Emerging cardiac technologies

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Cardiovascular disease: Australian facts 2011

Figure 12.4: Health care expenditure for all cardiovascular diseases per person, by age and area of expenditure, 2004–05

Source: AIHW Disease Expenditure Database.

Figure 12.2: Health care expenditure on cardiovascular diseases, by area of expenditure, 2004–05

Source: AIHW Disease Expenditure Database.
Trends in CV procedures, Australia, 2000-01 to 2009-10

Trends in cardiovascular procedures, Australia, 2000/01 to 2009/10

Coronary artery angiography (angiogram)

Coronary artery angioplasty

Veins (harvested for coronary arterial bypass)

Pacemaker insertion

Defibrillator insertion

Electrophysiology studies
Drivers for new technology

- R&D (technology development)
- Human genome (new testing paradigms)
- Industry (market opportunities)
- Clinicians (better outcomes)
- Patients (better outcomes)
- Hospitals (lower costs, reduced LOS, substitution)
NEW AND EMERGING CARDIAC TECHNOLOGIES IN AUSTRALIAN AND NEW ZEALAND PUBLIC HEALTH SERVICES OVER THE NEXT DECADE

PREPARED FOR HEALTHPACT

FEBRUARY 2013
Technologies reviewed by DLA Piper

- Percutaneous aortic valve replacement and repair
- Left atrial appendage occlusion devices
- Pumps/assist devices as a destination therapy for the management of heart failure
- Next generation pacemaker and implantable cardiac defibrillator devices
- Renal denervation systems
- Genetic testing in the assessment and management of cardiovascular diseases
Valve replacement technology
Valve replacement technology

• TAVI is considered a ‘disruptive technology’, i.e. ‘an innovation that helps create a new market and value network, and eventually goes on to disrupt an existing market and value network, displacing an earlier technology’.

• Significant clinical and patient benefits, but:
  – Expensive $25,000 - $30,000 per device
  – Many patients require a pacemaker
  – Resource intensive (workforce, cath lab, imaging, etc.)
  – Steep learning curve
  – Additive – new patient cohorts
  – Significant leakage
  – Unclear clinical and cost effectiveness
HealthPACT TAVI workshop report:

- No TAVI device has received TGA marketing approval
- TAVI devices have rapidly diffused throughout the health care sector, becoming established clinical practice at some sites, despite optimal target population has not been established
- Widespread, uncontrolled use of a high-cost and novel technology such as TAVI raises concerns for jurisdictions in respect to safety and effectiveness, in addition to the budgetary impact and affordability of the technology
HealthPACT TAVI workshop report:

- There is variation in TAVI usage between jurisdictions.
- Some centres perform a low volume of procedures, which has implications for the maintenance of quality, safety and training.
- Current evidence suggests TAVI is potentially cost effective for patients with severe aortic stenosis who are inoperable.
- Current evidence suggests TAVI may not be cost effective for patients with severe aortic stenosis who are high surgical risk although it appears to be safe and effective in this cohort. However doubt remains about the durability of effect.
Valve replacement technology

HealthPACT draft recommendations:

Valve repair technology
Left atrial appendage occlusion devices
VAD technology
VAD technology
Pacemaker technology
Renal denervation systems
Renal denervation systems

- Field evaluations are underway in Australia
- Clinical trials are underway overseas
- Proof of concept underway in Australia for a range of clinical indications, including chronic kidney disease, polycystic ovary syndrome and hypertension in Pregnant women
- For example, MonashHeart treated a child in November 2012 with severe hypertension due to autosomal recessive polycystic kidney disease and congenital hepatic fibrosis. So we can already see how this technology is being applied to other indications.
Renal denervation systems

- Safe? Yes.
- Clinically effective? Appears to be (hypertension).
- Cost effective? TBD.
- Lacking data on whether RDN substitutes for ‘frequent flyers’ presenting to ED with hypertensive crises – such evaluation will help determine whether this technology really is a substitute (and therefore leads to cost offsets) or an ‘add on’ to the service system, which will have budget and system impact.
Genetic testing in assessment and Mx of CVD

- Almost 60% CHD is heritable (both monogenic and polygenic gene variations)
- SCD incidence:
  - 1 in 1,000 general population
  - 5% per year in pt with previous event
  - 15% in pt with EF <35%
  - 20% in AMI survivor
- Diagnosing SCD is challenging; gene variations known for: LQTS, HCM, ARVCM
- As technology improves, anticipate cardiac genomics will be widely applied in clinical practice, particularly in:
  - testing for monogenic conditions
  - population screening for polygenic conditions
  - pharmacogenomics to optimise drug therapy
- Genetic testing: treatment, prevention
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<th>DCM</th>
<th>% of cases*</th>
<th>ARVC</th>
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Implications:

- Downstream demand for pacemakers
- Increase consultations (primary care and consultant)
- Increased device replacements
- Increased surgery for stuck leads (NB: LLE)
- Increase hospital and ambulatory costs
Disruptive technologies: Advances that will transform life, business, and the global economy
## Exhibit 9

**Sized applications of next-generation genomics could have direct economic impact of $700 billion to $1.6 trillion per year in 2025**

<table>
<thead>
<tr>
<th>Sized applications</th>
<th>Potential economic impact of sized applications in 2025 $ trillion, annually</th>
<th>Estimated scope in 2025</th>
<th>Estimated potential reach in 2025</th>
<th>Potential productivity or value gains in 2025</th>
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<td>Disease treatment</td>
<td>0.5–1.2</td>
<td>Estimated deaths from relevant diseases</td>
<td>Patients with access to relevant treatment</td>
<td>Extended life expectancy</td>
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<td>Cancer: 12 million Cardiovascular: 23 million Type 2 diabetes: 4 million 160 million newborns</td>
<td>Cancer: 20–40% Cardiovascular: 15–40% Type 2 diabetes: 20–40% Access to prenatal genetic screening: Developed world: 100% Less-developed: 30–50%</td>
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<td>Substance production</td>
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<td>60 billion gallons per year of ethanol 350–500 billion gallons per year of diesel</td>
<td>Ethanol: 20–40% of world production Diesel: 2–3% of world production</td>
<td>15–20% cost saving in ethanol production 150–200% price premium for diesel 30–70% CO₂ reduction from fuels over life cycle</td>
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<td>Agriculture</td>
<td>0.1–0.2</td>
<td>$1.2–1.3 trillion worth of major crops (wheat, maize, rice, soybeans, barley, tomatoes)</td>
<td>60–80% of agricultural production improved using genomics data 20–80% of current genetically engineered crops to be further enhanced</td>
<td>5–10% increase in yields due to process optimization 5–10% increase in yields from use of advanced genetically engineered crops</td>
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<td>Other potential applications (not sized)</td>
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<td>Sum of sized potential economic impacts</td>
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Emerging diagnostic technologies

- Wireless pulmonary artery haemodynamic monitor
- Next generation remote cardiac arrhythmia monitoring
- Smart T shirt
- Stretchable silicon electronics
- Combination intracardiac echocardiography and US system
- High resolution miniature ultrasound probe
- Ultrafast SPECT
Emerging treatment technologies - chamber

- Cardiac tissue engineering
- Next generation balloon ablation technologies
- Epicardial ablation system
- Guided medical positioning system
- Wireless power for cardiac devices
- Optogenetic cardiac pacemaker
- LifeVest wearable defibrillator
- Faraday sock
Emerging treatment technologies - valvular

- *Percutaneous pulmonary valve implantation*
- *Sutureless aortic valve replacement*
- *Fractional flow reserve-guided stenting equipment*
- *Extracorporeal shockwave myocardial revascularisation*
- *Robotic system for percutaneous coronary interventions*
Conclusion

• New cardiac technologies are driving new ways of diagnosing and treating disease, resulting in better outcomes for patients

• BUT new cardiac technologies are going to challenge the health system because they will drive:
  
  • Dx/Rx of new clinical indications
  • New patient cohorts
  • New clinics
  • New costs (system, service, patient)
  
• Increasing genetic knowledge will create huge expectations that clinicians will have to manage and be educated about
• New cardiac technologies will also have significant implications for service delivery, especially:

• Service planning
• Capital planning
• Workflow/MoC
• Establishing a register for cardiac devices is a positive step in collecting prospective data on new and emerging cardiac technologies and their evaluation and subsequent introduction – or otherwise.
Acknowledgements

• HealthPACT
• Co-clinical Leads, Victorian Cardiac Clinical Network
• DLA Piper