

## SHORT COMMUNICATION

# Point-of-care testing for haemoglobin A1c in remote Australian Indigenous communities improves timeliness of diabetes care

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## ABSTRACT

**Introduction:** In remote Australia timely access to pathology results and subsequent follow-up of patients for treatment is very challenging due to the long distances to the nearest laboratory. Point-of-care testing (POCT) offers a practical solution for pathology service provision in such remote communities. Since 2008, POCT for haemoglobin A1c (HbA1c) has been conducted in remote Northern Territory (NT) health centres for diabetes management of Indigenous patients through the national Quality Assurance in Aboriginal and Torres Strait Island Medical Services (QAAMS) Program.

**Methods:** Point-of-care testing HbA1c results performed on Indigenous diabetes patients in the NT from July 2008 to April 2011 was accessed via the NT's electronic patient information system. Patients who had three or more HbA1c results performed by POCT across this period were assessed to determine their overall change in glycaemic control. An audit of 40 of these Indigenous diabetes patients (who exhibited a decrease in HbA1c levels of more than 1.5%) was undertaken to compare clinical and operational efficiency of POCT versus laboratory testing over an equivalent time period (15 months).

**Results:** No change in glycaemic control was observed when these patients received laboratory HbA1c testing prior to the introduction of POCT. Long turnaround times for receipt of results and follow-up consultation with patients were identified during this period, compared to immediate receipt and actioning of results using POCT. Frequency of HbA1c testing was higher with POCT than for the laboratory.



**Conclusions:** This audit demonstrates that POCT can significantly improve the timeliness and clinical follow-up of pathology results in remote locations, while also reinforcing the clinical and cultural effectiveness of POCT and its critical role in assisting to improve diabetes management in Indigenous Australians.

**Key words:** Australia, diabetes, haemoglobin A1c, Indigenous, point-of-care testing, QAAMS, timeliness.

## Introduction

Indigenous Australians living in remote areas are twice as likely to have diabetes than Indigenous Australians living in non-remote areas<sup>1</sup>. The management of diabetes in remote locations has been historically difficult due to the limited access to resources at the health service level<sup>2,3</sup>. In Australia's Northern Territory (NT), remote health centres are, on average, 275 km from the nearest laboratory (range 100–700 km), making timely access to pathology results and subsequent follow-up of patients for treatment very difficult<sup>4,7</sup>. Point-of-care testing (POCT) offers a practical solution for pathology service provision in such remote communities. Through the national Quality Assurance in Aboriginal and Torres Strait Islander Medical Services (QAAMS) Program<sup>8–11</sup>, POCT for haemoglobin A1c (HbA1c) has been conducted in remote NT health centres for diabetes management of Indigenous patients since 2008. Here we present the results of a clinical audit comparing the timeliness of HbA1c testing before and after POCT was introduced into these remote health centres.

## Methods

Thirty remote health centres in the NT currently participate in the QAAMS Program through a partnership between the NT Department of Health and the Flinders University International Centre for Point-of-Care Testing. HbA1c POCT is performed on-site in the remote health centres using the DCA analyser (Siemens Healthcare Diagnostics; <http://www.healthcare.siemens.com.au/point-of-care/diabetes/dca-vantage-analyzer>), which uses 1 µL of capillary whole blood and provides a result in 6 min. Operators

performing the tests (remote area nurses and Aboriginal Health Practitioners) undergo training and competency certification through the QAAMS Program.

An audit of the number of HbA1c results performed by POCT on Indigenous diabetes patients from July 2008 to April 2011 was undertaken by accessing the NT's Primary Care Clinical Information System (PCIS).

Patients who had three or more HbA1c results performed by POCT across this period were assessed to determine their overall change in glycaemic control. A subgroup of these patients (who exhibited a decrease in HbA1c levels of more than 1.5%) underwent a more detailed clinical audit to compare selected parameters across a 15-month period before POCT was introduced (when HbA1c testing was performed by the nearest local laboratory) and the 15-month period after POCT had been introduced. The parameters examined in this 'before and after' dataset included:

- change in glycaemic control (mean change in HbA1c  $\pm$  standard deviation)
- turnaround time of result reporting (calculated by determining the time taken, in hours, between collecting the blood sample from the patient and the result being received from the laboratory or POCT device)
- turnaround time for follow-up consultation and management of the patient (calculated by determining the time taken, in days/hours, between collecting the blood sample from the patient and the treating medical practitioner consulting with patient about their laboratory or POCT HbA1c result and initiating management)



- number of HbA1c tests performed per patient.

Paired *t*-tests were used to determine the statistical significance of change in glycaemic control and the number of tests performed per patient before and after POCT was introduced.

## Ethics approval

Ethics approval to source this data was obtained through the Menzies School of Health Research (registration number: QAAR-2012-1823) in the NT. Confidentiality of patient data was assured because only de-identified patient information was analysed for the audit. Only pathology results collected for routine patient care were analysed in the audit. The audit did not result in changes to patient's routine clinical care. The audit formed part of the Northern Territory POCT Management Committee's charter to investigate the clinical effectiveness of POCT being undertaken as part of the program on behalf of the Northern Territory Government's Department of Health.

## Results

A total of 907 Indigenous diabetes patients had 1594 HbA1c tests performed by POCT at the participating remote NT health centres from July 2008 to April 2011. A total of 181 patients (20%) had three or more HbA1c POCT performed (range 3–8 tests) during this period, with the mean HbA1c in this group falling significantly from 9.2% (77 mmol/mol)  $\pm$  2.1 (at their first POCT measurement) to 8.8% (73 mmol/mol)  $\pm$  2.2 (at their most recent measurement) (paired *t*-test  $p=0.013$ ).

Forty of the 181 patients showed a greater than 1.5% reduction in HbA1c from their first to their most recent POCT over a mean period of  $15 \pm 6$  months.

Table 1 compares the change in glycaemic control, turnaround times for result reporting and patient follow-up/management and HbA1c testing frequency for this subset of 40 patients across an equivalent time period (mean  $15 \pm 6$  months) before and after the introduction of POCT.

## Discussion

The mean HbA1c within this group decreased significantly by 2.7% (paired *t*-test  $p \leq 0.001$ ) over the 15-month period post-POCT, while there was minimal change in glycaemic control (+0.3%) when the local laboratory was used to monitor HbA1c prior to the introduction of POCT.

The mean turnaround time from sample collection to receipt of result was 2.3 days when the laboratory was performing HbA1c testing, but was just 6 minutes (that is, the time taken for the result to be available on the DCA device) after POCT was introduced.

Importantly, when the laboratory performed the HbA1c and the patient was required to return to the service for a follow-up visit, the mean time to consult with the doctor was 24 days in this remote setting, compared to an immediate consultation with the doctor during the same visit post-POCT.

The mean number of HbA1c tests per patient was higher (by 1.5) following the introduction of POCT ( $p \leq 0.001$ ), being more consistent with the clinical recommendations for optimal frequency of HbA1c testing for poorly controlled Indigenous diabetes patients (four tests per year)<sup>12</sup>.

The provision of pathology laboratory services in remote locations such as the NT is severely compromised due to the region's geographic isolation and long distances between health centres and local laboratories, and to difficulties in being able to recall patients living in remote communities for follow-up consultation and actioning of pathology results. For these reasons, the Northern Territory Government decided in 2008 to invest in the opportunity to integrate quality-assured POCT into pathology service provision for its remote health centres. Many remote communities now have access to POCT for both chronic disease care (through the QAAMS Program) and acute clinical care<sup>13,14</sup> (using the i-STAT POCT device (Abbott Point of Care, Melbourne, Australia)).



**Table 1: Comparison of the clinical and operational efficiency of POCT versus laboratory HbA1c testing for pathology service provision in remote health centres of the Northern Territory**

Parameter	15 months before POCT	15 months after POCT
Mean ( $\pm$ standard deviation) change in HbA1c % (mmol/mol); first to most recent result	9.5% (80 mmol/mol) $\pm$ 1.6 to 9.8% (84 mmol/mol) $\pm$ 1.3	10.6% (92 mmol/mol) $\pm$ 1.6 to 7.9%* (63 mmol/mol) $\pm$ 1.3
Mean turnaround time for reporting of HbA1c result	42 ( $\pm$ 30) h	6 min
Mean turnaround time for patient follow-up and consultation	24 ( $\pm$ 15) days	<15 min <sup>†</sup>
Mean ( $\pm$ standard deviation) number of HbA1c tests/patient	2.7 tests ( $\pm$ 1.7)	4.2 tests* ( $\pm$ 0.8)

\*  $p \leq 0.001$  (paired *t*-test)

Hb, haemoglobin. POCT, point-of-care testing.

<sup>†</sup> In three cases, the doctor was not available to see the patient immediately with their POCT result. In these cases, patients were seen after 3, 6 and 14 days.

POCT provides many advantages as a mode of pathology service provision for Indigenous patients, including convenience and accessibility, increased sense of ownership of their blood samples, motivation to take control of their own health and an improved relationship with their doctor<sup>10</sup>. For the treating medical practitioner, the ability to see the patient and enact changes of management/treatment ‘on the spot’ facilitates improved clinical care.

## Conclusions

In previous prospective longitudinal studies relating to POCT in Indigenous settings, our work has shown that glycaemic control for Indigenous diabetes has improved following the introduction of POCT into rural and remote communities<sup>10,15</sup>. In this study, we have compared the clinical and operational efficiency of POCT versus laboratory testing over an equivalent time period (15 months) using a ‘before and after’ study design across remote health centres in the NT. This study design has enabled quantitation of the delays experienced in providing laboratory services and clinical actioning of laboratory results in the most remote and challenging health service setting in Australia. At the same time, this study reinforces the clinical and cultural

effectiveness of POCT and its critical role in assisting to improve diabetes management in Indigenous Australians.

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