip and Knee Arthroplasty Navigation and Robotic Systems**
- **Computer-Assisted Spare Implant Using Telemanipulators**
- **Endovascular Repair of Abdominal Aortic Aneurysm**
- **Functional Cardiac Magnetic Resonance Imaging in the Assessment of Viability and Perfusion**
- **Gamma Knife**
- **Intravascular Radiation: An Evidence-Based Analysis**
- **Islet Transplantation**
- **Left Ventricular Assist Device**
- **Neonatal Screening for Risk of Prenatal Diseases Using Fetal Mass Spectrometry**
- **Patient Monitoring System for MRI (PDF)**
- **Primary Angioplasty for the Treatment of Acute ST-Segment Elevated Myocardial Infarction**
- **Prosthetic Finger Joint Implant**
- **Radio Frequency Ablation for Primary Liver Cancer**
- **Repetitive Transcranial Magnetic Stimulation for the Treatment of Major Depression Disorder**
- **Small Bowel Transplant**
- **Thoracic Bioprosthetic Ablation for Dystrophic Urinary Bladder (TBDA)**
- **Video Laryngoscopy for Tracheal Intubation**
- **Wireless Capsule Endoscopy**
Midurethral Slings (MUS) for Women with Stress Urinary Incontinence

There is a 1.4% complication rate associated with the midurethral sling procedure.
Artificial Disc Replacement for Degenerative Disc Disease

![Graph showing cervical and lumbar volumes with OHTAC recommendation in 2006.](image-url)
Coil Embolization for Intracranial Aneurysms

OHTAC recommendation

Combined (Coil + Clippings)

Coil Embolization Volumes
Surgical Clipping Volumes

Fiscal Year

2003  2004  2005  2006  2007  2008
Bone Mineral Testing

- Previously approved in fee schedule for annual testing

- MAS analysis and modeling revealed:
  - testing every 7 years was sufficient provided that the first two annual tests >55 years were normal (average risk)
  - many men and women at high risk were not being tested

- OHTAC recommended increasing interval to 5-7 years for average risk individuals

- OHIP fee schedule was changed to permit testing every 5 years for average risk according to the MAS analysis

- MAS analysis confirmed by RCT published 2 years later
Mega-Analysis - a Tool for Evidence-Based Withdrawal of Obsolete Technologies: Relative Obsolescence

- **Mega-analysis.** Disaggregation of technologies around a disease condition or health state with re-aggregation for comparative analysis of effectiveness and cost-effectiveness

- Mega-analyses to date:
  - Osteoarthritis of the knee MAS (2005)
  - Cardiac viability MAS (2005)
  - Aging in the community MAS/PATH (2008)
  - Colon cancer screening MAS/PATH (2008)
  - Diabetes MAS/PATH (2009)
  - Intermediate care MAS/THETA (2009)
  - Wound care prevention MAS/THETA (2009)
  - Cardiac diagnostic tests MAS/THETA (2010)
  - COPD MAS/PATH (2010)

- **Micro-economic decision analytic models**
  - Ontario Cardiovascular Model (THETA) (2009)
  - Ontario Wound Prevention & Care Models (THETA) (2010)
  - Ontario Arthritis Model (PATH) (2011)
  - Ontario COPD Model (PATH) (2011)

- Turn-around time ~ 6-8 months
Arthroscopy, Lavage and Debridement for Osteoarthritis of the Knee.

OHTAC recommendation

Fiscal Year

2003 2004 2005 2006 2007 2008
# DIABETES MEGA-ANALYSIS

<table>
<thead>
<tr>
<th></th>
<th>Multidisciplinary Program</th>
<th>Insulin Pumps for Type 2</th>
<th>Behavioural Interventions</th>
<th>Bariatric Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta$ HbA1c</td>
<td>-1.02%</td>
<td>-0.14%</td>
<td>-0.44%</td>
<td>-2.70%</td>
</tr>
<tr>
<td>$\Delta$ Costs (in billions)</td>
<td>$5.623$</td>
<td>$8.010$</td>
<td>$0.212$</td>
<td>$1.573$</td>
</tr>
<tr>
<td>$\Delta$ QALYs</td>
<td>290,424</td>
<td>4,222</td>
<td>5,957</td>
<td>100,196</td>
</tr>
<tr>
<td>$/QALY$ gained</td>
<td>$19,869/QALY</td>
<td>$1.9M/QALY</td>
<td>$36,226/QALY</td>
<td>$15,697/QALY</td>
</tr>
<tr>
<td>$\Delta$ IHD</td>
<td>15,265</td>
<td>201</td>
<td>446</td>
<td>2,757</td>
</tr>
<tr>
<td>$\Delta$ MI</td>
<td>40,882</td>
<td>562</td>
<td>521</td>
<td>13,839</td>
</tr>
<tr>
<td>$\Delta$ Heart Failure</td>
<td>8,563</td>
<td>462</td>
<td>595</td>
<td>31,137</td>
</tr>
<tr>
<td>$\Delta$ Stroke</td>
<td>14,074</td>
<td>361</td>
<td>372</td>
<td>8,957</td>
</tr>
<tr>
<td>$\Delta$ Amputation</td>
<td>13,180</td>
<td>201</td>
<td>372</td>
<td>2,997</td>
</tr>
<tr>
<td>$\Delta$ Blindness</td>
<td>6,180</td>
<td>281</td>
<td>521</td>
<td>4,179</td>
</tr>
<tr>
<td>$\Delta$ Renal Failure</td>
<td>819</td>
<td>-8</td>
<td>74</td>
<td>17</td>
</tr>
</tbody>
</table>

*Excludes Insulin Infusion Pumps and Barriers to Access Studies - MAS & PATH 2009*
COPD

Acute exacerbations

Mucous clearing techniques
- Mucolytics
- Intrapulmonary percussive ventilation
  - Chest physio

Drug Therapy
- Antibiotics
- Corticosteroids
- Short-acting Bronchodilators
  - Anticholinergic
  - Beta 2 – Agonists

Treatment location
- Hospital @ home
  - Early discharge
  - Avoid admission
- Hospital

Pul. Rehab
- Early (≤1 month)
- Late (> 1 mnt)

Acute Respiratory Failure
- Hospital
- Home

Invasive ventilation
- Non-invasive Ventilation
- CPAP
- NPPV
- NNPV
- O₂
- Heliox

Topic currently under review by MAS
Not health systems – next mega-analysis
Recommended by Expert Panel Under review by MAS

CPAP, continuous positive airway pressure; NPPV, noninvasive positive pressure ventilation; NNPV, noninvasive negative pressure ventilation
Field Evaluation EBA to Assess Performance of Health Technologies in Real World Conditions

- Appropriate adoption and preventive obsolescence for new technologies
- Ontario has developed most experience internationally
- 38 initiated since 2003:
  - 8 RCTs
  - 17 observational
  - 7 registry
  - 2 polls
  - 4 decision analytic models

- 19 completed field evaluations:
  - Significantly affected decision-making 88%
  - Shaped cost curves
  - Published in international peer-reviewed journals
<table>
<thead>
<tr>
<th>TECHNOLOGY (N)</th>
<th>FE OVERSEEN BY</th>
<th>TYPE OF STUDY</th>
<th>REASON FOR FE</th>
<th>RESULT</th>
<th>POLICY DECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug eluting stents (DES) (21,000)</td>
<td>PATH, with ICES,</td>
<td>Prospective pragmatic registry-based</td>
<td>Generalisability of RCT evidence and cost effective analysis</td>
<td>Only effective in patients at high risk for restenosis</td>
<td>Funded 30% conversion from bare-metal to DES (90% in U.S.A.)</td>
</tr>
<tr>
<td>Endovascular abdominal aortic aneurysm repair (EVAR) (160)</td>
<td>PATH and single AHSC</td>
<td>Prospective observational</td>
<td>Safety assessment of endoleak</td>
<td>No endoleak. CE for high surgical risk but not low surgical risk patients</td>
<td>Funded EVAAR for high but not low surgical risk patients</td>
</tr>
<tr>
<td>Multifaceted primary care diabetes program</td>
<td>PATH, with Oxford University,</td>
<td>Syst. review &amp; micro simulation model</td>
<td>Prioritize investments according to downstream effects and CE of diabetes strategy.</td>
<td>Most CE were bariatric surgery, MDT. Least insulin infusion pumps for type II</td>
<td>Bariatric program funded and additional funding for MDT. No Insulin infusion pumps</td>
</tr>
<tr>
<td>64-slice CT angiography (CTA) v coronary angiography (CA) (175)</td>
<td>PATH, with cardiologists, radiologists, selected AHSCs</td>
<td>Patients for CA also underwent CTA</td>
<td>Uncertainty re-indications for use CE and QA parameters</td>
<td>Sensitivity lower than reported reducing CE</td>
<td>OHTAC recommended caution until sensitivity issue resolved</td>
</tr>
<tr>
<td>TECHNOLOGY (N)</td>
<td>OVERSEEN BY</td>
<td>TYPE OF STUDY</td>
<td>REASON FOR FIELD EVALUATION</td>
<td>RESULT</td>
<td>POLICY DECISION</td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
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<td>-----------------------------------------------------------------</td>
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<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PET to stage locally advanced NSCLC (310)</td>
<td>OCOG</td>
<td>RCT</td>
<td>Clinical utility in making treatment decisions</td>
<td>Terminated by efficacy &amp; safety committee</td>
<td>PET insured for this indication</td>
</tr>
<tr>
<td>PET to stage early NSCLC (322)</td>
<td>OCOG</td>
<td>RCT</td>
<td>Resolve inconsistencies to inform decision re-access</td>
<td>PET reduces futile thoracotomy rates</td>
<td>PET insured for this indication</td>
</tr>
<tr>
<td>PET to stage breast cancer (320)</td>
<td>OCOG</td>
<td>Prospective cohort</td>
<td>Compare PET to sentinel lymph node biopsy</td>
<td>No utility in staging</td>
<td>Not insured</td>
</tr>
<tr>
<td>PET for colorectal cancer metastatic to liver</td>
<td>OCOG</td>
<td>RCT</td>
<td>Clinical utility in decision for metastatectomy</td>
<td>Accrual completed February 2010</td>
<td>Awaiting results</td>
</tr>
<tr>
<td>PET for head and neck cancer (400)</td>
<td>OCOG</td>
<td>Prospective cohort</td>
<td>Clinical utility pre surgery following radiation therapy</td>
<td>No clinical utility</td>
<td>Not insured</td>
</tr>
<tr>
<td>Extracorporeal photopheresis (EP) (120)</td>
<td>PATH with AHSC</td>
<td>Prospective observational</td>
<td>Basis for decision whether to fund a program for GvH and Sezary</td>
<td>Effective in GvH. Inconclusive for Sezary</td>
<td>Insured for GvH. Awaiting decision on Sezary - small vol. after backlog dealt with</td>
</tr>
</tbody>
</table>
EVAR for Abdominal Aortic Aneurysms

- EVAR Volumes
- Open Surgical Repair Volumes
- Combined (EVAR + OSR)

Fiscal Year

2003 2004 2005 2006 2007 2008

EVAR Volumes
Open Surgical Repair Volumes
Combined (EVAR + OSR)
Effect of Field Evaluation on Withdrawal of Diffused Obsolete Technologies Variable

• Negative pressure wound treatment (NPWT) of pressure ulcers
  – RCT of NPWT vs routine wound dressing
  – 5 patients accrued over 3 years
  – Study discontinued

• Extracorporeal photopheresis
  – Observational study
  – Unable to convince oncologists not to provide other treatments concomitantly
  – Study discontinued

• PVP laser treatment for benign prostatic hyperplasia
  – Initial reluctance to replace TURP with this newer and less invasive technology
  – Difficulty in completing study because surgeons did not want to go back to TURP
Examples of Partial or Complete Disinvestment from Diffused Technologies

- Bare metal stents
- Vitamin D testing
- Bone mineral testing
- Knee arthroscopy with debridement and/or lavage
- Colposuspension for stress urinary incontinence
- Artificial disc replacement for cervical spine

*Followed MAS EBA and OHTAC recommendation without specific intervention
Examples of Preventive Obsolescence

- PET Scanning
- CT angiography
- Endovascular aortic aneurysm graft repair for low risk
- Drug eluting stents for low risk
- PSA for prostate cancer screening
- Mammography screening average risk under 50 years
- CT colonography
- Repetitive transcranial magnetic stimulation for depression
- Anal dysplasia screening for anal cancer
- Insulin infusion pumps for type 2 diabetes

IT IS EASIER TO SHAPE A DIFUSION CURVE THAN BEND A DIFFUSED CURVE
Examples of Evidence Resulting in Increased Access

- PET for specified cancers
- Specified drug eluting stents (high risk)
- Bariatric surgery especially for morbidly obese diabetes
- Neonatal screening for inborn errors of metabolism
- Gama knife for specified brain surgery
- Endocardial ablation for atrial fibrillation
- Endovascular aortic aneurysm repair for high surgical risk
- Gluten sensitivity blood test (recommended and decision pending)
- PVP laser for benign prostatic hyperplasia
- Renal and liver transplantation for HIV positive
- Multidisciplinary care for diabetes
- Extracorporeal photopheresis for graft vs host disease following organ transplantation
- Artificial disc replacement for lumbar spine
Lessons - Obsolescence Experience in Ontario

• EBA is important basis for preventive and post-diffusion obsolescence

• It is easier to shape a diffusion curve (preventive) than bend a diffused curve

• Success increases when:
  – substitutive with no net negative effect on practice
  – focus is macro/meso e.g. funding, fee code or safety issue

• Do not under-estimate the ability and spontaneous adaptability of the health system to make less-effective technologies obsolete leading to disinvestment

• Obsolescence must be part of economic analysis and planned as part of adoption strategy
Examples of MAS Evidence Based Analysis (EBA) on Shaping the Cost Curve for Technologies