Practical Examples of Point-of-Care Testing Technology Use in Rural and Remote Australia

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Introduction

Laboratory Pathology Services:

- Situated in large urban or metropolitan centres
- Result turnaround time to rural or remote health services = 12 hours up to 2 weeks
- Issues with loss-to-follow-up particularly for patients with chronic and infectious disease management
- Patients requiring regular testing sometimes forced to move closer to pathology services

Point-of-Care Testing (POCT):

- Provides immediate pathology results at the time of patient consultation
- Small, portable and small sample size
- Leads to improved outcome for patient as immediate result(s) enable ‘on the spot’ decisions for clinical management
WHO Collaborating Centre

Flinders University International Centre for Point-of-Care Testing

WHO Collaborating Centre
## ICPOCT Programs

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>DISEASE</th>
<th>POC TESTS</th>
<th>NUMBER PARTICIPATING SERVICES</th>
<th>REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTERNATIONAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ACE</strong></td>
<td>Diabetes</td>
<td>HbA1c and urine ACR</td>
<td>21 Rural and remote Indigenous health services across Canada (16), South Africa (1) and PNG (4)</td>
<td>International (rural and remote)</td>
</tr>
<tr>
<td><strong>NATIONAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>QAAMS</strong></td>
<td>Diabetes</td>
<td>HbA1c and urine ACR</td>
<td>200 sites at Indigenous medical services</td>
<td>National (urban, rural and remote)</td>
</tr>
<tr>
<td><strong>STATE/TERRITORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NT POCT PROGRAM</strong></td>
<td>Acute clinical care and chronic disease</td>
<td>Electrolytes, Urea, Creatinine, Glucose, Haemoglobin, Blood Gases, Troponin, INR</td>
<td>72 Remote health centres</td>
<td>Territory-wide (remote)</td>
</tr>
<tr>
<td><strong>TTANGO 2 (with Kirby Institute)</strong></td>
<td>Infectious Disease (STI)</td>
<td>Chlamydia and gonorrhoea (and Trichomonas)</td>
<td>28 Indigenous medical services</td>
<td>WA, QLD, SA and NT (rural and remote)</td>
</tr>
<tr>
<td><strong>HemoCue WBC DIFF TRIAL</strong></td>
<td>Infectious Disease</td>
<td>Total White cell count, Lymphocytes, Neutrophils, monocytes, eosinophils, basophils</td>
<td>13 Remote Health Services</td>
<td>Northern Territory (remote)</td>
</tr>
</tbody>
</table>
Common elements for all programs managed by ICPOCT:

- Training
- Quality Management
- Support Services
- Research Effectiveness
All Programs - Flexible Training Methods

- Online 24/7 Training
- Videoconference + GoToMeeting Training
- On-site group training
- Large training workshops
- Variety of training resources
Quality Assurance for Aboriginal and Torres Strait Islander Medical Services

- Diabetes diagnosis and management
- 200 enrolled devices (majority rural or remote)
- Funded for past 18 years by the Australian Government (1999-2021 ongoing)
- 2013 FAIMER awarded “Projects that Work”

Largest national POCT network in Australia

Website: www.qaams.org.au
- Siemens DCA Vantage POCT device
- Diabetes management & diagnosis
- Haemoglobin A1c (HbA1c)
- Urine albumin creatinine ratio (ACR)
- Results in 7 minutes or less
- Aboriginal Health Practitioners/Workers trained as POCT operators
- Medicare Rebate for tests
## Clinical Effectiveness

**QAAMS: Clinical and Operational Efficiency**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>15 months before POCT, (using the lab)</th>
<th>15 months after POCT introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean change in HbA1c; first to most recent</td>
<td>9.5% to 9.8%</td>
<td>10.6% to 7.9%*</td>
</tr>
<tr>
<td>Mean TAT for HbA1c result</td>
<td>42 hours</td>
<td>6 minutes</td>
</tr>
<tr>
<td>Mean TAT for patient follow-up</td>
<td>24 days</td>
<td>&lt;15 minutes</td>
</tr>
<tr>
<td>Mean number of HbA1c tests per patient</td>
<td>2.7 tests</td>
<td>4.2 tests^</td>
</tr>
</tbody>
</table>

TAT = Turn-around-time, n= 40 patients

* = Statistically significant (p <0.05, paired t-test)

^ = Recommendation is 1 HbA1c test every 3 months = 5 tests in 15 months

Analytical Quality: QAAMS
Imprecision for HbA1c QA testing

The lower the CV%, the better the quality of the test

### Cultural Effectiveness
#### QAAMS: Stakeholder Satisfaction Survey

<table>
<thead>
<tr>
<th>Indigenous Stakeholder</th>
<th>Satisfaction</th>
<th>% Unsatisfied</th>
<th>% Unsure</th>
<th>% Satisfied</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operators</td>
<td>Before POCT</td>
<td>30</td>
<td>28</td>
<td>42</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>After POCT</td>
<td>3</td>
<td>7</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Patients</td>
<td>Before POCT</td>
<td>11</td>
<td>28</td>
<td>61</td>
<td>159</td>
</tr>
<tr>
<td></td>
<td>After POCT</td>
<td>3</td>
<td>6</td>
<td>91</td>
<td></td>
</tr>
</tbody>
</table>

Cultural Effectiveness

“All sources of evidence suggest that QAAMS is meeting best practice standards in the areas of Indigenous healthcare, chronic disease management and Point of Care testing.” ¹

“QAAMS is one of the few programs to successfully navigate the cultural complexities and potential pitfalls of chronic disease management in Indigenous communities.” ²

NT POCT Program

- Commenced in 2008
- Now total 71 Remote Health Services (49 DoH and 22 ACCHS)
- i-STAT POCT device
- Acute care and chronic disease
- >1200 operators trained since 2008
- >2500 tests per month (2017)

Website: http://www.flinders.edu.au/medicine/sites/point-of-care/
### NT POCT Program - i-STAT POCT device

<table>
<thead>
<tr>
<th>Clinical Condition</th>
<th>i-STAT Test</th>
<th>Time to Result</th>
<th>Clinical Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute disease</td>
<td>Troponin I</td>
<td>10 mins</td>
<td>Early risk stratification for acute coronary syndrome</td>
</tr>
<tr>
<td></td>
<td>Electrolytes</td>
<td>2 mins</td>
<td>Assessment of hydration status</td>
</tr>
<tr>
<td></td>
<td>Blood gases</td>
<td>2 mins</td>
<td>Assessment of fluid and water balance, respiratory disorders and acid base status</td>
</tr>
<tr>
<td>Chronic disease</td>
<td>INR</td>
<td>&lt; 5 mins</td>
<td>Monitoring of patients on anticoagulation therapy</td>
</tr>
<tr>
<td>Both acute and</td>
<td>Creatinine and</td>
<td>2 mins</td>
<td>Assessment of acute renal failure/chronic renal disease</td>
</tr>
<tr>
<td>chronic disease</td>
<td>Urea</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Haemoglobin</td>
<td>2 mins</td>
<td>Assessment of acute blood loss/monitoring of anaemia</td>
</tr>
<tr>
<td></td>
<td>Glucose</td>
<td>2 mins</td>
<td>Monitoring glycaemic status</td>
</tr>
</tbody>
</table>
## Results – Analytical Quality

Table – Representative example of Quality Control testing results for the i-STAT.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>n</th>
<th>Target</th>
<th>i-STAT Mean</th>
<th>i-STAT CV%</th>
<th>Laboratory Median CV%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>233</td>
<td>122.0</td>
<td>121.5</td>
<td>0.6%</td>
<td>0.9%^</td>
</tr>
<tr>
<td>Potassium</td>
<td>233</td>
<td>2.9</td>
<td>2.9</td>
<td>0.8%</td>
<td>1.4%^</td>
</tr>
<tr>
<td>Chloride</td>
<td>235</td>
<td>72</td>
<td>73</td>
<td>1.2%</td>
<td>1.2%^</td>
</tr>
<tr>
<td>Glucose</td>
<td>231</td>
<td>15.0</td>
<td>15.1</td>
<td>1.0%</td>
<td>2.1%^</td>
</tr>
<tr>
<td>Urea</td>
<td>233</td>
<td>19.3</td>
<td>19.3</td>
<td>2.6%</td>
<td>2.5%^</td>
</tr>
<tr>
<td>Creatinine</td>
<td>234</td>
<td>335.5</td>
<td>336.8</td>
<td>2.9%</td>
<td>2.7%^</td>
</tr>
<tr>
<td>pH</td>
<td>230</td>
<td>7.04</td>
<td>7.05</td>
<td>0.2%</td>
<td>1.4%^</td>
</tr>
<tr>
<td>Lactate</td>
<td>229</td>
<td>0.34</td>
<td>0.31</td>
<td>7.0%</td>
<td>7.7%^</td>
</tr>
</tbody>
</table>

CV% = Coefficient of Variation percentage

^ Median imprecision achieved by laboratories in the Royal College of Pathologists of Australasia’s (RCPA) General Chemistry and Therapeutic Drugs, Cycle 103, 2016.

* Median imprecision achieved by laboratories in the Royal College of Pathologists of Australasia’s (RCPA) Blood Gas and Co-Oximetry, Cycle 57, 2016.

The lower the imprecision (CV%) the better the quality of result.
Results – Cost Effectiveness

**Title:** ‘Point-of-Care Testing for Better Management of Acutely Ill Remote Patients’
(funded by Emergency Medicine Foundation Grant)

- Investigated clinical and cost effectiveness of using the i-STAT as a decision support tool for triaging acutely ill patients
- Three common acute clinical presentations in 200 patients (chest pain [n=147], missed dialysis [n=28] and acute diarrhoea [n=25]) at 6 remote health centres (small, medium, large)
- POCT enabled early diagnosis and treatment for those appropriately evacuated (n=21)
- POCT resulted in the prevention of 60 medical evacuations
- Health Economist extrapolated results to provide Territory-wide estimates of cost savings
- Territory-wide **cost saving of $20.93 million per annum for NT health system** through prevention of unnecessary medical evacuations for just these 3 presentations.
- Demonstrated that POCT also delivered **improved clinical outcomes for acutely ill patients** in remote communities.

Infectious Disease POCT Network – TTANGO 2

TTANGO2
(Test, Treat AND GO 2)

- GeneXpert POCT device
- Tests for chlamydia (CT) and gonorrhoea (NG)
- CQI component to increase testing and improve the management of STIs
- 28 remote Indigenous communities across WA, SA and QLD soon to start in NT
- Collaboration between the Kirby Institute, FUICPOCT and a range of other stakeholders
TTANGO2 - Partnerships and Collaborations

• TTANGO2 Investigators and their institutions (Kirby Institute UNSW, Flinders University International Centre for Point-of-Care Testing, Royal Women’s Hospital, Burnet Institute, University of QLD Centre for Clinical Research, Deakin University, South Australian Health and Medical Research Institute, WA Department of Health, Cepheid, Apunipima Cape York Health Council, Ngaanyatjarra Health Service, PathWest Laboratory Medicine)

• In partnership with and support from
  ➢ WA: WA Health, AHCWA, NHS, KAMSC
  ➢ NT: AMSANT, NT Health
  ➢ SA: AHCSA, SA Health
  ➢ QLD: QAIHC, QLD Health, Apunipima
  ➢ Pathology providers: PathWest, CliniPath, Westerns, Pathology QLD, SA Pathology, SNP

• National Serology Reference Laboratory
• Monash University
• Medical Communications Associates
Infectious Disease POCT Network – TTANGO 2

- Molecular-based POCT device for chlamydia and gonorrhoea
- Reduced TAT for results (90 minutes)
- Treatment on same day
- Currently for CT / NG
- Trich (Trichomonas vaginalis) test in 2018

Results from TTANGO Trial

TTANGO - treatment intervals
Standard-care vs POC period

- 29.74% in Standard-care period
- 72.78% in POC period

Legend:
- Purple: not treated
- Navy: >30 days
- Blue: 15-30 days
- Light blue: 8-14 days
- Green: 3-7 days
- Light green: <3 days
HemoCue WBC DIFF Trial

- HemoCue WBC DIFF POCT device
- WBC DIFF device provides a total and 5-part differential white cell count result in < 5mins
  - Total white cell count
  - Lymphocytes
  - Neutrophils
  - Monocytes
  - Basophils
  - Eosinophils
- Analytically sound in remote environment*
- Trial in 13 remote health services in NT to research clinical, operational and cost effectiveness

HemoCue WBC DIFF Trial

Clinical Effectiveness:
- Sepsis
- Respiratory infections
- Fever
- Appendicitis
- Parasitic infection

Operational benefit:
- High satisfaction / ease of use
- 37% of FBE pathology reports returned with WCC not reliable / not reported as sample did not reach laboratory with 72 hours

Cost benefit:
- Cost savings through prevented evacuations

Quote from Rural Medical Practitioner:
“[The HemoCue WBC DIFF] is a piece of equipment that should be in every remote community.”
Conclusion

Point-of-Care Testing:

- Brings diagnostic test closer to the site of patient care
- Improving patient management for acute, chronic and infectious diseases
- More convenient for patients
- Can produce significant cost savings

Any questions?