The characteristics of rural health and the issues driving the delivery of healthcare services to the rural environment are very different from those of metropolitan centers. Geographic isolation and its effect on access to health services is the defining element of rural health (1). In addition, the differing social, lifestyle, and environmental determinants of health in the rural population, including a greater degree of cultural diversity; lack of employment opportunities; lower income levels; and poorer access to housing, education, and transport, significantly influence the mode of healthcare delivery, health status, and patterns of disease (2). Overall, the rural sector experiences higher mortality rates and poorer health status than metropolitan regions, a trend that becomes more apparent with increasing remoteness (3). Prevalence rates for both acute and chronic conditions and communicable and noncommunicable diseases are generally higher in rural than in metropolitan environments, and greatest in remote regions (4).

The challenge of reducing the health differential between rural and metropolitan environments lies with the development of inventive solutions to specific local health problems (1). The astute and practical application of point-of-care testing (POCT) can unquestionably be one of those inventive solutions in the broader context of improving rural healthcare delivery—in both the acute and chronic clinical context.

POINT-OF-CARE TESTING IN THE RURAL HEALTH ENVIRONMENT

A recent review of the role and value of POCT in general practice in Australia concluded that rural and remote health practices in particular could be major beneficiaries from the adoption of POCT (5).

There are a number of clinical conditions for which POCT represents a practical and viable option for the rural health practitioner. For acute trauma and/or emergency surgery where retrieval may be necessary, POCT for tests such as potassium and blood gases are of particular clinical relevance. Point-of-care (POC) measurement of cardiac markers such as the troponins, heart fatty acid binding protein, and ischemic modified albumin can provide important information in the differential diagnosis of chest pain and subsequent early initiation of thrombolytic treatment. Timely POC international normalized ratio (INR) monitoring is important in preventing thrombosis and avoiding excessive bleeding during surgical procedures. INR is also of use in monitoring of Coumadin® (warfarin) therapy.

There are several examples of innovative and effective rural hospital-based POCT models for some of these acute care tests being used in Australia. Queensland Health Pathology Service has developed an integrated state-wide network of approximately 50 rural and remote hospital sites that are all using the i-STAT® analyzer (i-STAT, East Windsor, NJ, USA) for onsite measurement of electrolytes and blood gases. All patient results and quality control data are captured following analysis and sent to a central data station, located at the Prince Charles Hospital in Brisbane, via a network downloader. Results with correct patient data entry are then forwarded to the hospital’s laboratory information system (6).

In South Australia, the iCARnet group (Integrated Cardiac Assessment Regional Network) was established in 2001 to support rural general practitioners in the delivery of up-to-date evidence-based management of patients presenting with chest pain, or other symptoms suggestive of acute coronary syndrome. The network provides POC Troponin T testing using a cardiac reader (Roche Diagnostics, Mannheim, Germany), evidence-based triage, risk stratification and management guidelines, and 24-h on-call cardiologists (7).

In addition, many POC tests for the management and/or risk assessment of patients with chronic illnesses are being used in the rural environment. Hemoglobin A1c (HbA1c), glucose, and urine microalbumin or albumin:creatinine ratio (ACR) are key tests for the management of patients with diabetes that can be performed at the point of care (8, 9). Urine ACR is also a particularly useful test in the detection of early renal disease (8), and blood urea and creatinine can be monitored for the management of established renal disease. Blood lipids can be conveniently measured by POC technology as part of heart disease risk assessment and management (10), while urine ACR has also been shown to predict cardiovascular risk (11, 12). Whole blood hemoglobin can be measured at the point of care for assessment of anemia status, which may be of significant clinical benefit because anemia is very prevalent in rural tropical environments, particularly among indigenous women and young children (13, 14). There are now many POC tests for tumor makers such as prostate-specific antigen (PSA) and carcinoembryonic antigen. Working POC models for some of these chronic disease tests are described later.
INDIGENOUS RURAL HEALTH ENVIRONMENT IN AUSTRALIA

Nowhere is the health differential between rural and metropolitan environments more profound than for indigenous peoples living in rural and remote regions. Regardless of which health indicator is used, the health status of Aboriginal people in Australia is worse than that of non-Aboriginal people (15, 16). The chronic diseases—diabetes, renal disease, and cardiovascular disease—typify the health disadvantage of Aboriginal people and collectively poise one of the most significant health issues for contemporary Australian Aboriginal society. For example, Aboriginal people suffer between 12 and 17 times more deaths attributable to non-insulin-dependent diabetes (NIDDM) than nonindigenous Australians. Overall prevalence rates of diabetes are generally within the range of 10% to 30%, and at least 2 to 4 times that of the non-Aboriginal population (16, 17). In some communities, nearly half of the entire adult indigenous population has diabetes.

During the 1990s there was a rapid escalation in the number of Aboriginal Australians with end-stage renal disease. Recent age- and sex-adjusted figures indicate Aboriginal people have ~9 times greater risk of developing end-stage renal disease than all other Australians. In some parts of Australia, notably the Tiwi Islands, rates of renal disease are among the highest in the world (18–21). In the Northern Territory, Aboriginal people comprise just over 20% of the population, but represent 95% of people on hemodialysis (22). Cardiovascular disease is the leading cause of mortality in Aboriginal Australians, with mortality rates attributable to coronary heart disease and stroke being twice those of non-Aboriginal Australians (23, 24). Of particular concern are the high death rates from coronary heart disease among young and middle-aged Aboriginal people, with death rates for people 25 to 44 years of age being more than 10 times those of other Australians (23). The extremely high rates of chronic disease among indigenous Australians are caused by a multitude of interrelated factors such as dispossession from their land, destruction of traditional culture and values, exposure to infectious diseases, poor environmental living conditions, and the effects of alcohol and Western diets that are high in fat and sugar.

These appalling statistics on chronic disease are not unique to Australian Aboriginal communities and are mirrored in many other indigenous populations living in rural parts of the world (25). For the Australian indigenous rural community, there is clearly an urgent clinical need to provide effective services for the monitoring of diabetes control to prevent the long-term complications of this debilitating condition. There is also a need to stem the tide of end-stage renal disease by developing community-controlled risk assessment programs for the early detection of this disease. Given that heart disease is the major cause of Aboriginal mortality, the need to characterize cardiovascular risk profiles, particularly among young Aboriginal people, is also of immediate concern. POCT can have a significant role in fulfilling each of these needs, but in this environment implementation and sustainability of POCT faces major challenges.

AUSTRALIAN ABORIGINAL MEDICAL SERVICE

Aboriginal medical services in Australia are either managed and controlled by local Aboriginal people with funding by the Commonwealth or state governments, or they are controlled and funded by state or territory governments. Aboriginal Community Controlled Health Services (ACCHSs) now represent the principal vehicle for delivering primary healthcare to Aboriginal and Torres Strait Islander peoples. There are more than 125 ACCHSs throughout Australia, more than 90% of which are located in rural and remote areas. A peak body called the National Aboriginal Community Controlled Health Organisation (NACCHO) represents the interests and affairs of ACCHSs nationally.

ACCHSs vary considerably in size, infrastructure, resources, and the number of Aboriginal people they service. Many are located several hundred, up to a thousand kilometers, from the nearest hospital or laboratory service. Staffing levels also vary widely, but most services generally have a medical doctor, a clinic nurse, and one or more Aboriginal health workers. The Aboriginal health worker is an Aboriginal person who lives and works in the local community and who has attained a primary healthcare qualification. The health worker provides the pivotal communication link between the community and non-Aboriginal professional staff at the health service.

POTENTIAL BENEFITS AND CHALLENGES OF POCT IN THE INDIGENOUS RURAL ENVIRONMENT

The most significant barrier to effective clinical services in rural and remote Aboriginal communities is limited access to pathology laboratories. As stated above, Aboriginal health services may be several hundred, even thousands, of kilometers from the nearest pathology service, and it may take up to several days for blood samples to reach that service, particularly if air transport is limited or unavailable. The return of results to the community and then to the individual patient incurs further delays. Conventional means of delivery of pathology services are time consuming and of less relevance to the patient, while clinical management is delayed. POCT services overcome these problems of “disadvantage by distance” and do not incur the additional costs associated with transport of pathology samples. Furthermore, distance, in either a temporal or geographical context, can also be associated with poor compliance, e.g., with reattendance at clinics, follow-up of results, and treatment changes. The benefits of POCT in relation to improved compliance have been demonstrated for diabetes and anticoagulation therapy in other communities (see Chapters 31 and 41).

POCT has other advantages specific to the Aboriginal healthcare setting. Through appropriate training, Aboriginal
Point-of-Care Testing in the Indigenous Rural Environment

Three health models utilizing POCT for chronic disease prevention and management, which have proven successful in the rural Australian Aboriginal environment, are now described. They are the Umoona Kidney Project, the national Quality Assurance for Aboriginal Medical Services (QAAMS) Program for POC HbA1c testing, and the Point-of-Care in Aboriginal Hands Program (26). Each model is based on four fundamental elements: continuing education, training, quality management, and ongoing support for POCT. It is important to reemphasize that these models function outside the comfort zone of the hospital base, with the Aboriginal community and their associated health service driving the model (not the laboratory). The POCT challenge has been to develop quality-assured, robust, sustainable, and clinically effective models for the community setting. Each model is discussed in turn under common themes of background, chronic disease focus, POCT instrumentation and markers used, principal activities and results, evaluation, sustainability, and transferability.

**Umoona Kidney Project**

The Umoona Kidney Project was a partnership between the Umoona Aboriginal community at Coober Pedy in South Australia’s far north (850 km from Adelaide) and the Renal Units at Flinders Medical Centre and Women’s and Children’s Hospital, Adelaide, South Australia (27–31). The program involved a number of people and health professional groups. From the Umoona community, the board, the director, the clinical nurse, four Aboriginal health workers, and community members participated in the program. From the Flinders’ and Women’s and Children’s Hospital teams, there were two nephrologists, two scientists, and one nutritionist from each site together with a medical student who worked under a National Health and Medical Research Council (NHMRC) Training Scholarship.

The primary focus of the Umoona Kidney Project was a voluntary (or opportunistic) renal disease risk assessment program for the >400 adults and children in the community. There was also a voluntary clinical management program for adults identified as being at risk for renal disease.

The DCA 2000 (Bayer Diagnostics, Tarrytown, NY, USA) was the cornerstone of both the renal risk assessment program and the clinical management arm. The device measures urine albumin:creatinine ratio (ACR) on 40 μL of a first morning urine, as a marker for early renal disease or microalbuminuria. Prior to the commencement of the program, the Adelaide team spent 6 months of groundwork speaking to the community, holding information forums, showing the POCT technology and discussing the ACR test, and educating and training the Aboriginal health worker team in the use of the technology and quality management practices. This groundwork unquestionably contributed to the successful use of the DCA 2000 and the program overall. In addition to the ACR test, risk assessment also involved the measurement of blood pressure, blood glucose, body mass index, and dipstick urinalysis, while a full medical examination and history was taken for each person.

The overall risk factor profile of the 158 adults assessed (which represented ~65% of the adults in the community) showed 42% of the people had high blood pressure, 24% had diabetes, and there was a large pool of incipient renal disease, with 19% of adults having persistent microalbuminuria and 9% macroalbuminuria. A significant association was observed between blood pressure, blood glucose, and body mass index and the progression of albuminuria (as measured by the DCA 2000). A strong association was also found between albuminuria and an increasing number of coexisting risk factors, with only 20% of people having a normal urine ACR in the presence of three or more risk factors (27).
In relation to clinical management, 35 people were identified as being at risk for renal disease. All were either overtly hypertensive, hypertensive with other risk factors, or diabetic with microalbuminuria. Each was voluntarily offered the opportunity to take the ACE inhibitor medication Coversyl (Perindopril, Servier Laboratories, Australia) to reduce blood pressure and stabilize renal function. They were monitored according to a management protocol set by the Flinders’ renal specialists, who conducted a total of 231 onsite clinical consultations with the patients on medication from 1998 to 2000. A sustained and statistically significant drop in blood pressure to normal levels was observed, as well as a stabilization of renal function, with mean ACR of the group (monitored using the DCA 2000) falling from 17 to 12 mg/mmol (150 to 106 mg/g) ($P = 0.09$, paired $t$-test). Across this 2-year period, there was no change in the group potassium, urea, creatinine, or glomerular filtration rate (Table 29-1).

Across 2 years of continuous field testing ($n = 46$) the DCA 2000 exhibited a precision base (CV%) of 6.9% and 3.6% for urine albumin (for Bayer quality control samples with concentrations of 36 and 208 mg/L, respectively), 3.2% and 4.1% for creatinine [9 and 36 mmol/L (1018 and 4072 mg/L)] and 6.7% and 5.3% for urine ACR [ratios of 4.1 and 5.8 mg/mmol (36.2 and 51.3 mg/g)] (29). These are well within precision goals of 10%, 6%, and 12% for urine albumin, creatinine, and ACR that are derived from biological variation and other international consensus data on performance criteria (8, 32).

Members of the Umoona community evaluated the program internally through a survey conducted by community elders, supported by the NHMRC medical student. By all criteria, the community expressed a high level of satisfaction with the program and the use of POCT technology, with a greater than 90% satisfaction rating recorded for all questions. Education and training initiatives for ACR POCT began in earnest in September 1999. Over the next 15 months Umoona’s Aboriginal health workers took an increasingly greater responsibility for performing onsite blood pressure measurements and urine ACR testing on the DCA 2000. In December 2000, the program was handed over to the Umoona Community as a self-sustaining activity fully integrated into the health service infrastructure. Both the South Australian Government’s Department of Human Services Renal and Urology Services Implementation Plan 2000–2011 and the Statewide Iga Warta Aboriginal Renal Disease Summit, 1999 endorsed the Umoona model for expansion to other Aboriginal communities in rural and remote South Australia.

One of the most pleasing aspects of the Umoona Kidney Project was that POCT became a focal point for raising community awareness about renal disease. Through the trust and respect gained from the renal program, a number of other community activities (for both adults and children) around related health issues and health promotion were conducted. These included developing a nutrition training program for Umoona’s Aboriginal health workers at their request (28), staging a poster competition for the children at the local area school about healthy foods, and holding education days at the school about kidney health and the importance of good nutrition (sponsored by the Australian Kidney Foundation). A bush tucker trip was also conducted with the Umoona community elders for the school children, where the children were taught how to dig for witchetty grubs, collect other bush foods, and cook kangaroo.

### National QAAMS Program for Point-of-Care HbA1c Testing

The QAAMS Program arose from a recommendation of the Australian National Diabetes Strategy in 1998 (33), commenced as a pilot program in June 1999, and is now fully integrated into mainstream Aboriginal healthcare in Australia (34, 35). Since its inception, the program has been a collaborative partnership between a number of groups including the Office for Aboriginal and Torres Strait Islander Health and the Diagnostics and Technology Branch within the Australian Government’s Department of Health and Ageing, NACCHO.

### Table 29-1 Reduction in Renal and Cardiovascular Risk 2 Years after Commencing Coversyl

<table>
<thead>
<tr>
<th>Marker</th>
<th>Measure/matrix</th>
<th>Units</th>
<th>Pre-Coversyl baseline,  mean ± SEM</th>
<th>Post-Coversyl 2 years, mean ± SEM</th>
<th>$P$-valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>Systolic</td>
<td>mmHg</td>
<td>151 ± 3</td>
<td>137 ± 3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Diastolic</td>
<td>mmHg</td>
<td>92 ± 2</td>
<td>84 ± 2</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Lying</td>
<td>Systolic</td>
<td>mmHg</td>
<td>147 ± 3</td>
<td>131 ± 3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Diastolic</td>
<td>mmHg</td>
<td>94 ± 2</td>
<td>84 ± 2</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Albumin:creatinine ratio (ACR)</td>
<td>Urine</td>
<td>mg/mmol</td>
<td>16.5 ± 3.9</td>
<td>12.0 ± 2.8</td>
<td>NS</td>
</tr>
<tr>
<td>Potassium</td>
<td>Plasma</td>
<td>mmol/L</td>
<td>4.0 ± 0.1</td>
<td>4.0 ± 0.1</td>
<td>NS</td>
</tr>
<tr>
<td>Urea</td>
<td>Plasma</td>
<td>mmol/L</td>
<td>4.9 ± 0.3</td>
<td>5.1 ± 0.3</td>
<td>NS</td>
</tr>
<tr>
<td>Creatinine</td>
<td>Plasma</td>
<td>mmol/L</td>
<td>0.081 ± 0.003</td>
<td>0.077 ± 0.003</td>
<td>NS</td>
</tr>
<tr>
<td>Glomerular filtration rate (GFR)</td>
<td>Plasma</td>
<td>mL/min</td>
<td>110 ± 5</td>
<td>118 ± 8</td>
<td>0.019</td>
</tr>
</tbody>
</table>

a Values of $P < 0.05$ are significant; NS, not significant.

b Calculated GFR from Cockcroft and Gault (44).
the Royal College of Pathologists of Australasia (RCPA)’s Quality Assurance Programs, and the Community Point-of-Care Services unit within the Flinders University Rural Clinical School.

The chronic disease focus of the QAAMS program is the management of Aboriginal people with established diabetes. More than 2300 patients are involved in the program, which is being conducted at 50 commonwealth-, state-, and territory-funded Aboriginal medical services around Australia. These sites encompass every state and territory in Australia, with more than 90% located in rural or remote areas (Figure 29-1).

The DCA 2000 was selected for use in this program following the recommendation of the National Diabetes Strategy (33) and all HbA1c tests are performed by Aboriginal health workers. An educational resource package was prepared for each site, which included a laminated A3-size book, video, and supporting posters for specific aspects of the program. Initial training was provided for Aboriginal health workers from every participating site. Health workers were given instruction on how to perform the HbA1c test on the DCA 2000 and on the principles and practice of quality control and quality assurance.

With 50 POCT devices in the field, it was critical that a formal surveillance mechanism was implemented to monitor the performance of results generated by these instruments. Therefore a quality assurance program was developed collaboratively by the Community Point-of-Care Services unit at Flinders University and the RCPA Quality Assurance Programs. The breadth of quality assurance programs available to central laboratories is well known but, to the author’s knowledge, the QAAMS program is the first POCT program of this type to be developed for indigenous people anywhere in the world.

The QAAMS program is modeled on the laboratory quality assurance program system used by the RCPA. Each QAAMS participant is provided with an annual kit of quality assurance samples for testing (with two samples to be tested per month), a single-page result sheet, and a monthly summary report with a graphical result format similar to, but more simplified than, that provided for laboratories. Each site has its own code number to ensure confidentiality of results. The government charter in establishing this program has been to provide education, training, and quality management support services and not to collect or analyze patient data. This remains the property of the participating services, under NACCHO’s direction.

At the time of writing, nine 6-month testing cycles have now been completed over the past 4.5 years from July 1999 to December 2003. Some of the key performance indicators are as follows. Participation rate has averaged 86% (range 73% to 93%) across all nine testing cycles, with almost 4000 quality assurance results returned during this time. The percentage of results considered acceptable has averaged 83% (range 81% to 86%), using limits for acceptable performance that are the same as those for the laboratory-based glycohemoglobin program conducted by the RCPA (5%). The median precision (CV%) achieved by the DCA 2000 analyzers across nine cycles has averaged 3.8%, with the precision base consistently improving across time and a CV% of 3.2% being recorded in the most recent testing cycle (Table 29-2).

As mentioned, the RCPA runs a parallel glycohemoglobin program for laboratories in Australasia. Seventy-five laboratory DCA 2000 users are registered in this program, which uses an identical quality assurance material to that of QAAMS. Across the past six testing cycles, the precision base achieved by Aboriginal medical services in the QAAMS program has been equivalent to that achieved by the laboratories (Table 29-2). This reflects the intensive ongoing commitment to continuing education, training, and support for the participating services that the QAAMS program provides.

The importance of precise HbA1c results for serial monitoring of diabetes control is now well recognized following studies such as the Diabetes Control and Complications Trial and the UK Prospective Diabetes Study clinical trials (36, 37). The desirable precision goal (CV%) for HbA1c analysis now recommended by most professional groups is 3% or less (8, 38, 39). In the QAAMS program, the precision base of DCA 2000 is now approaching the 3% goal. In a practical sense, for rural and remote communities where geographical isolation is common and laboratory access is limited, the DCA 2000 analyzer clearly provides a reliable, robust, and timely means of obtaining HbA1c analyses.

In March 2001 NACCHO conducted an independent evaluation of the first 18 months of the QAAMS program (40). The executive summary of this report stated that the use of the DCA 2000 represented a major opportunity to provide better care for and management of Aboriginal clients with diabetes within the community setting, while the ability of POCT to generate rapid results served as a catalyst to enhance patient self-management. The summary also concluded that the DCA 2000’s simplicity of use led to high levels of acceptance by Aboriginal

Figure 29-1 Map showing general location of QAAMS participants in 2003.
health workers nationally, with nearly two-thirds of services expressing the view that it had raised the self-esteem of their health workers. Importantly, the sense of community control was enhanced as a result of diabetes management becoming more focused within Aboriginal medical services.

In December 2000 the Australian Government’s Health Minister announced that a Medicare rebate could be claimed for HbA1c testing performed by the DCA 2000 analyzer in Aboriginal Community Controlled Health Services under a separate item number established specifically for the QAAMS program. The rebate, which has ensured a sustainable funding mechanism for the program, is conditional on several factors including continuing participation in and sound analytical performance for quality assurance testing in the QAAMS program.

To enhance the sustainability of the program further, an annual workshop for participants has been held since 2001. These workshops have now become a key feature of the QAAMS calendar. The meetings are very interactive, with significant opportunities for retraining and networking. All participants now undergo competency assessment and certification (in both practical and theoretical elements of the program) at the workshop. In 2003, the island of Tonga from the Western Pacific region was recruited as the program’s first international participant. Considerable interest remains from other Western Pacific islands and Canada. The QAAMS model is transferrable to other types of POCT. In January 2003 a new QAAMS program commenced for the measurement of urine ACR on the DCA 2000. There are 30 ACCHSs enrolled in the program and ACR testing will be used to monitor microalbuminuria in Aboriginal patients with diabetes.

**Point-of-Care in Aboriginal Hands Program**

The Point-of-Care in Aboriginal Hands program commenced in mid-2001 (41). It is a partnership between the Community Point-of-Care Services unit at the Flinders University Rural Clinical School and four rural and remote Aboriginal health services at Port Lincoln, the Riverland, and Meningie, rural towns and regions in South Australia, varying from 200 to 650 km from metropolitan Adelaide, and at Kalgoorlie in Western Australia, a rural mining town almost 500 km from metropolitan Perth. Meningie is a small rural community, with one health worker and two doctors servicing the community. The Port Lincoln Aboriginal Health Service and the Riverland Regional Health Service are well-resourced rural health centers, servicing larger population bases. The Bega Garnbirringu Aboriginal health service at Kalgoorlie is by far the largest health center, servicing Aboriginal people from the entire Goldfields region of outback Western Australia and having a very large health worker team and strong clinical and infrastructure support.

Education, training, and quality management of POCT again underpin the program and the local Aboriginal health worker is responsible for the day-to-day operation of the POCT technology. The Point-of-Care in Aboriginal Hands program differs from the other models described in several fundamental ways. First, it has a greater local community focus with local medical officers and/or medical directors undertaking all clinical management at each health service, as opposed to the renal specialists associated with the previously described Umoona program. Second, the Point-of-Care in Aboriginal Hands program has a broader chronic disease focus that looks at the early detection and management of diabetes, renal disease, and cardiovascular disease collectively rather than having a single disease focus; for example, renal for the Umoona project or diabetes for the QAAMS HbA1c program. Finally, there is wider use of POCT. Aboriginal Health Workers are trained in how to use the Bayer DCA 2000 for both HbA1c and urine ACR testing and the Cholestech LDX lipid analyzer (Cholestech, Hayward, CA, USA), which provides a full lipid profile and a glucose measurement on a fingertips of blood in 5 min (42).

The principal activities are education and training for the entire local health professional team and a voluntary (opportunistic) chronic disease risk assessment service for community members at each site with a concomitant chronic disease management arm. Although most of the point-of-care risk assessments are conducted in the clinic setting, the opportunity is taken whenever possible to conduct field-testing outside the clinic. For example, testing has been carried out at such diverse locations as a local ecotourism center, a local adult education college, and in a tin shed at the Port Lincoln Aboriginal Women’s Centre (an event that was also linked with a nutrition health promotion activity). In the Riverland, a bus has been purchased and renovated to provide a mobile POCT service throughout the Riverland region (with risk assessment also

<table>
<thead>
<tr>
<th>Program</th>
<th>Type of service</th>
<th>Cycle period</th>
</tr>
</thead>
<tbody>
<tr>
<td>QAAMS</td>
<td>ACCHS</td>
<td>3.7</td>
</tr>
<tr>
<td>Glycohemoglobin</td>
<td>Laboratory</td>
<td>3.4</td>
</tr>
</tbody>
</table>

* Values are CV%, calculated by dividing the SD by the midpoint of the service’s range of concentrations, expressed as a percentage. The SD is the error of the estimate $\bar{x}$ and represents the mean SD across the range of concentrations analyzed.
linked to an eye examination for people with diabetes through a separate program). These examples highlight the flexibility and versatility of POCT in the community setting.

More than 600 chronic disease risk assessments have been performed by POCT across all four participating sites. A number of common trends relating to chronic disease risk between participating communities have been identified. Diabetes is extremely prevalent (ranging from 15% to 26% in the general community). Again, there is a large incipient pool of renal disease, with rates of microalbuminuria ranging from 19% to 26% in the general community. Elevated lipids are very common (35% to 44%), particularly in males and the younger age group (where increased lipids were found in 24% to 28% of people assessed). Obesity is extremely prevalent in females (ranging from 47% to 59%). An example of the risk assessment profile found at Port Lincoln is shown in Figure 29-2.

For clinical management, flow charts for POCT processes have been developed in collaboration with each community, based on best practice evidence and input of the local clinicians. The frequency of follow-up testing is determined by diabetes, blood pressure, microalbumin, and lipid status. A well-defined niche for the use of POCT in chronic disease management has been identified, namely integration of POCT with the Australian government’s Chronic Disease Self Management Care Plan initiative (43). At Port Lincoln, for example, a subset of 29 patients in the Point-of-Care in Aboriginal Hands program were entered into the Chronic Disease Self-Management Care Plan program during 2002. Their HbA1c (as performed by POCT on the DCA 2000) was measured at baseline and at 12 months. The mean HbA1c of the group improved from 7.8% at baseline to 7.4% after a year (43).

A number of case studies have also been identified across the program that clearly demonstrate the benefits of POCT in the early detection and diagnosis of chronic disease, more expedient initiation of treatment, improved clinical effectiveness, and greater patient satisfaction and motivation. Two case examples are described in the following.

The first case describes a 57-year-old man with NIDDM, obesity, and ischemic heart disease. He had been “lost to the health system” in the community for more than 2 years until he re-presented at clinic in December 2001. His POC results on presentation were: HbA1c, 10.5%; blood glucose, 11.6 mmol/L (209 mg/dL); urine ACR, 2.8 mg/mmol (24.8 mg/g); blood pressure, 150/90 mmHg; and weight, 124 kg (273 lb). Insulin was resumed immediately to treat his poor glycemic control. During the next year, regular HbA1c tests were performed using POCT, and the patient’s HbA1c fell to 9.7% (February 2002), 8.8% (August 2002), and 8.4% (December 2002). Across this period, he received ongoing dietary, podiatry, and retinopathy review. He commented that regular POCT has helped motivate him to achieve improved diabetes control. He has also initiated lifestyle changes including taking bush trips every second day and consuming more bush foods and fish.

The second case describes a 32-year-old male student from a very remote Aboriginal community who was visiting “town” to attend a training course. He presented at the local health service complaining of headaches after drinking heavily the previous night. His POCT results were: HbA1c, 10.6%; blood glucose, 19.0 mmol/L (342 mg/dL); urine ACR 22.7, mg/mmol (200 mg/g); cholesterol, 12.0 mmol/L (463 mg/dL); nonfasting triglyceride >7.3 mmol/L (>650 mg/dL) (the upper measuring limit of the Cholestech LDX analyzer), and blood pressure, 156/115 mmHg. The patient’s blood sample was also left standing on the bench, allowing the red blood cells to settle and reveal plasma that was strawberry milk in color. Opportunistic POCT led to the patient being identified as diabetic with poor glycemic control, microalbuminuria, and severe hyperlipidemia (as well as hypertension). Treatment was initiated immediately and the patient returned home and is now managed by the visiting Royal Flying Doctor Air Service. Visualization of the milky plasma also led to valuable education for the health worker team about heart disease and raised community awareness about blood fats, as this sample was photo-

Figure 29-2  Chronic disease risk assessment profile at Port Lincoln, South Australia.
17. International Diabetes Institute. Review of the epidemiology, aetiology, pathogenesis and preventability of diabetes in Aboriginal and Torres Strait Islander populations. Canberra: Office for Aboriginal and Torres Strait Islander Health Services, Commonwealth Department of Health and Family Services, 1998 (Publication No. 2335).

### Table 29-3 Median Precision of QAAMS HbA1c and Urine ACR Testing by Four Sites in the Point-of-Care in Aboriginal Hands Program

<table>
<thead>
<tr>
<th>Site</th>
<th>HbA1c</th>
<th>Urine ACR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median precision</td>
<td>Precision goal</td>
</tr>
<tr>
<td>1</td>
<td>3.2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3.1</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>3.1</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>2.9</td>
<td>—</td>
</tr>
</tbody>
</table>

<sup>a</sup> Values are CV%.
<sup>b</sup> Data unavailable due to inappropriate storage of sample kit.

graphed and is now used as a teaching aid at community health promotion functions.

For quality management purposes, all sites are now enrolled in both national QAAMS programs for HbA1c and urine ACR. In addition, they conduct onsite internal quality control testing, the results of which are immediately faxed to and managed by the Flinders’ Community Point-of-Care Services unit. There is also monthly communication between the unit and each participating site around a quality management checklist. Table 29-3 details the analytical performance achieved by each site for QAAMS testing in the most recent cycle. These results again clearly demonstrate that POCT can be carried out to a high level of analytical competency by Aboriginal health workers, provided they are supported by a quality management framework comprising ongoing education, training, and participation in structured quality management programs.

The Point-of-Care in Aboriginal Hands program has been well accepted by the participating Aboriginal communities, Aboriginal health workers, and supporting clinical staff. The program has worked effectively in four different rural communities, each with different levels of staff resources, infrastructure support, and clinical agendas.

**REFERENCES**


data unavailable due to inappropriate storage of sample kit.  

Values are CV%.

Data unavailable due to inappropriate storage of sample kit.


